FINAL DECISION AND RESPONSE TO COMMENTS

for

NIPSCO Bailly Generating Station, Area C
246 Bailly Station Road
Chesterton, Indiana
EPA ID: IND 000 718 114

I. INTRODUCTION

The U.S. Environmental Protection Agency (EPA), Region 5, is issuing this Final Decision and Response to Comments (FD/RC), which identifies the final remedy selected for the Area C portion of the NIPSCO Bailly Generating facility ("the Facility" or "Bailly Facility") located in Chesterton, Indiana, pursuant to the Resource Conservation and Recovery Act (RCRA) Section 3008(h). The proposed remedy was published in the Statement of Basis, and a public comment period opened on July 6, 2020. The public comment period ended on October 19, 2020 after a request for an extension by the public. This FD/RC provides a summary of information found in greater detail in the Statement of Basis (SB), an evaluation of additional information gathered in response to public comments and responses to the public comments. In response to stakeholder concerns, EPA has made changes to the remedy that was proposed in the SB document. For example, the SB had not proposed a remedy for SWMU 14. This Final Decision now includes a presumptive[1] remedy at SWMU 14. A SWMU 14 coal combustion residual ("CCR") "hot spot" removal with off-site disposal is now required as part of the cleanup. EPA has also selected additional stakeholder engagement as part of the final remedy. Section III, below, describes the selected final remedy in detail. The Response to Comments section of this document provides EPA's responses to all public comments received. The SB has been attached to this document for convenience (Attachment A) and is also available on the EPA site cleanup website, https://go.usa.gov/xvuqx.

II. FACILITY BACKGROUND

In 2005, EPA and the Northern Indiana Public Service Company ("NIPSCO") entered into an Administrative Order on Consent ("Order") requiring that NIPSCO investigate and clean up contamination released at its property and establishing EPA oversight of the remedial process. The Order was issued under the authority of Section 3008(h) of the Solid Waste Disposal Act (commonly referred to as the Resource Conservation and Recovery Act of 1976, "RCRA"), as amended by the Hazardous and Solid Waste Amendments of 1984, 42 U.S.C. § 6928(h). EPA's ability to require RCRA facilities to conduct investigations and cleanup under Section 3008(h) is often referred to as "Corrective Action" authority.

[1] A presumptive remedy is a technology that EPA believes, based upon its past experience, generally will be the most appropriate remedy for a specified type of site.

The NIPSCO Bailly Generating facility burned coal to produce electricity. The Facility's combustion processes and maintenance activities generated several waste streams including CCR, non-contact cooling water, industrial wastewater, cleaning wastes and rinsates, used oil, asbestos insulation, scrap, and limited amounts of spent chemicals. By volume, most of the generated solid waste consisted of CCR. As a result of past activities, EPA identified the Facility as being subject to the Corrective Action provisions of RCRA. The cleanup and long-term stewardship activities selected in this document are required to fulfill that RCRA Corrective Action obligation.

The Facility's coal-fired power plant started operating in 1962 and ceased operation in 2018. The Facility is in Porter County in northwest Indiana and occupies 350 acres on the eastern edge of an industrial area along the shoreline of Lake Michigan. The Indiana Dunes National Park (formerly Indiana Dunes National Lakeshore[2]) borders the northern and eastern portions of the Facility. The Cowles Bog Wetland Complex, a globally significant and ecologically sensitive feature, is immediately adjacent to the northeast of the Facility. The Facility is bordered on the west and south by the ArcelorMittal Steel Burns Harbor Plant. For the purpose of the Corrective Action program, the Facility was divided into three areas, Areas A, B, and C. EPA's July 9, 2012 Final Decision selected the final remedy for Area A and Area B.

As the final Area of the Facility to be addressed, Area C has multiple components and consists of the eastern portion of the Facility as shown in SB Figure 1. Specifically, Area C is comprised of:

> 1) An area previously used for CCR disposal, SWMU 15, and an area previously filled in with mostly sand, SWMU 14. SWMU 14's composition, based on additional investigation during March 2021, is approximately 75% sand[3] and 25% other material (including boiler slag (CCR), coal, steel slag with bricks, gravel and fly ash (CCR)). The total area is approximately 87,000 cubic yards with 2% of the fill constituting leachable CCR, or fly ash.

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[2] "On February 15, 2019, the Consolidated Appropriations Act of 2019 was signed into law, which included reclassifying Indiana Dunes National Lakeshore as Indiana Dunes National Park." The Administrative Record will reflect the prior designation, IDNL; however, this Statement of Basis and all documents hereafter will use the current national park designation, IDNP.

[3] EPA believes there is sufficient evidence to suggest SWMU 14 was filled in with sand that was generated by the excavation associated with the "Nuclear-1" project. In 1967, NIPSCO began planning for the permitting and construction of a nuclear reactor/electric generating plant at the Bailly facility. This project was referred to as Nuclear-1 (N-1). Despite objections of the Department of the Interior (DOI) regarding potential environmental quality and visual impacts to Indiana Dunes, NIPSCO received an Atomic Energy Commission construction permit for N-1 in 1974. Beginning in 1976, NIPSCO constructed a rectangular slurry wall. Upon initiation of dewatering activities, a large excavation was completed within the bounds of the slurry wall. It is around this timeframe, between 1977 – 1979, aerial photographs show SWMU 14 being filled in. It is reasonable to believe that the sand in SWMU 14 came from Area A and that the other material was an incidental inclusion. There does not appear to be any record of this activity.

2) A Greenbelt buffer that separates the Facility from the adjacent IDNP. The Greenbelt buffer follows the length of the northern and eastern boundary of the Facility and the IDNP. Generally, the Greenbelt is approximately 300 to 400 feet wide as it follows the Facility's property boundary from north to south. However, as the Greenbelt extends south, it becomes irregularly shaped as it encounters SWMU 15 and the Eastern Wetlands.

3) The adjacent IDNP area within Area C entails approximately 600 acres; however, CCR has affected groundwater in only a few areas. The IDNP area includes ecologically sensitive areas, including parts of the Eastern Wetland and the Northwest and Central Blag Sloughs, Little Lake, the Great Marsh, and Cowles Bog Wetland Complex.

The Facility is located on the southern tip of Lake Michigan. Lake Michigan is hydraulically connected to Area C and the IDNP. Consequently, Lake Michigan water levels influence the groundwater, wetlands, and surface waters throughout Area C and the IDNP. The aquifer is also very sensitive to rainfall due to the overall hydrologic conditions.

Recently designated a national park, IDNP is a globally rare landscape with sand dunes and swales (wetlands). It provides habitat to approximately 30 percent of Indiana's rare and endangered species including 60 rare plant and animal species. The Cowles Bog Wetland Complex is a particularly sensitive feature of the National Park located adjacent to the Facility. The 205-acre bog complex is a Congressionally designated National Natural Landmark due to its unique biodiversity. This interdunal wetland complex is supported by emerging groundwater beneath a floating mat of peat moss and unique vegetation.

The cleanup approach that has been selected as the final remedy is intended to balance the need to eliminate contamination to IDNP while preserving its fragile ecosystems. Invasive or potentially destructive cleanup methods have not been selected for IDNP. This approach has been developed in consultation with IDNP.

RCRA Facility Investigation Results

A Corrective Action Remedial Facility Investigation ("RFI") was initiated at the Facility in 2005. The purpose of a RFI is to determine whether hazardous waste or hazardous constituents were released into the environment at a Facility, and if so, to evaluate the significance of the releases in terms of risk to human health and the environment.

NIPSCO conducted an extensive multi-phase, multi-media investigation in Area C under EPA's oversight. Soil, sediment, groundwater, surface water and plant samples were collected to determine the nature and extent of the contamination. Studies were conducted to fully understand the makeup of the National Park and the various ecological interactions critical to the park. Over the course of several years and multiple, iterative studies, sufficient information was gathered to determine the impacts of contamination from the Facility on the National Park and how best to address them. More information about the specific studies conducted and the constituents of concern that were identified can be found starting on page 8 of the SB. *See* Attachment A

EPA uses risk assessments to evaluate the information and data collected during the investigation to determine whether the contamination present poses a risk to human health or the environment. This is done in a human health risk assessment (HHRA) and a baseline ecological risk assessment (BERA). Both types of risk assessments were conducted for Area C. Risk assessments are used to make a risk management decision as to whether a cleanup is necessary to protect human health and the environment. Additional information on how EPA conducts risk assessments can be found on page 12 of the SB.

EPA did not find unacceptable risk associated with human health. Unacceptable risk was identified in the BERA and the conclusions included the following:

- unacceptable risk to plants
- potential risk to benthic receptors and invertivorous birds
- potential risk to amphibians likely low, but uncertainty is too high to rule out
- potential risk to terrestrial invertebrates
- unacceptable risk to certain terrestrial wildlife in some areas

Due to the multiple lines of evidence suggesting ecological risk to the National Park, EPA directed NIPSCO to proceed with a risk management decision. A risk management decision refers to an action or set of actions that are developed and implemented to reduce risk to an acceptable level. The proposed remedies that were presented in the Statement of Basis represented the conclusion of a risk management decision process utilized to identify the best possible remedial option. The risk management process and this subsequent remedy decision utilized a high degree of conservatism due to the sensitive nature of the National Park. The area has been recognized since the late 1800's for its unique flora and fauna. The park has more than 1,400 species of vascular plants, ranking it 8^{th} in total plant species among the National Parks. It is known for its globally rare black oak savannas. More information about the risk management decision process can be found in Sections V and VI of the SB.

This FD/RC evaluates those proposed remedies within the context of the public comment period. EPA values stakeholder engagement and the input received during the public comment period was utilized to select the final remedy.

III. SELECTED FINAL REMEDY

Below is a summary of the final remedy. Section VI of the SB provides additional detail on those remedies that have not changed from the proposed remedy.

SWMU 15

The final remedy selected for SWMU 15 has not changed from the proposed remedy. EPA found stakeholder acceptance of this alternative to be high. The final remedy includes excavation of CCR above the water table (92,000 cubic yards) and disposal at an off-site facility permitted to accept CCR. Remaining CCR below the water table (86,000 cubic yards) will be solidified in place by mixing in cementitious binders designed to reduce the leachability of CCR contaminants through a reduction of both hydraulic conductivity and increased chemical fixation (also referred to as in-situ solidification and stabilization or "ISS"). As part of this component of the remedy, NIPSCO is required to submit a *Pilot Test Scope of Work*. A modestly sized pilot study is anticipated in order to appropriately frame the Corrective Measures Implementation (CMI) Plan; therefore, pilot study work must be completed prior to CMI Plan development. In response to public comments, additional supporting information on the SWMU 15 remedy is being provided in Attachment B.

Greenbelt and Eastern Wetland Area

The final remedy selected for the Greenbelt and Eastern Wetland area has not changed from the proposed remedy. EPA found stakeholder acceptance of this alternative to be high. The soil and CCR will be removed to a depth of approximately 3.5 feet below grade based upon existing delineation sampling. This area was delineated during the investigation; however, it may be necessary to collect additional samples to confirm the extent of the CCR. Upon completion of the excavation, native dune sand and topsoil from an EPA-approved borrow pit will be imported for use as backfill. EPA will consult with IDNP on the source of the backfill. The backfilled area will then be re-vegetated with native species selected in consultation with the IDNP and monitored for 10 events over a period of 5 years, as part of the long-term stewardship plan.

Previously Barren Soil Area

The final remedy for the previously barren soil areas has not changed from the proposed remedy. EPA found stakeholder acceptance of this alternative to be high. In conjunction with source control measures that have already taken place and those that will take place in the future, EPA finds monitored natural attenuation for this recovering area to be the least disruptive to the IDNP.

IDNP Groundwater

The final remedy for IDNP groundwater has not changed from the proposed remedy. EPA found stakeholder acceptance of this alternative to be high, with two qualifiers: source control at SWMU 14 and stakeholder engagement on the long-term stewardship plan. Monitored natural attenuation (MNA) was proposed for the off-site groundwater plume that extends down gradient from the site into IDNP. MNA was determined to be the least destructive option to the National Park that is capable of reaching remedial endpoints in a reasonable timeframe. This final decision addresses the two qualifiers identified above and is discussed in more detail below.

SWMU 14

The SB did not propose a remedy for SWMU 14 based upon the outcome of the risk assessments. EPA considered concerns raised in public comments however and requested that

NIPSCO further investigate SWMU 14. The additional soil borings showed that the relatively small amount of CCR present in SWMU 14 is limited and discontinuous in nature. This Final Decision includes a CCR "hot spot" removal that will excavate 4,100 cubic yards of fill, targeting fine CCR (fly ash) and dispose of it off-site. The off-site disposal facility will be permitted to receive CCR. As described below, this will result in the removal of all but 1% (by fill volume) of the fine CCR. The two-step process of identifying this presumptive remedy is described in more detail below. The first step involved an uncertainties analysis and the second step involved additional sampling and updating the site conceptual model.

Based upon stakeholder comments, EPA reevaluated uncertainties associated with multiple lines of evidence at SWMU 14. That reevaluation was presented to NIPSCO in the January 21, 2021 letter from EPA, attached (Attachment C). An abundance of uncertainty associated with potential future risks was identified based on the then current conceptual site model. The "no-effects" ecological risk threshold necessary for the sensitive National Park led EPA to determine those uncertainties were unacceptable. In order to better define the area of excavation, EPA requested NIPSCO further investigate SWMU 14. As presented in Attachment E, NIPSCO found SWMU 14 was not historically used to dispose of CCR, as previously believed. SWMU 14 is an area that was filled in with mostly sand and contains other material that appears inadvertently mixed with the sand. Based on 123 soil borings, the composition of the fill was determined to be 73.7% sand, 9% course CCR (boiler slag), 7.6% coal, 6.3% steel slag with brick, 1.4% gravel and 2% fine CCR (fly ash).

EPA identified four areas where multiple soil borings contain fine CCR and are near each other. Combining these data points, where the borings showed aggregate thickness of fine CCR greater than 0.5 foot, created four areas targeted for removal. The depth of excavation will be defined by the deepest interval of fine CCR with a maximum excavation depth of 10 feet. None of the borings found CCR (course or fine) below groundwater. These four areas combined cover approximately 0.7 acre. Excavating these areas will remove approximately 50% of the highly leachable CCR from SWMU 14 and remove all but 1% (by fill volume) of the fine CCR. The remaining fine CCR that is dispersed throughout the 87,000 cubic yard area in thin, discreet layers will be left in place. The fine CCR left in place will have an aggregate thickness of less than 0.5 foot. The updated conceptual site model now provides significantly more confidence that future uncertainties associated with SWMU 14 are limited. By doing so, it also supports the original risk assessment conclusions. Approximately 90% of SWMU 14 is non-CCR material. To achieve a "no-effects" level to the National Park, EPA is including a "hot spot" removal at SWMU 14.

EPA is selecting this remedial option as a "presumptive final remedy." A presumptive remedy is a remedial alternative that is well established, and EPA believes, based upon its past experience, will be the most appropriate remedy for a specific site. The CCR located at SWMU 14 is located above the water table. An excavation and off-site disposal approach is consistent with the portion of CCR in SWMU 15 that is also above the water table. Excavation is a straight-forward remedial option that will permanently eliminate contamination. As a presumptive remedy, this remedial approach did not go through a remedial alternatives analysis, as applied to the other components of the remedy. EPA believes the refined conceptual site model fully supports the "no risk" conclusion of the ecological risk assessment; therefore, a presumptive remedy is consistent with EPA guidance for low risk or no risk scenarios. As with all other elements of the final remedy, an approved CMI plan will be required.

Long-Term Stewardship
This final remedy includes a requirement for a long-term stewardship (LTS) plan. EPA found stakeholder acceptance to be high, with one qualifier: stakeholders expressed a desire to have engagement in the development of the LTS plan. This final decision addresses that request as discussed in more detail below. The LTS plan requirements include: an Institutional Control Implementation and Assurance Plan (ICIAP), five-year remedy review procedures, operation, maintenance and monitoring details. An annual certification that all controls, including institutional controls, are in place and remain effective should be provided for in this plan. Long term remedies will be reviewed and inspected on a five-year basis to ensure the remedy is functioning as intended, the exposure assumptions, toxicity data, cleanup levels, and corrective action objectives are still valid, and any information that comes to light that could call into question the protectiveness of the remedy is considered.

Focused Stakeholder Engagement Group
This final remedy includes a requirement for a focused stakeholder engagement group. This component of the final remedy is being selected based upon public comment and was not proposed in the SB. EPA will work with NIPSCO to develop a small group of representative stakeholders who will participate in a limited series of meetings with NIPSCO and EPA. The purpose of these meetings will be to facilitate stakeholder input on the technical components of the CMI Plan and the Long-Term Stewardship (LTS) Plan. Stakeholders will have an opportunity to discuss the development of these plans with NIPSCO and EPA and provide input. The public comments submitted requested this opportunity due to the long-term ramifications of this cleanup on the health and sustainability of public lands, specifically, the IDNP.

Based upon experience, EPA found that engaging a focused stakeholder group offers an efficient and effective process for expediting cleanup and ensuring long-term protectiveness. This group may be comprised of representatives from the environmental groups requesting this opportunity, local interest groups, and the National Park Service, for example. A defined number of meetings will be established upfront to assist individuals in identifying the level of commitment this group will represent. Each meeting will have an agenda designed to address and resolve specific issues. EPA has had success in the implementation of such groups that are focused in scope, time, and commitment.

Institutional Controls
Institutional controls (ICs) will be placed on the Facility property. This requirement was proposed in the SB. EPA found stakeholder acceptance of this requirement to be high. ICs restrict land or resource use at a Facility through legal instruments and are distinct from

engineered or constructed remedies. ICs preclude or minimize exposures to contamination or protect the integrity of a remedy by limiting land or resource use through means such as rules, regulations, building permit requirements, well-drilling prohibitions and other types of ordinances. For an IC to become part of a remedy, there must be binding documentation such as land-use restrictions in a recorded environmental covenant, local zoning restrictions, or rules restricting private wells. There will be institutional controls consistent with Indiana Code 13-11-2-193.5 and 13-25-4-24 implemented at this Facility to prohibit interference with the remedy, prohibit the use of groundwater for drinking water and limit the future use of the Facility to a non-residential scenario, such as commercial or industrial. Land use restrictions through ICs will only apply to the Facility property and will not be imposed on the Greenbelt (that is covered by a conservation easement between IDNP and NIPSCO) or IDNP property. The Facility property includes all land within NIPSCO's property boundary.

Financial Assurance

This final remedy requires that NIPSCO demonstrate a financial ability to complete corrective action, including constructing the proposed remedy, monitoring conditions following remedy construction, and conducting long-term stewardship requirements by securing an appropriate financial instrument, consistent with the requirements of 40 C.F.R §§ 264.142 and 264.144. NIPSCO will develop a detailed cost-estimate to support this demonstration. NIPSCO may use any of the following financial mechanisms to make the demonstration: financial trust, surety bonds, letters of credit, insurance, and/or qualification as a self-insurer (corporate guaranty) by means of a financial test. EPA recommends NIPSCO consider using a financial trust or insurance in light of the long-term requirements associated with protecting the National Park. After successfully completing the construction phase of the remedy, NIPSCO may request that EPA reduce the amount of the financial assurance to the amount necessary to cover the remaining costs of the remedy, including monitored natural attenuation, operation and maintenance costs, and long-term stewardship requirements. NIPSCO may make similar requests of EPA at future remedy completion milestones.

IV. PUBLIC PARTICIPATION ACTIVITIES

A public comment period for the proposed remedy opened on July 6, 2020 and was scheduled to conclude after 45 days on August 19, 2020. On July 23, 2020, EPA received a request from the public to extend the comment period by an additional 60 days. EPA found that request to be reasonable based upon site specific circumstances and granted the extension. The comment period concluded on October 19, 2020.

Approximately 200 fact sheets were mailed to the surrounding communities and stakeholders, a newspaper advertisement was placed, and a press release was published. The EPA site cleanup website (https://go.usa.gov/xvuqx) provided access to the SB as well as other site files. The website also included a Power Point presentation providing the public with background information and details of the proposed remedy. A "Frequently Asked Questions" guide was posted to the website and updated regularly throughout the comment period. EPA hosted a call-in "Question and Answer" session on August 3, 2020 from 5pm – 7pm EST.

EPA received comments from a variety of individuals, including residential property owners and local community members. Comments were also submitted by the following environmental groups: Southern Environmental Law Center; National Parks Conservation Association in collaboration with Save the Dunes, including a technical evaluation by CEA Engineers; and, Earthjustice in collaboration with Hoosier Environmental Council, Izaak Walton League, Just Transition NWI, NAACP LaPorte County, and NWI Green Drinks, including a technical evaluation by Geo-Hydro, Inc.

The Response to Comments portion of this document is intended to respond to the public comments received during the comment period. All comments received by EPA are reproduced or summarized with responses below. This response document does not reproduce each individual comment received by the environmental groups verbatim due to the length and complexity of those comments. Rather, EPA has summarized the comments in this document in order to provide concise responses. The full submittals EPA received from the environmental groups have been attached to this document for complete transparency. (Attachment D).

V. FUTURE ACTIONS

The following future actions, required of NIPSCO by EPA as part of the FD/RC, are integral to the remedy implementation.

- Submit for EPA approval the SWMU 15 Pilot Study Scope of Work.
- Develop *Focused Stakeholder Engagement Group*.
- Submit for EPA approval a CMI Plan which will detail the work plans, methods, and schedules for the implementation of the final measures as outlined above. The CMI Plan will reflect outcomes achieved during stakeholder engagement as part of the Focused Stakeholder Engagement Group meetings.
- Submit for EPA approval a LTS Plan that details the monitoring and maintenance activities that will be performed after the implementation of the remedy and includes the components described above. The LTS Plan will reflect outcomes achieved during stakeholder engagement as part of the Focused Stakeholder Engagement Group meetings.
- Implement the financial assurance requirements of this remedy.
- Record, implement and maintain EPA-approved institutional controls that are developed in consultation with the Indiana Department of Environmental Management. Land restrictions will be embodied in a recorded environmental restrictive covenant and deed restriction that runs with the land and will be provided to IDEM's Institutional Controls Registry and Virtual File Cabinet.

VI. ADMINISTRATIVE RECORD

The Administrative Record supporting the selected final remedy is available at the following locations: Portage Public Library, 2665 Irving Street, Portage, Indiana, and the EPA Region 5 Records Center, 77 W. Jackson Blvd., 7th floor, Chicago, Illinois. The Facility records can also be found on EPA's cleanup website, at: https://go.usa.gov/xvuqx.

VII. DECLARATIONS

Based on the information in the FD/RC and the Administrative Record, EPA has determined that the selected remedy for Area C of the NIPSCO Bailly Generating Station facility is appropriate and protective of human health and the environment. EPA believes the selected remedy addresses stakeholder concerns regarding the impacts to the Indiana Dunes National Park and serves to protect those public lands.

7/13/2021

X Edward Nam

Edward Nam
Director, Land, Chemicals and Redevelopment Div...
Signed by: Environmental Protection Agency

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Director
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US EPA, Region 5

EPA RESPONSE TO COMMENTS

Area C: NIPSCO Bailly Generating Station
Chesterton, Indiana
EPA ID: IND 000 718 114

Overview

The EPA SB, containing the proposed remedy for Area C of the NIPSCO Bailly Generating Station, was made available for public review and comment on July 6, 2020. The public comment period was scheduled to conclude after 45 days on August 19, 2020. On July 23, 2020, EPA received a request from the public to extend the comment period by an additional 60 days. The comment period was extended and concluded on October 19, 2020.

EPA mailed approximately 200 fact sheets to the surrounding communities and stakeholders, a newspaper advertisement was placed, and a press release was published. The EPA site cleanup website provided access to the SB as well as other site files. The website also included a Power Point presentation providing the public with background information and details of the proposed remedy. A "Frequently Asked Questions" guide was posted to the website and updated regularly throughout the comment period. EPA hosted a call-in "Question and Answer" session on August 3, 2020 from 5pm – 7pm.

EPA received comments from a variety of individuals, including residential property owners and local community members. Comments were also submitted by the following environmental groups: Southern Environmental Law Center; National Parks Conservation Association in collaboration with Save the Dunes, including a technical evaluation by CEA Engineers; and, Earthjustice in collaboration with Hoosier Environmental Council, Izaak Walton League, Just Transition NWI, NAACP LaPorte County, and NWI Green Drinks, including a technical evaluation by Geo-Hydro, Inc.

The purpose of this document is to provide responses to comments received during the public comment period. All comments received by EPA are reproduced or summarized with responses below. This response document does not reproduce each individual comment received by the environmental groups verbatim due to the length and complexity of those comments. Rather, EPA has summarized the comments in this document in order to provide concise responses. The comment letters have been attached for full transparency in Attachment D.

Public Comments and EPA Responses

Comment #1:
I am writing regarding some questions and comments that I have regarding the EPA cleanup of the Bailly Generating Station in Chesterton, Indiana. As a member of the Sierra Club, Earthjustice, and the Dunes community, I am an avid outdoorsman who visits the Indiana Dunes State and National Park very regularly, particularly the Cowles Bog area which is the region of topic here (Area C).
Is it my understanding that the Area C zone was an unregulated "dumping ground" for coal ash in the 1960s and 1970s.

- Due to this, what is the degree of environmental damage that has been done to the area because of this?
- In addition, how exactly was the coal ash disposed of in Area C? Was it buried within the dunes and wooded region somehow?

The reason I ask is because in my frequent visits to the area, I find the area to be very natural and cannot seem to notice any evidence of any kind of "landfill" within the area. I am fully aware these activities took place a half a century ago so evidence of such could be very hard to locate but I just wanted to acquire a bit more information on it.

My other questions and comments are with regard to how exactly the cleanup will take place.
- Will it disturb the dunes, woods, and wetlands in the area and, if so, to what degree?
- Also, how long will this cleanup take? Cowles Bog, along with all of the Indiana Dunes, is one of the most beautiful and ecologically diverse parts of the United States with an amazing number of diverse plants, and any damage to it would be a true tragedy.

In conclusion, I firmly believe that these areas must be protected as much as possible not just for our own sake but also for the sake of our posterity. For it is said that "We don't inherit the earth from our ancestors; we borrow it from our children." Thank you very much for your time and attention and I eagerly look forward to hearing from you regarding this particularly important matter.

Response to Comment #1:
Thank you for reviewing the proposed remedy and taking the time to submit this thoughtful comment. We believe the response below addresses each of your questions and concerns.

EPA's figure showing Area C includes a portion of the National Park. That National Park property was included in NIPSCO's investigation to determine the extent of contamination from the Facility. The portion of Area C located within the National Park was not used for coal ash disposal. SWMU 15, which is a unit on NIPSCO's property, was used to dispose of coal ash. Area C is the investigation boundary created to ensure any contamination that had migrated off-site was appropriately characterized. During the time NIPSCO managed coal ash on their property there were no regulations prohibiting those activities. See EPA's FAQ for more information about that (https://go.usa.gov/xvuqx).

The degree of environmental damage that has occurred due to the placement of coal ash in SWMU 15 is presented in Sections III, IV and Attachment C of the SB. The footprint of the contamination is limited to an area adjacent to the Facility and shown in the SB Figure 10. Below is a summary from the SB for convenience.

Contamination leaving the facility in groundwater from SWMU 15 and entering the IDNP exceeds applicable ecological criteria. Groundwater contamination is found in the surface waters of IDNP as a result of the groundwater and surface water being connected. Stressed vegetation has been observed and studied within the National Park. There is a complicated hydrogeologic cycle between the groundwater, surface water and sediment as it pertains to the bioavailability of certain metals. The most chronically exposed receptors to this cycling of contamination between groundwater, surface water, and sediment are the plants. Studies subsequently demonstrated Facility contamination within the plant tissue.

NIPSCO submitted the Baseline Ecological Risk Assessment (BERA) to EPA in 2011 and concluded there were no risks to any receptors from any of the contamination. EPA, in consultation with the National Park Service, evaluated the methods used in the BERA and concluded it did not agree with NIPSCO's conclusion. Attachment C of the Statement of Basis is the evaluation EPA conducted and provided to NIPSCO in early 2013. In general, EPA found the level of uncertainty associated with many of the studies too high to eliminate the possibility of unacceptable risk. The nature of the off-site environment, the National Park, requires the highest level of protection and conservatism. EPA's BERA comments in Attachment C provide specific details about receptors, areas, and risks posed. As a summary, EPA's conclusions included the following:

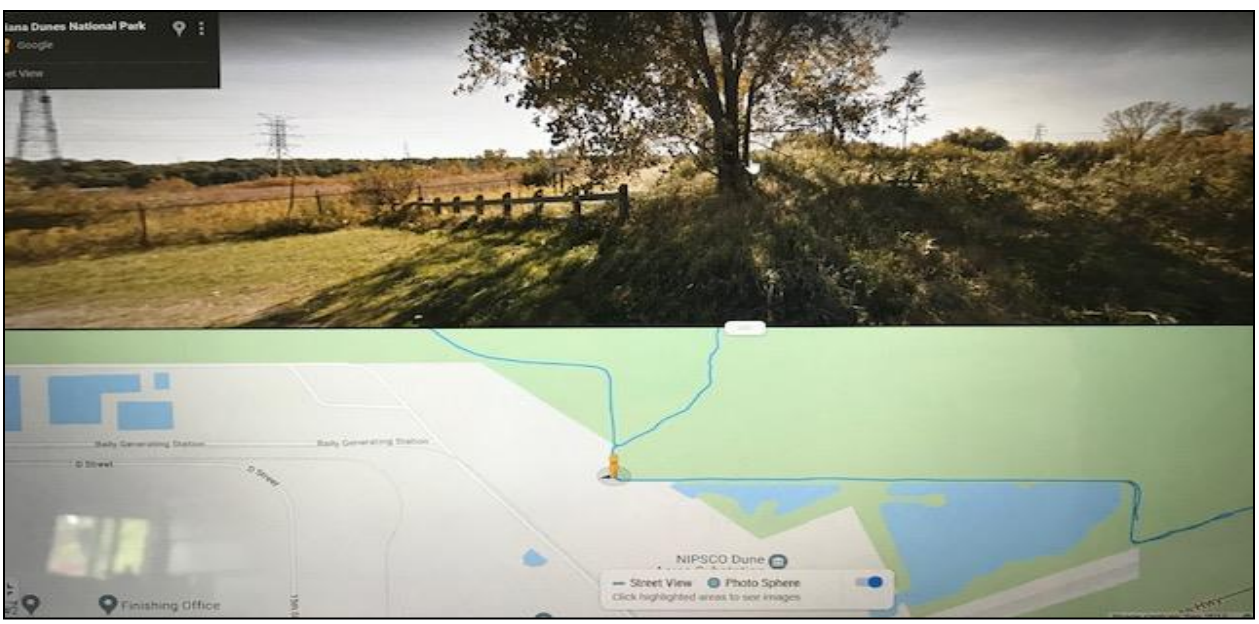
- unacceptable risk to plants
- potential risk to benthic receptors (aquatic organisms in sediment) and invertivores (birds)
- potential risk to amphibians likely low, but uncertainty is too high to rule out
- potential risk to terrestrial invertebrates (such as insects)
- unacceptable risk to certain terrestrial wildlife in some areas

Due to the overwhelming multiple lines of evidence suggesting ecological risk to the National Park, EPA directed NIPSCO to proceed with a risk management decision without revising the BERA. A risk management decision refers to an action or set of actions that are developed and implemented to reduce risk to an acceptable level. In this case, EPA specified that an acceptable decision would include source control (SWMU 15), limited off-site remediation (in coordination with NPS), and long-term monitoring (the subject of the proposed remedy).

Coal ash was disposed of in SWMU 15, which is approximately 17 acres. The ash was created by the burning of coal at the power plant in Area A and first sluiced to surface impoundments in Area B. Accumulated ash was periodically removed from the impoundments and trucked over to the unit now known as SWMU 15. At the time disposal started, in the 1960's, this area was at a lower elevation than present day. It appears coal ash was disposed of in this area until the unit was filled to the same height as the surrounding elevation. In other words, SWMU 15 was not excavated for the purpose of filling it in. Attachment B of the SB includes an assessment of historic aerial photos documenting the development of SWMU 15.

Regarding your question as to whether or not coal ash was buried within the dunes or wooded areas, it was not. Coal ash was disposed of on NIPSCO's property by placing it (burying it) in SWMU 15. NIPSCO's property, which is zoned by Porter County as "High Impact", includes a buffer zone called the "Greenbelt area", which is zoned as such to provide a buffer between industrial land and natural areas. The only location where ash was previously disposed was on NIPSCO's property at SWMU 15. A small amount of ash sloughed off SWMU 15 at some time during its placement and resulted in a small amount of ash in the Greenbelt buffer area. That ash was discovered during the investigation and is a part of this final remedy. It will be removed, and the area will be restored in consultation with the National Park Service. In March 2021, it was also discovered that a small amount of CCR was disposed of at SWMU 14 at the time it was filled in with sand from other areas of the site. The areas of SWMU 14 that are considered "hot spots" will also be removed as part of the final remedy (see Attachment E).

These units have an elevation that is mostly consistent with the rest of the ground surface on the NIPSCO facility. Therefore, they do not have the appearance of a landfill. Below is a Google Maps screen shot showing what SWMU 15 looks like from the trail located immediately north and east of it.



The remedy as proposed will not disturb the dunes, woods or wetlands. A considerable amount of time and collaboration with the National Park Service went into the development of this remedy. The proposal for Monitored Natural Attenuation for the groundwater plume that has migrated into the National Park was put forward specifically because it will cause the least amount of disruption to the resources. The weight given to this remedy was largely from systematic planning meetings held between EPA, the National Park Service and NIPSCO. The remedy proposed for SWMU 15 will occur entirely within NIPSCO's property. The small amount of ash that will be removed from the Greenbelt area is immediately in front of SWMU 15 and will not impact the National Park. The final grading and landscaping that will take place at SWMU 15 will be in a manner acceptable to the National Park.

The exact start date depends on several prior steps. EPA must first receive and consider all public comments and incorporate our responses to the Final Decision/Response to Comments document. The various elements of this selected remedy must be implemented, such as the CMI and LTS Plans. Then, NIPSCO will complete a "pilot study" at SWMU 15 to gather specific pieces of information needed to fully execute the remedy. It's estimated the remedy could be implemented in 2022 and will take 12 months over two construction seasons.

EPA recognizes that the Indiana Dunes is a globally rare dune and swale environment and we appreciate your thoughtful comments regarding the protection and preservation of it. The unique nature of this natural resource was deemed worth National Park status in 2019. With 30 percent of Indiana's rare and endangered species, the Indiana Dunes National Park is being afforded the highest degree of protection.

Comment #2:
I wish for the site to be as clean as it was before NIPSCO got there.

Response to Comment #2:
Thank you for your comment. We hope this response provides some context as to how environmental investigations and cleanups take place under this program. The RCRA Corrective Action program is a risk-based program that takes site-specific circumstances into consideration. To assess risk, we use contaminant screening and action levels developed for specific land uses. Different risk levels are calculated for residential scenarios and for commercial/industrial scenarios based upon the frequency of exposure (for example, the number of days a person is present in a year, number of hours a person is present in a day, etc.) and type of exposure (inhalation, consumption, skin contact, etc.). Other levels are calculated for ecological settings where wildlife is a concern. These levels are health or environmental-based concentrations derived using chemical-specific toxicity information and scenario-specific exposure assumptions.

The Corrective Action program was designed to be a flexible, site-specific cleanup program at operating facilities. The EPA's Corrective Action policy, established in EPA's 1996 Advanced Notice of Proposed Rulemaking for RCRA Corrective Action Facilities (61 FR 19432), recognizes non-residential land use scenarios are appropriate at actively managed or otherwise not abandoned properties. EPA is charged with considering proposed cleanups within the context of current and reasonably anticipated future use. Our role and jurisdiction is to make sure the facility conducts the investigation and cleanup in a manner consistent with the criteria for the anticipated land use.

This FD presumes that future land use at Bailly will be limited to uses consistent with the commercial/industrial cleanup levels. If a non-commercial/industrial use is proposed in the future, then additional risk associated with the specific alternative use must be evaluated. Should the analysis show more cleanup is necessary, then to be protective, additional work would be needed to support the alternative use. At this time, given the extent of the area's industrial development and the existence of a buffer zone between the industrial area and the National Park, EPA believes that the industrial/commercial use designation is appropriate and consistent with EPA guidance. It is also consistent with the Porter County Zoning Ordinance, which currently has the facility zoned as "High Impact Use" and the buffer area zoned as "Greenway Use". Of course, the CCR-contaminated groundwater that has migrated off-site will be remediated to levels protective of the Great Lakes environment consistent with the sensitive status of the National Park.

Comment #3:
I'm wondering how long the cleanup will take. I'm aware of some work that was done in the past at Dean Mitchell Station. I'm concerned about historic fly ash storage and disposal practices at NIPSCO facilities. I have concerns that fly ash was not managed properly.

Response to Comment #3:
Thank you for your comment. EPA anticipates this cleanup will require a brief pilot study to take place in 2021 and full-scale remediation to take place over two construction seasons in 2022-2023. The mission of the Corrective Action program is to ensure human health and the environment is protected by addressing historic impacts. Regarding the historic fly ash management practices at the NIPSCO facilities, at the time NIPSCO used portions of their property to dispose of CCR, CCR was not regulated, was not considered a toxic or hazardous waste and there was no permit requirement to do so. The hazardous waste that NIPSCO generated was from the cleaning chemicals used on the boiler, the unit that burned the coal. This material was not disposed of on site and was properly managed for offsite disposal under RCRA. CCR is regulated as a solid waste, it has never been regulated as hazardous waste. In 1980, Congress exempted coal combustion residuals from regulation under the hazardous waste requirements until EPA completed a study to assess risks and make a regulatory determination. After studying CCR, EPA made two separate regulatory determinations (in 1993 and in 2000) to exclude CCR from hazardous waste regulation under Subtitle C of RCRA and instead regulate them under the non-hazardous waste regulations under Subtitle D. The most recent CCR Rule, published in 2015, continues to regulate CCR as a non-hazardous solid waste. However, this rule now establishes a comprehensive set of requirements for the safe disposal of CCR. Both the regulations and the understanding of the science of CCR have evolved over time (see, EPA's CCR regulatory history website at: https://www.epa.gov/coalash/legislative-and-regulatory-timeline-fossil-fuel-combustion-wastes). CCR will no longer be generated or managed at this facility since closing in 2018.

For questions about the work at the NIPSCO Dean Mitchell facility, please contact Chris Myer of IDEM at: (317) 233-4625, or, cmyer@idem.in.gov.

Comment #4:

Please see to it with the best of your ability that NIPSCO properly cleans up the site located in Porter County, IN near the Bailey generation station, adjacent to Arcelor Mittal steel mill in Burns Harbor.

I have friends in the area who have well water that that they use for drinking and cooking purposes. The area is ecologically important and needs protection from industry's contamination.

Response to Comment #4:
EPA appreciates your concerns and recognizes that the Indiana Dunes National Park is a globally rare ecosystem responsible for providing habitat to 30% of Indiana's sensitive species. EPA made investigation, risk assessment and proposed cleanup decisions based almost solely on the National Park's sensitive status.

Based upon the Indiana DNR's water well records database, there are no drinking water wells or other personally owned wells anywhere near the groundwater plume from the Bailly Facility. The location of contaminated groundwater associated with the facility is either on NIPSCO's property or immediately adjacent to its property on the National Park. The contamination does not impact any area where a private, drinking water well would be located. Here is the link to the publicly assessable water well database viewer:

https://indnr.maps.arcgis.com/apps/webappviewer/index.html?id=4b4f37e1dde744ce865e1be4d157ac93

Further, EPA conducted a human health risk assessment as part of this proposed remedy. Based upon the concentrations of contaminants and the limited exposure that is possible based on its location, there is no unacceptable risk to people in the area from this contamination. The risks associated with these levels of boron, in particular, are to sensitive ecological receptors.

Comment #5:
From my review of the presented documentation the matter at issue here is boron effluence into Cowles Bog. Low concentration of boron is beneficial to plant life. High concentration of boron is detrimental. The area in question, Area SWMU 15, is particularly vulnerable due to the presence of artisan springs all along the ridge that borders Route 12.

The problem here is the presence in Area SWMU 15 of 25 feet of boron containing mineral deposits. Boron is naturally concentrated in lacustrine deposits by percolation of water through the boron containing strata. This transfers the boron into the water table layers.

In arid environments the boron concentrates in the dry lake beds as borax which can then be mined. In our situation however there is no opportunity for desiccation of the mineral deposits. Consequently, the boron remains suspended in the water table at diminishing concentrations from the point of origin.

Because of this the western section of Cowles Bog is vulnerable to concentrations of boron incompatible with plant life. The human risk of boron is over 20 mgm [sic] per day. The expected human need for boron is 1 mgm [sic] per day. Therefore, there is not a high risk to humans from the high boron concentrations in the west part of Cowles Bog as compared to plant life.

Removing the boron containing sediments overlying the water table in Area SWMU15 is an important factor in reducing boron concentrations in Cowles Bog. Then there remains the issue of the boron that has already been concentrated in the pit in Area SWMU15 under the water table. If that can be successfully accomplished there should be no further risk to Cowles Bog.

I understand there is a proposal to create a concretion of the materials under the water table in Area SWMU 15. My only knowledge of this sort of remediation is that it has been successful in similar very serious circumstances. My only concern is vigorous protection of the containment area. It appears that this has been addressed in the EPA bulletin concerning NIPSCO Bailly Generating Facility July 2020.

I heartily endorse the remediation plan as outlined in the EPA's Proposed Statement of Basis for the NIPSCO Bailly Generating Facility.

Response to Comment #5:
Thank you for taking the time to review our proposed remedy. EPA appreciates your comment.

Comment #6:
Please remove the hazardous ash in a safe way or prevent it from leaching into ground water and Lake Michigan. This could be very toxic to the residents of the area.

Response to Comment #6:
Thank you for submitting a comment to express your concern. The proposed remedy includes the removal and off-site disposal of approximately 100,000 cubic yards of CCR from SWMU 15. The remaining CCR in that unit, another 100,000 cubic yards, is below the water table. That CCR will be chemically stabilized and physically solidified. This process has been tested and has shown the ability to stop the leaching that is currently happening. EPA is also selecting a final remedy for SWMU 14 in order to remove areas of CCR from that unit.

The existing groundwater contamination is confined to an area that is immediately next to the Facility. There are no residential properties impacted by the contamination or near the contamination. The concentrations that have been detected in the National Park are not high enough to be unsafe to people.

Comment #7:
I am concerned that you are not removing all the ash. Although the information claims that the ash below the water table will be stabilized, as a taxpayer, I do not want to find out later that the process to stabilize it did not work as expected and end up having to foot the bill at a later date to dig it up. I do not want to pay for the process twice.

Response to Comment #7:
EPA understands your concerns and appreciates your comment. Selecting a final remedy capable of achieving remedial endpoints is a top priority for cleanups. EPA's cleanup program and

Office of Research and Development spent a great deal of time studying the remedial options for SWMU 15. NIPSCO's technical team submitted numerous high-quality studies to assist in our understanding of the site conditions and the remedial alternatives that were considered. The RCRA Corrective Action program is designed to address sites where viable responsible parties are present. The responsible party, NIPSCO in this case, is financially responsible for the investigation and cleanup. NIPSCO will be paying for the cleanup in its entirety and monitoring its success under EPA oversight.

After extensive study, it was determined that the groundwater pumping, or dewatering, that would have to take place in order to excavate all of SWMU 15 would likely stress and damage the natural resources in the National Park. The selected remedy, partial excavation and partial in-situ solidification/stabilization (ISS), was selected because it demonstrated the ability to achieve the remedial endpoints without harming the National Park. Solidification/stabilization is within the top five most frequently selected in-situ methods for source remediation according to the 2017 Superfund Remedy Report, 15th Edition. As summarized on *clu-in.org,* EPA's 2010 Superfund Remedy Report indicates that 56 Superfund National Priorities List sites used ISS to treat sources between 1982-2008. This technology has a history of demonstrating success and is an alternative we can use to remediate the source while protecting the natural resources.

Comment #8:
The Environmental Protection Agency's proposal to clean up buried coal ash buried next to the newly created Indiana Dunes National Park makes complete sense. The great threat of heavy metal contamination seeping into the adjacent park ecosystems must be dealt with, although with pains being taken to allow for proper disposal of boron and other substances. The EPA has rightfully identified the need for this removal, and I support the agency planned methods for doing so.

Response to Comment #8:
Thank you for taking the time to review our proposed remedy. EPA appreciates your comment.

Comment #9:
I am expressing support for the cleanup that is done hopefully once and for the long-term, so it doesn't need to be readdressed. It would appear that NIPSCO should be taking the lead with the financial responsibility, with EPA guiding and aiding/overseeing the work. This is getting attention only because it's leaking and going into a National Park, but I'm sure this is happening all over. This should get primary attention, sure, but NIPSCO has sites all over Indiana that they should be cleaning up. Once an area is stored and contained, reverting the site back to public use (National Park) is important. I guess I'd like to get this done and completed as soon as possible.

Response to Comment #9:
Thank you for expressing your support of our proposed remedy.

Comment #10:
As well as being involved in local NWI conservation with the Porter Co Chapter of the Izaak Walton League whose founders also created Save the Dunes, I live across the street from Bailly Generating Plant with my two young sons.

I have strong concerns that the affected property not only harms local lands and wildlife, but my own well water. When the materials are being removed, I am also worried that air quality at my home will be worse than it is now with the local steel mill.

Please take my concerns into consideration when removing combustion residuals so that they are sealed and contained and do not drop off trucks.

Response to Comment #10:
Thank you for taking the time to express your concerns and submit your comment. Many of the responses above address how EPA is working to ensure protection of the natural resources currently impacted. We have also responded to the concerns regarding drinking water and human health impacts in the responses above, please see our Response to Comment #4.

Regarding air quality and CCR transport issues during the cleanup, this selected remedy requires NIPSCO to engage critical stakeholders in order to be able to submit a CMI Plan that EPA will approve. The CMI Plan will include an ambient air monitoring protocol, health and safety measures, and contingency plans in the event issues arise. EPA will be preforming oversight in the field while the cleanup occurs.

Public comments submitted by environmental groups and EPA responses

The following comment was submitted by the Southern Environmental Law Center (SELC), it has been summarized below with the complete submittal attached (Attachment D).

SWMU 15 Comment Summary:
Southern Environmental Law Center (SELC) wrote to address a potential unintended consequence of EPA's approach in the SB. The SB repeatedly references safety concerns related to the removal of coal ash located below the water table. SELC expressed a concern regarding the emphasis EPA appeared to make on the excavation safety concerns as a balancing criterion for remedy selection. SELC expressed that they are "concerned that EPA's explanation for its approach in the Bailly Statement of Basis could be taken out of context and used to resist needed cleanups in our region and elsewhere in the country."

SELC provided multiple examples where saturated coal ash is being excavated at other sites across the country. Across multiple sites located in the Southeast United States, facilities are actively excavating over 250 million tons of coal ash, much of it located in groundwater.

The comment generally concludes with the following, "Any comments concerning worker safety should be based on the specific circumstances of the Bailly site and specifically the fact that no dewatering is occurring there."

Response to SELC's SWMU 15 Comment:

EPA's characterization of the SWMU 15 remedy was intended to reflect our multiple lines of evidence approach on a site-specific issue. Worker safety concerns are discussed in the SB as they pertain to the need to dewater the unit for a full excavation scenario. Based upon laboratory studies of the CCR in question, the percent saturation, internal friction angle, and cohesive strength all demonstrate characteristics that would make for potentially hazardous excavation conditions in the absence of dewatering. Worker safety was discussed and considered within the context of the overall cleanup approach. The approach at SWMU 15 must take into consideration the uniquely sensitive hydrologic regime that exists due to the interconnectedness of SWMU 15 and the adjacent National Park ephemeral wetlands.

As acknowledged by SELC's comments, it is the site-specific conditions at Bailly which make dewatering problematic, and therefore, raises the level of worker safety concern. EPA did not intend to state or imply that the presence of saturated ash, in and of itself, disqualifies full and complete excavation as a remedial option. Nor does the presence of ash beneath the water table at significant depths necessarily prohibit full excavation. EPA's "multiple lines of evidence" approach, in combination with our remedial selection threshold and balancing criteria, were utilized to systematically arrive at the remedy proposed for SWMU 15 in the SB. Based upon decades of science supporting the use of in-situ stabilization/solidification, EPA found this approach would be equally as effective as complete excavation to achieving remedial endpoints. The likely impacts of excavation dewatering to the adjacent sensitive, ephemeral wetlands within the National Park was a heavily weighted criterion during the remedy proposal process.

EPA has reflected this position more clearly in this response. We also requested a memo from NIPSCO to provide clear lines of evidence that concisely support the SWMU 15 remedy for convenience and transparency. That memo is attached to this Final Decision.

The following comments were submitted by the National Parks Conservation Association (NPCA) in collaboration with Save the Dunes; and, Earthjustice in collaboration with Hoosier Environmental Council, Izaak Walton League, Just Transition NWI, NAACP LaPorte County Branch and NWI Green Drinks. Summarized below are similar comments grouped by topic, with the complete comment submittals attached for transparency. (Attachment D).

SWMU 15 Comment:
NPCA supports the proposed remediation plan for SWMU 15 but requests that the proposed institutional controls for the site provide for the use of SWMU 15 as a necessary buffer zone between IDNP and adjacent industrial use. NPCA strongly urges NIPSCO to work with NPS to operate this site as undeveloped open space. Either the institutional controls need to ban development on SWMU 15, effectively preserving as open space or as a buffer, or the remediation plan would need to be changed to permit development.

Response to NPCA SWMU 15 Comment:

EPA has included the development of a CMI and LTS stakeholder engagement group in this final remedy as an opportunity to discuss the development of these plans and issues associated with long term facility management.

EPA's Corrective Action jurisdiction includes assessing risks to human health and the environment and ensuring unacceptable exposure pathways are not complete for reasonably anticipated land use scenarios. SWMU 15 is on NIPSCO's property and will be remediated to an industrial/commercial standard. The appropriate institutional controls will include a restriction of future land use to industrial/commercial uses and a prohibition on groundwater use for drinking water purposes. In the absence of complete exposure pathways that pose unacceptable risks, EPA authority to require NIPSCO to reuse their property in specific ways is limited. Redevelopment on SWMU 15 is not necessarily precluded from future plans. Future development would require appropriate measures are taken to ensure the industrial/commercial risk assessment assumptions are followed (Health and Safety Plan, Soil Management Plan, *etc.*) and that the land is geotechnically sound given the ISS monolith.

Institutional Controls and the Greenbelt Comment:
It is unclear in the SB whether EPA intends for the institutional controls, and the restrictive land use covenant specifically, to include or apply to any portion of the Greenbelt Area. NPCA's support of the proposed cleanup is contingent upon an explicit statement by EPA that the restrictive covenant will cover no portion of the Greenbelt area with any restriction that could preclude addition to the National Park.

Response to Institutional Controls and the Greenbelt Comment:
No portion of the Greenbelt Area or IDNP will be included in the institutional controls, including land use restrictions.

SWMU 14 Comment:
Southern Environmental Law Center, National Parks Conservation Association, Save the Dunes, Earthjustice, Hoosier Environmental Council, Izaak Walton League, Just Transition NWI, NAACP LaPorte County, and NWI Green Drinks each expressed strong concern that coal ash would be left at SWMU 14. There is a concern that contaminant transport from SWMU 14 into the downgradient groundwater and surface water of the National Park will accumulate further over time. NPCA acknowledged the risk-based process EPA's Corrective Action program uses and understands it was applied appropriately at SWMU 14; however, future uncertainties remain. Earthjustice presented lines of evidence to suggest the risk analysis performed to support the proposed remedy was flawed and/or incomplete.

Specific elements of the SWMU 14 comments are as follows, in summary:

-the proposed remedy fails to meet the Corrective Action threshold criteria due to the abundance of uncertainty associated with leaving CCR in place at SWMU 14

-failure to determine the impact of regional and local groundwater pumping on past, current or future conditions as it pertains to the location of CCR relative to groundwater
-uncertainty regarding the future groundwater levels or future impacts of precipitation
-use of an inappropriate leach test for the characterization of the CCR and subsequent potential risk
-the magnitude of groundwater plumes attributed to SWMU 14 were not evaluated

NPCA requested additional institutional controls and long-term monitoring associated with any CCR left in place. It is noted that the proposed remedy included the need for institutional controls site-wide, which includes SWMU 14; however, NPCA believes there is insufficient discussion in the SB regarding the details of such controls and their subsequent efficacy. NPCA also recommended NIPSCO enroll SWMU 14 in the Indiana Department of Environmental Management (IDEM) Voluntary Remediation Program (VRP).

Earthjustice stated excavation and off-site disposal must be considered rather than leaving CCR in place.

Response to SWMU 14 Comment:
EPA has spent considerable time re-evaluating SWMU 14 in the context of these public comments. This evaluation occurred in two steps. The first step involved an uncertainties analysis that is provided in the attached January 21, 2021 letter from EPA to NIPSCO. As articulated in our letter, EPA found an abundance of uncertainty associated with the conceptual site model and potential future risk of leaving CCR in place at SWMU 14. In combination with the lack of stakeholder acceptance, EPA found multiple lines of evidence in support of a presumptive remedy of excavation and off-site disposal of the CCR.

The second step involved refining the conceptual site model in order to better understand the physical limits of excavation and overall scope of cleanup. Our understanding of SWMU 14 was based upon NIPSCO's historic description of the unit and several test pit investigations. A reasonable assumption was made that SWMU 14, like SWMU 15, had been used entirely for CCR disposal. However, the refinement step significantly changed our understanding of SWMU 14.

As described in Attachment E, refinement of the conceptual site model included a soil boring investigation across the entire unit on 50-foot grids with 123 soil borings collected. Borings collected information from the ground surface down to the native sand to ensure all non-native (fill) material was characterized. Rather than finding a unit predominately filled with CCR, the investigation determined that 73.7% of non-native material (fill) in SWMU 14 is composed of sand. CCR was identified in SWMU 14 as both course (boiler slag) and fine (fly ash) CCR. Other material identified within SWMU 14 include coal, steel slag with brick and gravel. Approximately 90% of the unit is non-CCR material. Based upon the limited volume of non-sand fill and the non-continuous, discreet nature of its deposition, it appears SWMU 14 was filled with sand[4] from another area of the site (likely Area A given the presence of coal and other lines of evidence) and the additional material was inadvertently moved along with it.

The total area of fill is estimated at 87,000 cubic yards with leachable fine CCR (fly ash) making up 2% of the volume. The non-sand fill is present in discreet, thin layers that do not constitute any significant deposits. Unlike SWMU 15, there is no continuous layer of CCR to suggest it was deliberately placed at this location for consolidation and disposal. The composition of SWMU 14 based upon this refined site model supports the findings of the original risk assessments and reduces the uncertainty discussed during the first step of this re-evaluation. Nonetheless, EPA is including a "hot spot" removal of leachable CCR in this Final Decision. As described in the Final Decision above, the removal will include four areas where aggregate fine CCR was greater than 0.5 foot. The total volume removed will be 4,100 cubic yards of fill that includes 50% of SWMU 14's fine CCR by volume. The remaining fine CCR, 1% by volume of the fill area, is present in thin, discreet layers that are highly mixed with sand. See Attachment E for more detail, including a figure of the areas to be removed.

The SWMU 14 final remedy will include excavation of four areas containing the highest percentage of fine CCR with off-site disposal at a facility permitted to accept CCR. Fine CCR (fly ash) is being targeted based upon its characteristic to more readily leach contaminants[5]. This approach balances what is reasonable to extract from the mostly sand fill in order to remove contamination that is adjacent to the National Park. A CMI and LTS Plan approved by EPA and developed with stakeholder input will be developed. As a component of the LTS Plan, the appropriate institutional controls will be discussed during the stakeholder engagement group sessions.

EPA believes Attachments C and E and the resolution of this issue with a "hot spot" removal addresses this comment. Concerns regarding the uncertainty of future contamination of the National Park from SWMU 14 has been resolved by accurately characterizing the nature of the

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[4] EPA believes there is sufficient evidence to suggest SWMU 14 was filled in with sand that was generated by the excavation associated with the "Nuclear-1" project. In 1967, NIPSCO began planning for the permitting and construction of a nuclear reactor/electric generating plant at the Bailly facility. This project was referred to as Nuclear-1 (N-1). Despite objections of the Department of the Interior (DOI) regarding potential environmental quality and visual impacts to Indiana Dunes, NIPSCO received an Atomic Energy Commission construction permit for N-1 in 1974. Beginning in 1976, NIPSCO constructed a rectangular slurry wall. Upon initiation of dewatering activities, a large excavation was completed within the bounds of the slurry wall. It is around this timeframe, between 1977 – 1979, aerial photographs show SWMU 14 being filled in. It is reasonable to believe that the sand in SWMU 14 came from Area A and that the other material was an incidental inclusion. There does not appear to be any record of this activity.

[5] Boiler slag is comprised of larger particles that fall to the bottom of the boiler and are also composed primarily of amorphous or glassy aluminosilicate materials derived from the melted mineral phases. The availability of a constituent for leaching depends on whether the element resides on the surface of the ash particle, in the outer glass hull, or within the interior glass matrix. Because fly ash particulates are much smaller than boiler slag particulates, they have a larger surface area. The constituents that have condensed on the surface of the fly ash are more available for leaching. Thus, boiler slag has a much lower potential to leach inorganics than fly ash, as demonstrated by leach testing performed on samples collected at SWMU 15 (fly ash) and the Greenbelt (boiler slag).

unit. By doing so, EPA's confidence in the risk assessment outcomes has also increased. The long-term monitoring requests are no longer applicable to this unit in the absence of a current or reasonably anticipated future risk to offsite receptors.

Greenbelt and Eastern Wetland Comment:
All of the groups expressed general support for the proposed remedy for the Greenbelt area; however, concerns over the implementation of the work exists. "The protectiveness of this remedy will depend on the procedures used to distinguish between coal ash and unimpacted native materials."

Response to Greenbelt and Eastern Wetland Comment:
EPA concurs with the commenters that complete excavation of the ash in the Greenbelt is critical to the success of this portion of the remedy. As indicated in the FD, additional sampling may be necessary to supplement the existing delineation sampling. Also, CCR is very distinctive and can be easily identified visually. A photograph of the CCR in the Greenbelt has been provided below. A CMI Plan approved by EPA and developed with stakeholder input will be developed. That plan will identify the existing delineation sampling that has taken place and propose any additional sampling, or other techniques, to refine the area of excavation. The Greenbelt will not be the subject of any institutional controls; therefore, the cleanup must reach unrestricted land use levels.

CCR from the Greenbelt area. There is a distinct visual difference between CCR and the native sands.

IDNP Groundwater and LTS Comment:

EPA's proposed remedy at SWMU 15 in combination with monitored natural attenuation for the IDNP groundwater plume is reasonable from an engineering and technical perspective and should minimize the potential for adverse impacts to the sensitive ecological communities in the National Park over time; however, the progress towards meeting the groundwater corrective action objectives needs to be closely monitored under the long-term stewardship plan. The timeline to reaching the remedial endpoint may be difficult to model or predict due to the variability of natural processes. EPA needs to require that the LTS plan extend as long as needed to meet the remedial endpoint.

The LTS Plan needs to include a requirement for monitoring groundwater aluminum concentrations and pH downgradient of SWMU 15 and SWMU 14 and in the portions of the Dunes with aluminum above background. In the event EPA establishes a primary drinking water standard for aluminum or the State of Indiana develops a drinking water standard for aluminum, the cleanup standards and objectives need to be modified to include aluminum.

The proposed remedy of MNA is not appropriate in light of CCR remaining in SWMU 14.

Response to IDNP Groundwater and LTS Comment:
The EPA Corrective Action program does not limit the length of time a facility is in the long-term stewardship phase. We currently manage facilities that have exceeded a post-remedy monitoring period of 30 years and will continue to implement Corrective Action until remedial endpoints are met. The off-site long-term stewardship requirements at Bailly will remain in place until remedial endpoints are achieved, maintained and approved by EPA. Certain long-term stewardship obligations, such as institutional controls, can never be terminated unless the land is cleaned up to unrestricted use, such as residential.

As alluded to in your comment, aluminum availability in groundwater depends upon pH levels. An evaluation of the natural occurrence and geochemistry of aluminum in IDNP was conducted as part of the investigation in order to better understand potential contributions from the Facility. Investigations within IDNP found aluminum in soil and groundwater above background levels in Blag Slough, SWMU 15 wells, and wells within the eastern wetlands, Little Lake and other wetlands. Aluminum was not detected above background in wells immediately downgradient of SWMU 15 or in any IDNP surface water samples. The aluminum in soils and sediment within IDNP appear to be attributable to naturally occurring aluminosilicate minerals such as micas and feldspars. Area Houghton and Adrian muck soils which contain a lot of decaying organic matter result in an acidic environment that mobilizes naturally occurring aluminum into the dissolved phase and groundwater.

Within SWMU 15 itself the pH ranges from eight to over eleven (due to the CCR) and aluminum is detected in groundwater above background at those locations (inside the landfill). Immediately downgradient of SWMU 15, groundwater pH is circumneutral (6.5-7.5) and aluminum was not detected in groundwater above background. Further downgradient, where the wells are installed in the muck soils with high amounts of organic matter, the pH is between four and six (due to the organic matter) and elevated aluminum concentrations in groundwater are observed. There does not appear to be a complete migration pathway from SWMU 15 to the downgradient wells with elevated aluminum. This pattern is consistent with the conceptual site model indicating the IDNP aluminum appears to be largely naturally occurring and not entirely attributed to SWMU 15's leaching into the groundwater.

Aluminum will be monitored during the post-remediation monitoring but will need to be evaluated in the context of naturally occurring levels that vary based upon geochemistry. Concentrations will be plotted with existing historic data and anomalous concentrations will be further evaluated. Further discussion regarding long-term stewardship monitoring is welcome as part of the stakeholder engagement described below.

This final remedy includes a hot spot removal at SWMU 14 based on a refined site model that better informs our understanding of CCR in that unit. Fine CCR in SWMU 14 represents approximately 2% of the 87,000 cubic yards and is present in small, discontinuous amounts. Though it appears the risk assessments for SWMU 14 are accurately representing current and potential future risk, EPA identified four areas that can be excavated and disposed of off-site. The MNA portion of the final remedy will be supported by source control at SWMU 15 and the re-evaluation and hot spot removal at SWMU 14. The CMI Plan will reflect the details of the MNA program and that Plan will be a subject of the focused stakeholder engagement group.

CMI and LTS Plan Comment:
The CMI Plan and the LTS Plan have not been made available as part of the proposed remedy for public comment. Remedy implementation and LTS are critical elements of the Area C cleanup and, therefore, should be made available for the public to review. The decision logic used to determine the effectiveness of source control and MNA at achieving groundwater corrective action objectives is fundamental to cleanup success and protection of the National Park.

Response to CMI and LTS Plan Comment:
The CMI and LTS are critical elements at this Facility given the unique circumstances of its location. Generally, draft deliverables such as draft reports exchanged between a facility and EPA are not publicly released. However, given the impact on public lands, which have been designated a National Natural Landmark and have global ecological significance, EPA believes continued stakeholder input is reasonable and important at this uniquely situated Facility.

In lieu of holding an additional public comment period, EPA instead will engage with NIPSCO and a focused stakeholder group. At other facilities, usually where residential property is impacted, EPA has found focused stakeholder groups to be very effective. A focused stakeholder group consists of a small group of representative individuals invested in participating in a process, with EPA and the responsible party, that is designed to achieve specific goals.

A focused stakeholder group will be offered to the environmental groups that submitted comments. Other community members and local officials may also be considered. EPA and NIPSCO will commit to developing an agenda and format for a deliberative process designed to draft a consensus driven CMI Plan and LTS Plan. EPA envisions a finite number of meetings with specific goals in order for participants to gauge the level of commitment required. These meetings will provide stakeholders the opportunity to discuss the content of these plans, provide feedback, and participate in a collaborative effort.

In an abundance of caution, these meetings are anticipated to take place remotely during the on-going COVID-19 pandemic.

Financial Assurance Comment:
NPCA requests that EPA require NIPSCO provide the required financial assurance for this corrective action through a trust fund or insurance.

Response to Financial Assurance Comment:
EPA has recommended in this Final Decision that the financial assurance mechanism at the Bailly Facility be in the form of either a trust or insurance. We believe the protection of public lands warrants this recommendation; however, the regulations provide NIPSCO the option to select from several mechanisms to provide financial assurance. Of course, EPA will review the financial assurance mechanism regularly to assure that it is appropriate.

EPA thanks all of the individuals and groups that submitted comments on our proposed remedy for Area C of the NIPSCO Bailly Facility. EPA values stakeholder engagement and appreciates the contributions it has made to this Final Decision.

ATTACHMENT A

Statement of Basis

Northern Indiana Public Service Company (NIPSCO)

Bailly Generating Station, Area C

July 6, 2020

955952

UNITED STATES

ENVIRONMENTAL PROTECTION AGENCY

REGION 5

Statement of Basis

For

AREA C

Northern Indiana Public Service Company (NIPSCO)
Bailly Generating Station

Chesterton, Indiana

EPA ID NO. 000 718 114

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FIGURES

TABLES

ATTACHMENTS

ACRONYMS

AOC	Area of Concern
BERA	Baseline Ecological Risk Assessment
BGS	Below Ground Surface
CAO	Corrective Action Objective
CCR	Coal Combustion Residuals aka Coal Ash
CMS	Corrective Measures Study
ESL	Ecological Screening Level
EPA	U.S. Environmental Protection Agency
GLI	Great Lakes Initiative
HHRA	Human Health Risk Assessment
HI	Hazard Index
IC	Institutional Control
ICIAP	Institutional Control Implementation and Assurance Plan
IDEM	Indiana Department of Environmental Management
IDNL	Indiana Dunes National Lakeshore
IDNP	Indiana Dunes National Park formerly known as IDNL
ISS	In-Situ Solidification/Stabilization
MCL	Maximum Contaminant Level (Drinking Water)
MCS	Media Contaminant Standard
MNA	Monitored Natural Attenuation
LTS Plan	Long-Term Stewardship (LTS) Plan
RCRA	Resource Conservation and Recovery Act
RISC	Risk Integrated System of Closure (IDEM)
RSL	Regional Screening Level
RFI	RCRA Facility Investigation
SB	Statement of Basis
SWMU	Solid Waste Management Unit
U.S.C.	United States Code
WQS	Water Quality Standards

SECTION I: INTRODUCTION AND PURPOSE OF THE STATEMENT OF BASIS

The primary purpose of this Statement of Basis ("SB") document is to invite written comments from the public on the approach proposed by the U.S. Environmental Protection Agency (EPA) to remediate and manage contaminated soil and groundwater at Area C of the NIPSCO Bailly Generating Station *(246 Bailly Station Road, Chesterton, Indiana 46304)* ("Facility") (see Figure 1). The Facility burned coal to generate electricity. The byproduct of burned coal, coal ash, was historically disposed of on-site where it contaminated soil and groundwater. This proposed remedy is designed to protect people currently using the Facility, future industrial or commercial workers, and off-site receptors. Off-site receptors include recreational users of the adjacent Indiana Dunes National Park ("IDNP" or "National Park") property. The proposed cleanup involves excavation and off-site disposal of contaminated soils at the source area. In addition, contaminated soil present beneath the water table will be solidified to prevent remaining contaminants from migrating to the groundwater or surface water. This document summarizes the proposed remedy for Area C of the Facility. Additional technical details can be found in the Corrective Measures Proposal (Final Area C Corrective Measures Study, NIPSCO July 9, 2019) and other documents contained in the Administrative Record for this Facility (see Attachment A).

EPA invites written comments from the public on the proposed remedy. Additionally, EPA will host a public meeting to answer questions and receive additional comments. Public comments will be used to inform EPA's final decision regarding the remedy selection. EPA will publish a Final Decision and Response to Comments document conveying EPA's decision about how the Facility will be remediated, after the close of the comment period. See page 24 for instructions explaining how to provide comments to EPA on the SB.

Corrective Action Order on Consent – 3008(h)
In 2005, EPA and the Northern Indiana Public Service Company ("NIPSCO") entered into an Administrative Order on Consent ("Order") requiring that NIPSCO investigate and clean up contamination released at its property and establishing EPA oversight of the remedial process. The Order was issued under the authority of Section 3008(h) of the Solid Waste Disposal Act (commonly referred to as the Resource Conservation and Recovery Act of 1976, "RCRA"), as amended by the Hazardous and Solid Waste Amendments of 1984, 42 U.S.C. § 6928(h).

The work ordered by EPA is designed and implemented to protect human health and the environment. EPA's RCRA Corrective Action program oversees the cleanup of the Facility. The Corrective Action program is responsible for ensuring that facilities investigate and clean up releases of hazardous waste and hazardous constituents at their properties and any releases that have spread beyond the property boundaries, which may pose a risk to human health or the environment. To accommodate the investigation, the Facility was divided into three Areas, A, B and C. Area A and Area B were the subject of an EPA 2012 Final Decision for the NIPSCO Facility. Area C needed additional investigatory work, however, to enable EPA to determine the appropriate cleanup remedy for the remaining portion of the Facility and the adjacent off-site areas. See Figure 3. Area C is the subject of this document. The proposed remedies, or clean-up actions, for the Facility were chosen based upon the current and future anticipated use of the property.

Area C Remedy Summary
After reviewing the results of samples and studies, past environmental practices, historical investigations and remedial activities, a suite of cleanup options were evaluated for each contaminated area that posed a risk to human health or the environment. EPA refers to an area where waste was stored or disposed or routinely released as a Solid Waste Management Unit ("SWMU"or "SWMUs"). Each cleanup option was evaluated for its ability to protect human health and the environment at these contaminated areas or SWMUs. After comparing options and weighing each against EPA standards, EPA is proposing the cleanup actions presented below. Each of the options summarized below are described in more detail in Section VI (see Figure 2 which shows the SWMUs and areas of contamination).

Proposed Remedies
SWMU 15: Partial Excavation and Off-Site Disposal of Coal Combustion Residuals ("CCR") with In-Situ Solidification ("ISS") of CCR Below the Water Table
SWMU 15 is an area where NIPSCO historically disposed of coal combustion residuals on its property. CCR contaminants commonly include metals such as the aluminum, arsenic, boron, molybedenum and selenium that were found in SWMU 15. Under this proposed remedy, NIPSCO will excavate the CCR[1] located above the water table (approximately 100,000 cubic yards) and dispose of it off-site. The remaining CCR located below the water table (approximately 85,000 cubic yards) will be stabilized and contained through the process of solidification (called "in-situ solidification/stabilization" or "ISS"). ISS is a common[2] method of containment involving the mixture of additives with waste to physically and chemically reduce the mobility and toxicity of contaminants. ISS encapsulates the waste and forms a solid material while chemical reactions between the additives and waste further bind the contamination up into the solid mass. ISS is being proposed for the deeper, saturated CCR due to worker safety and logistical reasons, discussed later.

Greenbelt and Eastern Wetland: Excavation and Off-Site Disposal
A small area of CCR was discovered in the off-site Greenbelt[3] area and adjacent IDNP property. The presence of CCR within IDNP is unacceptable and, therefore, excavation and off-site disposal is the only proposed option (referred to as a "presumptive remedy"). NIPSCO will excavate the CCR and intermingled soil for off-site disposal with a target volume of 705 cubic yards, based on the

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[1] Coal combustion residual ("CCR"), commonly known as coal ash, is created when coal is burned by power plants to produce electricity. It consists of the material (ash) that is left after the coal is burned. See page 12, table listing Potential Constituents of Concern Table associated with CCR.

[2] Solidification/stabilization is within the top five most frequently selected in-situ methods for source remediation according to the 2017 Superfund Remedy Report, 15th Edition. As summarized on *clu-in.org,* EPA's 2010 Superfund Remedy Report indicates that 56 Superfund National Priorities List sites used ISS to treat sources between 1982-2008.

[3] In 1996, NIPSCO and the National Park Service ("NPS") entered into a memorandum of agreement related to the Greenbelt property, which exists as a buffer between the developed portions of the Facility and Indiana Dunes National Park. The goal of the agreement was to ensure that the Greenbelt property was managed in a manner consistent with the adjacent IDNP. Through the agreement, a portion of the Greenbelt was conveyed to NPS by donation, a portion of the property was the subject of a perpetual conservation easement granted to NPS, and a portion of the property was made the subject of a revocable license granted to NPS. NIPSCO also entered the Greenbelt property into the Indiana DNR Classified Wetlands Program in 2010. In 2018, as part of a land exchange between NIPSCO and NPS, a 5.6-acre parcel of the Greenbelt located directly east of the operational area of Bailly Generating Station was transferred from NIPSCO to NPS. In 2019, NIPSCO, in coordination with IDNP, commenced ecological restoration efforts within the Greenbelt property and adjoining Park wetlands.

investigation. The excavated material will be replaced with clean dune sand from an approved source and NIPSCO will collaborate with IDNP to restore the area with plantings that are native to the National Park.

IDNP Groundwater: Source Control and Monitored Natural Attenuation ("MNA")
Groundwater contaminated by the CCR in SWMU 15 has migrated to the off-site IDNP property. The primary risk driver to IDNP is boron. This proposed remedy will require regular monitoring of the groundwater with an expectation that remedial objectives will be met within a reasonable timeframe (within 15 years). This approach is predicated on eliminating the leaching CCR in SWMU 15 that is the source of contamination. MNA is being proposed, in consultation with IDNP, as the least disruptive option to the National Park. A contingency plan will be evaluated in the event source control and natural attenuation do not achieve remedial endpoints. A contingency plan could include additional or different monitoring to verify conditions or an alternative cleanup action. Any contingency plan evaluated will be done in consultation with IDNP.

Previously Barren IDNP Soil Area: Monitored Natural Attenuation
This area will continue to be monitored to ensure the historic contamination from the settling ponds is resolved. As a remedial option, MNA requires source control. The source of the altered soil pH in this area was the previously unlined wastewater and coal ash settling ponds. These ponds were lined in 1980. Observed trends in the area indicate conditions are returning to normal and desirable, native plant communities are becoming established. This remedial option requires on-going monitoring with a contingency plan and is proposed, in consultation with IDNP, as the least disruptive option to the National Park.

Facility-Wide: Land Use Institutional Control
To limit exposure to remaining contaminants, EPA will require NIPSCO to establish and record an environmental restrictive covenant, approved by IDEM and EPA, to restrict the land use of the NIPSCO property to industrial or commercial use now and in the future. A restrictive covenant will also prohibit the use of groundwater as a drinking water source. This component of the proposed remedy will only apply to the NIPSCO property and is consistent with NIPSCO's anticipated future land use.

Facility-Wide: Financial Assurance
NIPSCO must demonstrate a financial ability to complete the proposed remedy and long-term monitoring by securing an appropriate financial instrument.

Facility-Wide: Long Term Stewardship/Five Year Remedy Review
EPA will require NIPSCO to establish a long-term stewardship plan, including monitoring and reporting, for the duration of time contamination remains above unrestricted use levels. The frequency of data collection and reporting will be defined within the long-term stewardship plan. Institutional and engineered controls will be certified on a regular schedule in accordance with an Institutional Control Implementation and Assurance Plan (ICIAP). Five-year remedy reviews, a component of long-term stewardship, will be the appropriate means to update the conceptual site model (CSM), as needed.

SECTION II: FACILITY BACKGROUND

Location and Setting

The Facility is in Porter County in northwest Indiana and occupies 350 acres on the eastern edge of an industrial area along the shoreline of Lake Michigan. The Indiana Dunes National Park (formerly Indiana Dunes National Lakeshore[4]) borders the northern and eastern portions of the Facility. The Cowles Bog Wetland Complex, a globally significant and ecologically sensitive feature, is northeast of the SWMU 15 area. The Facility is bordered on the west and south by the ArcelorMittal Steel Burns Harbor Plant. For the purpose of the Corrective Action program, the Facility was divided into three areas, Areas A, B, and C (see Figure 3). EPA's July 9, 2012 Final Decision selected the final remedy for Area A and Area B. This SB proposes a final remedy for Area C.

As the final Area of the NIPSCO Facility to be addressed, Area C has multiple components and is irregularly shaped. Area C consists of the eastern portion of the Facility as shown in Figure 3. Specifically, Area C is comprised of:

1) Areas previously used as CCR disposal areas, including SWMUs 14 and 15. See Figure 2 and Figure 10.

2) A Greenbelt buffer that separates the Facility from the adjacent IDNP. The Greenbelt buffer follows the length of the northern and eastern boundary of the Facility and the IDNP. Generally, the Greenbelt is approximately 300 to 400 feet wide as it follows Facility's property boundary from north to south. However, as the Greenbelt extends south, it becomes irregularly shaped as it encounters SWMU 14 and SWMU 15 and the Eastern Wetlands. Within the Greenbelt are the Southeast Pond, the Previously Barren Soil Area, and portions of the Eastern Wetland and the Northwest and Central Blag Sloughs. See Figure 6.

3) The adjacent IDNP entails approximately 600 acres although CCR has affected groundwater in only a few areas of the IDNP depicted in Figure 10. The IDNP includes parts of the Eastern Wetland and the Northwest and Central Blag Sloughs, Little Lake, the Great Marsh, Cowles Bog Wetland Complex, and the Southeast Pond. See Figure 3 and Figure 6.

This proposed remedy addresses areas of concern ("AOC" or "AOCs") that pose an unacceptable risk to people or ecological receptors. The largest on-site AOC that poses an unacceptable risk is SWMU 15 where CCR was disposed of and came into contact with groundwater. As discussed in more detail in Section IV, SWMU 15 poses an unacceptable risk solely to ecological receptors.

CCR also was disposed of in SWMU 14, but, unlike SWMU 15, the CCR was not placed below the water table. Because the CCR in SWMU 14 does not contact the groundwater, it does not substantially impact

[4] On February 15, 2019 the Indiana Dunes National Lakeshore (IDNL) was signed into law as the Indiana Dunes National Park (IDNP). The Administrative Record will reflect the prior designation, IDNL; however, this Statement of Basis and all documents hereafter will use the current national park designation, IDNP.

the groundwater. EPA evaluated the potential risk to both human health and ecological receptors associated with SWMU 14 and determined SWMU 14 did not pose an unacceptable risk to any receptor. Consequently, this proposed remedy does not include SWMU 14. The entire Facility, including SWMU 14 of Area C, will be managed with institutional controls to control use of the land and groundwater. The Facility will also require long-term stewardship.

The Facility is located on the southern tip of Lake Michigan. Lake Michigan is hydraulically connected to Area C and the IDNP. Consequently, Lake Michigan water levels influence the groundwater, wetlands, and surface waters throughout Area C and the IDNP.

Recently designated a national park, IDNP is a globally rare landscape with sand dunes and swales (wetlands). It provides habitat to approximately 30 percent of Indiana's rare and endangered species including 60 rare plant and animal species[5]. The Cowles Bog Wetland Complex is a particularly sensitive feature of the National Park located adjacent to the Facility. The 205-acre bog complex is a Congressionally designated National Natural Landmark due to its unique biodiversity[6]. This interdunal wetland complex is supported by emerging groundwater beneath a floating mat of peat moss and unique vegetation.

The cleanup approach being proposed in this document is intended to balance the need to eliminate contamination to IDNP while preserving its fragile ecosystems. Invasive or potentially destructive cleanup methods have not been proposed for IDNP. This approach has been developed in consultation with IDNP.

Ownership History

NIPSCO purchased the 350 acres of undeveloped land at this site in 1932. Though development did not take place until decades later, the land was acquired at a time when the steel industry was expanding in northwest Indiana and NIPSCO anticipated future energy needs[7]. Construction of the coal-fired power plant began in 1959 and it became operational in 1962. In 2017, NIPSCO announced it would be closing the Facility and it ceased operation in 2018.

Manufacturing, Release, and Regulatory History

The Facility included about 300,000 square feet of buildings and production areas within the Area A portion. It generated electricity for distribution to industrial, commercial, and residential customers from two coal-fired, high-pressure steam boilers, each connected to a steam turbine generator. The Facility ceased operation of the coal fired boilers on May 31, 2018. Area C consists of the former wastewater treatment plant and the eastern landfill areas (SWMUs 14 and 15), as well as a portion of the IDNP.

Illinois Basin coal, 4,500 tons of which was burned daily in the two boilers, was delivered to the plant in railroad cars and unloaded into large receiving hoppers located beneath railroad tracks in the rotary dumper building. The coal pile was in the center of Area A. The coal was conveyed by belt from the coal pile to the crusher house, where it was crushed into pieces to meet optimal firing specifications. The crushed coal was conveyed inside the building and placed in two 2,900-ton storage bunkers until

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[5] Shirley Heinze Land Trust, www.heinzetrust.org
[6] The National Park Service, www.nps.gov
[7] Schoon, Kenneth J., *Shifting Sands*, 2016

needed. This coal pile was about 400 by 800 feet in area and could store enough coal for approximately 45 days of power generation.

The Facility obtained makeup and cooling water for plant operations from Lake Michigan. At peak demand, the Facility used up to 300,000 gallons of lake water per minute. Most of this water was used to cool and condense steam. The resulting non-contact cooling water and boiler blowdown were discharged to Lake Michigan in accordance with NIPSCO's National Pollutant Discharge Elimination System (NPDES) permit IN 0000132. The permit was modified in 2019 to reflect changes in operation and is set to expire July 31, 2022.

Several waste streams were generated by the power generation and the Facility's maintenance processes, including bottom and fly ash (CCR), non-contact cooling water, industrial wastewater, cleaning wastes and rinsates, used oil, asbestos insulation, scrap, and limited amounts of spent chemicals. By volume, most of the generated solid waste consisted of CCR. As a result of past activities, EPA identified the Facility as being subject to certain provisions of RCRA (in particular, RCRA Corrective Action). The cleanup activities proposed in this document are required to fulfill that RCRA Corrective Action obligation.

CCR was disposed of on-site between 1962 and approximately 1979 at SWMUs 14 and 15. By approximately 1979, neither SWMU was being used for CCR disposal. Dewatered bottom ash was sent off-site for beneficial recycling as shot blast media. Fly ash was sent off-site for disposal in a regulated landfill.

Physical Setting and Site Characteristics

The Facility has an "L"-shaped footprint and has been divided into Areas A, B, and C as previously described and depicted in Figure 3. Area A includes the western portion of the Facility where the power generation buildings, associated infrastructure and coal storage are located. NIPSCO retired the two coal-fired units on May 31, 2018. The Facility will continue to house equipment to ensure transmission of continuous voltage and a gas-fired "peaking unit" used during high-demand periods.

Area B includes settling ponds associated with the Facility's former wastewater management system, which are in the central portion of the property. As part of the coal-fired unit decommissioning these impoundments are no longer receiving CCR and are in the process of being closed, with State oversight, consistent with the CCR Final Rule (40 CFR Parts 257 and 261).

Area C, the subject of this SB, is comprised of locations where CCR was disposed of including SWMU 15 and SWMU 14. It also includes the Greenbelt, the Southeast Pond and the Eastern Wetlands. Area C also includes portions of the IDNP including a Previously Barren Soil Area and a downgradient portion of the IDNP where the CCR contaminants have been detected in the groundwater and surface water. The IDNP portion of Area C is over 600 acres; however, CCR-related contamination also has been identified in a small downgradient area, shown on Figure 10.

The largest of the CCR disposal areas, SWMU 15, is the source of off-site contaminated groundwater that poses a risk to ecological receptors. The groundwater migrates from upgradient, encounters the underground CCR which contaminates the groundwater and, then, the contaminated water continues to migrate downgradient into the IDNP. The northern portion of SWMU 15 is a mostly vegetated, vacant field and the southern portion of SWMU 15 is also vacant land but covered in gravel and slag. The slag was historically placed as fill and will be removed and disposed of off-site during the proposed remedy.

Soil
Soils located at and near the Facility are composed primarily of five types: Oakville fine sand, Houghton muck, Adrian muck, Maumee loamy fine sand, and Dune sand. The soils are mainly dune deposits that contain sand and some fine gravel. In addition to the dune deposits, the IDNP interdunal wetlands contain paludal deposits (peat, muck, some marl, and mixtures of peat and sand).

Geology
The geology along the southern shore of Lake Michigan represents a complex glacial and post-glacial history consisting of shallow-water coastal lake, wetland, and dune sedimentation that began during, and continued after, the final stages of glacial retreat in the Great Lakes area (see Figures 4 and 5).

Unconsolidated deposits near the Facility are underlain by the Antrium Shale (Upper Devonian) and carbonate rock (Muscatatuck Group) of Devonian Age. Bedrock near the Facility ranges from 430 to 450 feet above mean sea level (amsl). The Antrium Shale consists of brown to black non-calcareous shale and overlies the Muscatatuck Group in the Facility area. The Muscatatuck Group consists of rocks that are predominately limestone and dolomite.

A 1977 United States Geological Survey (USGS) boring near the eastern portion of the Facility encountered bedrock (Antrium Shale) at 175 feet below ground surface (bgs). A second USGS boring on the western portion of the Facility encountered shale (Antrium Shale) at 182 feet bgs.

Hydrogeology
Surficial aquifers under the Facility consist of glacially-derived sediments associated directly or indirectly with the advance and retreat of the Lake Michigan ice lobe during the Wisconsinan glaciation. There are three major aquifers within the unconsolidated sediments at and near the Facility: Basal Sand, Subtill, and Surficial.

The most extensive aquifer around the Facility is the surficial aquifer and consists primarily of unconfined lacustrine and eolian sands. The surficial aquifer under the Facility is approximately 50 feet thick and groundwater flow in the surficial aquifer is primarily horizontal toward Lake Michigan. The saturated thickness ranges from 20 to 40 feet. The aquifer is recharged in the dune-beach complex (north of U.S. Route 12) and discharges into streams, ditches or ponded areas in the adjacent interdunal wetlands, including the western terminus of the Great Marsh. The Great Marsh is an expansive interdunal wetland formed as part of the broader dune system approximately 4,000 years ago. Historically, it consisted of a single open body of water comprised of one watershed. In the early twentieth century, the Great Marsh was impacted by urbanization and was divided into three watersheds. It is currently about 12 miles from west to east with the Cowles Bog Wetland Complex located at its far western edge.

Surface Water
Surface water within Area C is limited mostly to off-site wetlands within IDNP (discussed more below). Some of those water bodies are permanent features and some come and go with seasonal water fluctuations. On-site water bodies, settling ponds, are in Area B. These ponds were associated with the Facility's former wastewater management system for the coal-fired power generation. The Area A coal-fired unit is undergoing decommissioning, and these settling ponds no longer receive non-contact cooling water and are being closed under IDEM oversight consistent with the applicable regulations.

North and downgradient from the CCR disposal areas and settling ponds, there are a variety of surface water bodies present. As shown in Figure 6, the Central Blag Slough forms the northern edge of Area B and contains surface water depending on precipitation and groundwater elevations. The same is true for Little Lake and the Eastern Wetlands located within Area C, north of SWMU 15. A permanent surface water body known as Southeast Pond exists in the eastern part of Area C. The Cowles Bog Wetland Complex, located east of Area C, lies north of the Southeast Pond and extends to the east. Lake Michigan is located north of the IDNP. The Little Calumet River is located approximately 0.5 miles south of the Facility and discharges to Lake Michigan through Burns Ditch about 5 stream miles west of the Facility.

Ecological Setting

The Facility itself does not contain ecological habitat. The surrounding IDNP however, including Area C, is a globally significant ecosystem. IDNP is a “dune and swale” environment, which means a series of tall sandy ridges (dunes) parallel to the lake alternating with low-lying areas that form wetlands. This unique environment was created by the advance and retreat of the last glacier responsible for creating Lake Michigan. The biological diversity within the National Park is amongst the highest per unit area of all our national parks. There are over 1,100 flowering plant species and ferns and 350 species of birds. IDNP was the focus of the investigations for Area C and the remedies proposed in this document are designed to ensure the National Park is protected and minimally disturbed while also being restored.

SECTION III: SUMMARY OF ENVIRONMENTAL INVESTIGATION

The purpose of a Corrective Action Remedial Facility Investigation (“RFI”) is to determine whether hazardous waste or hazardous constituents were released into the environment at a Facility, and if so, to evaluate the significance of the releases in terms of risk to human health and the environment. The investigation is governed by a conceptual site model (“CSM”) which illustrates Site physical characteristics, sources of contaminants, their fate and transport, affected environmental media, and potentially exposed people and ecological receptors (plants and animals). Each RFI varies depending on Facility-specific details.

During the investigation phase, environmental media such as soil, groundwater, surface water, sediments, and biota are sampled and analyzed for contamination. Where contaminated media are found, subsequent sampling is usually completed to refine the CSM and define the extent of contamination (how far it may have traveled), and to collect enough information for analysis of exposure effects in risk assessments. After each sampling event or investigation phase, EPA evaluates the CSM to determine the adequacy of the data to support decision-making. If found to be inadequate, additional data collection is necessary. Due to the sensitive nature of the National Park and complicated hydrology of the area, this process took many years to complete for Area C.

Site Investigation Summary

NIPSCO conducted an extensive multi-phase, multi-media investigation in Area C. Soil, sediment, groundwater, surface water and plant samples have been collected to determine the nature and extent of the contamination. Studies were conducted to fully understand the makeup of the National Park and the various ecological interactions critical to the park. Over the course of several years and multiple, iterative studies, sufficient information was gathered to determine the impacts of contamination from the Facility on the National Park and how best to address them.

Under Corrective Action, two SWMUs (14 and 15) and two AOCs (9 and 10) as well as downgradient locations in IDNP were identified within Area C as needing investigation to determine whether they have released hazardous waste or hazardous waste constituents (See Figure 2). These areas were identified based upon waste handling history and potential contaminant fate and transport mechanisms. Groundwater, surface water, soil and sediment were characterized at the SWMUs and AOCs and at downgradient locations of potential concern (e.g., Great Marsh, Little Lake, Eastern Wetlands, Central Blag Slough and Northwest Blag Slough). Biological assessments were also conducted in order to fully characterize the impacts to the IDNP. Studies focused heavily on plants but also included amphibians, due to their sensitivity to contamination. Even low levels of contaminants pose a risk to the receptors within the National Park due to the receptors' sensitivity.

Over the course of the RFI, the following studies were performed to determine what the chemicals of concern were, where they were located and what risks they posed:

Soil Investigations

- test pit investigations to delineate the extent of known and suspected CCR in SWMU 14 and 15;
- soil borings and collection of over 450 soil samples to characterize soil lithology and identify areas of exceedances of screening criteria and/or background concentrations;

Groundwater & Hydrogeologic Investigations

- installation of over 50 groundwater monitoring wells on and off-site;
- quarterly groundwater, surface water and sediment sampling to identify exceedances of screening criteria and/or background concentrations;
- analysis of over 400 sediment samples, over 400 surface water samples, and over 600 groundwater samples;
- installation and quarterly measurement of staff gauges in the IDNP to identify vertical hydraulic gradients in low-lying wetland areas;
- testing and quarterly monitoring well gauging to identify horizontal hydraulic gradients;
- sampling of the Lake Michigan groundwater/surface water interface (GSI) within IDNP along the shore of the lake;

Ecological (Plant and Animal) Investigations

- investigation to characterize the fraction of vegetative stress in contaminated portions of IDNP;
- investigation to assess whether a relationship exists between the absence of IDNP vegetation in barren soil areas and presence of Facility-related constituents in soil;
- assessment of whether a relationship exists between observation of vegetative stress and the presence of Facility-related constituents in soil and plant tissue;
- amphibian survey to observe and evaluate the ecological receptors in IDNP wetlands downgradient from the Facility;
- amphibian surveys to further assess whether Facility-related constituents were impacting IDNP amphibian populations;
- amphibian toxicity study to determine whether some component of sediment in the IDNP exhibits toxicity to embryonic and/or larval amphibians;
- rhizome and soil testing to evaluate the potential for plant bioconcentration of metals and subsequent release back to soils; and
- plant toxicity study to assess whether Facility-related constituents were impacting plants in the IDNP

Investigations, such as the ones summarized above, collect data and compare those results to screening values. A contaminant found above its screening value is considered a constituent of potential concern ("COPC"). Those COPCs are then further evaluated during the risk assessment process to determine if they are causing any unacceptable risk to the receptor of concern (discussed more in the next section). The COPC's that were identified during the investigation are presented in the table below. See Figures 7, 8 and 9 to reference these investigation locations.

Constituents of Potential Concern SWMU 15		
Soil	**Sediment**	**Groundwater**
Arsenic	Not Applicable	Aluminum
Boron		Arsenic
Cadmium		Boron
Chromium		Molybdenum
Copper		Selenium
Lead		
Manganese		
Molybdenum		
Selenium		
Eastern Wetland		
Soil [1]	**Sediment [1]**	**Groundwater**
Arsenic	Arsenic	Aluminum
Boron	Barium	Boron
Cadmium	Boron	
Chromium	Cadmium	
Copper	Chromium	
Molybdenum	Copper	
Selenium	Lead	
	Manganese	
	Mercury	
	Molybdenum	
	Selenium	
Central Blag Slough		
Soil	**Sediment**	**Groundwater**
Not Applicable	pH	Aluminum
		Manganese
Northwest Blag Slough		
Soil	**Sediment**	**Groundwater**
Not Applicable	Not Required	Aluminum
Little Lake		
Soil	**Sediment**	**Groundwater**
Not Applicable	Not Required	Aluminum
		Manganese
Other Wetlands		
Soil	**Sediment**	**Groundwater**

Not Applicable	Not Required	Aluminum
		Manganese
SWMU - Solid Waste Management Unit		
Not Applicable - soil or sediment not present in sub-area.		
Not Required - sediment in this sub-area does not require investigation based on CSM.		
[1] Only applies in Greenbelt at toe of SWMU 15 and potentially extending into the IDNL near IDNL-GW13.		

The contaminants listed above were found at concentrations above conservative screening values. Those screening values are very low and developed to overestimate impacts to ensure nothing is prematurely ruled out. The screening values for the Area C investigation included:

- Groundwater: Great Lakes Initiative values (GLI); plant screening values (Oak Ridge National Laboratory values); Piping Plover values developed by EPA for site-specific evaluation; and, background
- Surface Water: GLI; background
- Soil (ecological): EPA Ecological Soil Screening Levels (avian, mammalian, plant, invertebrates); EPA Region 5 Ecological Screening Levels; and, Oak Ridge National Laboratory values
- Soil (human health): IDEM RISC Industrial default closure level; EPA Regional Screening Level (industrial); and, background
- Sediment: EPA Region 5 Ecological Screening Levels; NOAA Screening Quick Reference Tables; and, background

Since completion of the Area C RFI (AMEC, 2011), NIPSCO conducted additional CMS investigations to better understand the horizontal and vertical distribution of CCR in SWMU 15, groundwater geo-chemistry and soil mineralogy, and hydrology. Detailed field and laboratory studies were conducted to quantify boron attenuation on aquifer solids, define the attenuation mechanisms (both temporary sorption and permanent fixation), and the capacity of the aquifer to remove boron from the dissolved phase. Findings from these investigations were used to refine the conceptual site model for groundwater flow and boron transport. Beginning in 2016, a series of CMS-focused investigative studies were conducted at SWMU 15 to examine the excavation, encapsulation, and ISS technology options that were evaluated for source control.

The SWMU 15 investigations included multiple, direct-push and hand-auger borings to better understand the distribution of fine CCR and the nature of underlying, native soils, particularly in central portions of the landfill. Sonic borings were subsequently advanced to better understand lithology at depths greater than 40 feet, the limit of direct-push borings. Samples of CCR were collected for chemical and geotechnical analysis, as well as bench-scale testing of various formulations to evaluate the ISS technology. Samples of sand and clay were also collected for geotechnical testing for consideration of additional design parameters.

The IDNP investigations were conducted primarily in groundwater downgradient of SWMU 15. Data were collected to determine the viability and mechanisms of natural attenuation and in support of potential remedial alternatives evaluated for IDNP groundwater. NIPSCO coordinated with EPA's Office of Research and Development to ensure any monitored natural attenuation evaluations were conducted in accordance with EPA's guidance[8]. Additional assessment was conducted in Cowles Bog and Little Lake to refine the conceptual site model (CSM) for groundwater flow. Parameters that were developed from the IDNP studies were incorporated into numerical models of groundwater flow and contaminant transport to perform a comparative analysis of the alternatives developed for IDNP groundwater.

The following is a summary of those additional investigations that have taken place since the RFI:

- groundwater geochemistry and soil mineralogy studies to quantify boron attenuation on aquifer solids;
- an aerial photograph study to understand the history and sequence of SWMU 15 development;
- supplemental SWMU 15 delineation and CCR characterization (including soil borings, soil and CCR sampling for analysis of chemical and geotechnical properties, and CCR sampling for leachability testing);
- deep soil boring program to assess clay continuity and the native lithology underlying SWMU 15;
- soil pH study in area of barren soil;
- hydraulic conductivity testing, groundwater/surface water transducer study, groundwater gauging, water elevation surveys, and Cowles Bog groundwater sampling to better evaluate the hydraulic conditions within the sensitive IDNP area.

Attachment B provides detailed information about the investigations that have taken place from about 2012 to present. These investigations have significantly impacted the selection of this proposed remedy and therefore are provided in an attachment for convenience. The information can also be found in the *Final Area C Corrective Measures Study* (2019).

SECTION IV: SUMMARY OF RISK EVALUATION

EPA uses risk assessments to evaluate the information and data collected during the investigation to determine whether the contamination present poses a risk to human health or the environment. This is done in a human health risk assessment (HHRA) and a baseline ecological risk assessment (BERA). Both types of risk assessments were conducted for Area C. Risk assessments are used to make a risk management decision as to whether a cleanup is necessary.

For human health risk assessments, EPA has developed a cancer risk range that it deems acceptable to protect the public. This range is identified through the risk assessment process and used to make risk management decisions. Cancer risk is often expressed as the maximum number of new cases of cancer projected to occur in a population due to exposure to the cancer-causing substance over a 70-year lifetime. For example, a cancer risk of one in one million means that in a population of one million people, not more than one additional person would be expected to develop cancer as a result of the exposure to the substance causing that risk. EPA utilizes the acceptable exposure level, or "risk goal" described in the National Contingency Plan (NCP) at 40 C.F.R. Part 300 for enforcement and cleanup decisions at both Superfund sites and RCRA facilities. The NCP defines the acceptable excess upper lifetime cancer risk as generally a range between $1x10^{-6}$ – $1x10^{-4}$ for determining remediation goals. See 40 C.F.R. 430 (e)(2)(i)(A). If the contaminants are noncancerous but could cause other health problems, then a hazard index quotient is used. To be acceptable to the EPA, the hazard index (HI) quotient for all

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[8] EPA, *Monitored Natural Attenuation of Inorganic Contaminants in Groundwater* (2007)

contaminants must be less than one. The hazard index is the ratio of the concentration of a contaminant to its human health screening value.

The constituents listed above in the COPC table were evaluated in both human health and ecological risk assessments. The Area C human health risk assessment evaluated potential exposures to current and future Facility workers, future construction workers, current and future trespassers, current and future park workers, park visitors and teen volunteers. The assessment concluded there are no unacceptable risks to people from Area C. All carcinogenic and noncarcinogenic risk estimates associated with potential exposures to all media in all exposure areas are below the target risk range of $1x10^{-6}$ and $1x10^{-4}$ and hazard index of 1. However, as discussed in the next section, cleanup criteria for the IDNP groundwater includes safe drinking water criteria (MCLs) in addition to the Great Lakes Initiates criteria. EPA's groundwater remediation policy includes restoration of aquifers to their maximum beneficial use[9]. Also, when a facility's contamination extends off-site onto neighboring property, the contamination must be addressed in a manner consistent with the off-site property's use. As a National Park, both ecological and human health receptors must be protected in such a way as to not limit future uses. Based on this policy, the off-site groundwater will be remediated to drinking water standards (discussed more in the next section).

A BERA was conducted to provide a comprehensive assessment of potential risks to populations of ecological receptors that may be exposed to contamination at or from Area C. The constituents listed in the COPC table above were evaluated in soil, surface water, sediment, and/or groundwater in seven habitat areas: Northwest Blag Slough, Central Blag Slough, Little Lake, Eastern Wetlands, SWMU 14 and SWMU 15, and Southeast Pond. Ecological receptors, including mammals, birds (one of which was the Federally endangered piping plover), amphibians, fish, soil invertebrates, benthic invertebrates, and terrestrial plants were assessed.

Contamination leaving the Facility in groundwater from SWMU 15 and entering the IDNP exceeds applicable ecological criteria (discussed more in the next section, also see Figure 10). Groundwater contamination is found in the surface waters of IDNP as a result of the groundwater and surface water being connected. Stressed vegetation has been observed and studied within the National Park. There is a complicated hydrogeologic cycle between the groundwater, surface water and sediment as it pertains to the bioavailability of certain metals. The most chronically exposed receptors to this cycling of contamination between groundwater, surface water, and sediment are the plants. Studies subsequently demonstrated Facility contamination within the plant tissue.

NIPSCO submitted the BERA to EPA in 2011 and concluded there were no risks to any receptors from any of the contamination. EPA, in consultation with the National Park Service, evaluated the methods used in the BERA and concluded it did not agree with NIPSCO's conclusion**.** Attachment C is the evaluation EPA conducted and provided to NIPSCO in early 2013. In general, EPA found the level of uncertainty associated with many of the studies too high to eliminate the possibility of unacceptable risk. The nature of the off-site environment, the National Park, requires the highest level of protection and conservatism. EPA's BERA comments in Attachment C provide specific details about receptors, areas, and risks posed. As a summary, EPA's conclusions included the following:

[9] EPA, *Handbook of Groundwater Protection and Cleanup Policies for RCRA Corrective Action Sites* (2004)

- unacceptable risk to plants
- potential risk to benthic receptors and invertivorous birds
- potential risk to amphibians likely low, but uncertainty is too high to rule out
- potential risk to terrestrial invertebrates
- unacceptable risk to certain terrestrial wildlife in some areas

Due to the overwhelming multiple lines of evidence suggesting ecological risk to the National Park, EPA directed NIPSCO to proceed with a risk management decision without revising the BERA. A risk management decision refers to an action or set of actions that are developed and implemented to reduce risk to an acceptable level. In this case, EPA specified that an acceptable decision would include source control (SWMU 15), limited off-site remediation (in coordination with NPS), and long-term monitoring.

This Statement of Basis represents the conclusion of that risk management decision process. Although all COPCs were evaluated it was found that the boron groundwater plume extending into IDNP is of most significance. Boron exhibits the largest area of groundwater impacted and poses unacceptable risk to the National Park's plant life. Boron concentrations have been compared to the Great Lakes Screening values.

SECTION V: CORRECTIVE ACTION OBJECTIVES AND MEDIA CLEANUP STANDARDS

The proposed final remedy and associated remedial goals are designed to protect human health and the environment by mitigating risk to current and potential future receptors. They are also designed to restore IDNP without causing any further damage by the cleanup. EPA's long-term goals for the remedy being proposed are the following:

- Protect human health and the environment;
- Attain the applicable media (e.g., soil, water, etc) cleanup standards ("MCS" or "cleanup levels");
- Control the sources of the releases to the extent practicable; and
- Manage all remediation waste in compliance with applicable standards.

Presented in the following table are the cleanup objectives, or Corrective Action Objectives (CAOs), for the affected media and applicable cleanup standards. The CAOs are the overarching goals the remedy needs to achieve (prevent direct exposure, reduce inhalation risk, restore groundwater to most beneficial use, etc). Bear in mind that on-site cleanup standards are industrial/commercial because the reasonably anticipated reuse of the NIPSCO facility will be industrial/commercial use. Nonetheless, the off-site IDNP property will have no use restrictions. Consequently, the media cleanup standards for the off-site IDNP areas are equivalent to residential cleanup standards.

Environmental Media	Corrective Action Objectives				
	SWMU 15 On-Site	Greenbelt and Eastern Wetland	IDNP Off-Site	Cross-media Transfer	Resource Restoration
Groundwater	At downgradient points of compliance, groundwater will meet the lower of EPA's Great Lakes Initiative[10] (GLI) values or Maximum Contaminant Level (drinking water levels, MCLs)	The lower of EPA's Great Lakes Initiative (GLI) values or Maximum Contaminant Level (drinking water levels, MCLs)	The lower of EPA's Great Lakes Initiative (GLI) values or Maximum Contaminant Level (drinking water levels, MCLs)	Prevent the migration of contaminated groundwater from SWMU 15 impacting IDNP through source control	Restore groundwater in IDNP to GLI values by eliminating the source
Soil	Prevent direct exposure: IDEM Default Closure Levels (DCLs) for industrial soil and EPA Regional Screening Levels (RSLs) for analytes where IDEM has not published DCLs	Prevent direct exposure: IDEM Residential Direct Exposure Criteria and Migration to Groundwater	NA	Prevent CCR contamination in SWMU 15 from leaching to groundwater and entering IDNP soil through an engineered remedy	NA
Sediment	NA	EPA Region 5 Ecological Screening Levels, or site-specific background	NA	Prevent the cycling of contaminated groundwater to surface water or sediment by eliminating the source of contamination	Restore the sediment in IDNP to ecologically safe levels by eliminating the source of contamination.

[10] Section 118(c)(2) of the Clean Water Act (CWA) (Pub. L. 92–500 as amended by the Great Lakes Critical Programs Act of 1990 (CPA), Pub. L. 101–596, November 16, 1990) required EPA to publish proposed and final water quality guidance on minimum water quality standards, antidegradation policies, and implementation procedures for the Great Lakes System. The GLI was established in order to develop a consistent level of environmental protection for the Great Lakes ecosystem (60 Fed Reg 15366-15425). The GLI methodologies were developed with the sensitivity of the Great Lakes resources in mind, including the lakes themselves, their connecting channels and all the streams, rivers, lakes and other bodies of water that are within the drainage basin of the Lakes. (60 Fed Reg 15367, 15388) (40 CFR 132.2). GLI values are derived from Criteria and Values for Selected Substances Calculated Using the Great Lakes Basin Methodologies (IDEM, 2002). Also, certain contaminants did not have designated MCLs and EPA used GLI limits because the GLI is specific to the region and highly conservative.

Environmental Media	Corrective Action Objectives				
	SWMU 15 On-Site	Greenbelt and Eastern Wetland	IDNP Off-Site	Cross-media Transfer	Resource Restoration
Surface Water	NA	NA	Due to the connection between the groundwater and surface water, the IDNP surface water will also attain GLI levels	Prevent the cycling of contaminated groundwater to surface water through source control	Restore the surface water in the IDNP by remediating the groundwater cycling to the surface to GLI values

The specific media cleanup standards for each constituent of concern that will achieve those corrective action objectives are as follows:

Analyte	Direct Contact (mg/kg)	Leaching from Unsaturated Soil (ug/L)	Groundwater MCS (ug/L)
ARSENIC	30 [1]	30	10 [3]
BORON	100,000 [2]	4,800	1,600 [4]
CADMIUM	980 [1]	15	5 [3]
CHROMIUM	100,000 [1]	300	100 [3]
COPPER	47,000 [1]	840	280 [4]
LEAD	800 [1]	45	15 [3]
MANGANESE	26,000 [2]	2,982	994 - 2,351 [5]
MOLYBDENUM	5,800 [2]	2,400	800 [4]
SELENIUM	5,800 [1]	13.8	4.61 [4]
Notes:			
[1] IDEM RISC Industrial Soil Default Closure Level			
https://www.in.gov/idem/cleanups/files/risc_screening_table_2018_a6.pdf			
[2] EPA Industrial Soil Regional Screening Level			
[3] MCL - Maximum Contaminant Level			
[4] GLI - Great Lakes Initiative			
[5] GLI hardness-adjusted range with background established as lower limit. Because hardness does not apply to SPLP results, the leaching-based soil standard for manganese was established as three times the background value for groundwater.			
GLI values derived from Criteria and Values for Selected Substances Calculated Using the Great Lakes Basin Methodologies (IDEM, 2002); boron value from IDEM Water Quality Standards Tier II 2004 update.			

The proposed MCS for unsaturated soil is derived by multiplying the proposed MCS for groundwater by a factor of 3. The MCS for soil is measured using the Synthetic Precipitation Leaching Procedure (SPLP).		
MCS - Media Cleanup Standard		

SECTION VI: PROPOSED FINAL REMEDY AND EVALUATION OF ALTERNATIVES

The process of developing a proposed final remedy often starts with a broad range of options that are evaluated and either retained for further consideration or eliminated based on disqualifying evidence. For Area C, technologies were eliminated if they did not protect human health and the environment by mitigating risk to receptors and address the source of contamination (SWMU 15). A summary of all the alternative technologies evaluated for the Facility are in the table below and detailed information about the proposed remedies follow. More information about all the cleanup options considered can be found in the Corrective Measures Study Report (2019). The proposed final cleanup remedies for Area C are shaded in the table below and described in greater detail below. The other alternative cleanups listed were not selected due to evidence indicating they would not work or would not work as well as the proposed remedies.

Alternatives Considered	SWMU 15	Greenbelt and Eastern Wetland	IDNP Groundwater	Previously Barren Soil Areas
1	Full Excavation and Off-Site Disposal of CCR	Full Excavation and Off-Site Disposal of CCR (presumptive remedy)	In Situ Remediation	Excavation and Off-Site Disposal with Soil Replacement
2	Full Excavation and On-Site Consolidation of CCR		Groundwater Pump & Treat	Soil Flushing/pH Adjustment
3	Full Excavation with On-Site Consolidation and Off-site Disposal of CCR		Source Control and Monitored Natural Attenuation Alternative Water Supply (if needed)	Source Control and Monitored Natural Attenuation Alternative Water Supply (if needed)
4	Partial Excavation with Off-Site Disposal and In-Situ Solidification/Stabilization of Remaining CCR		Alternative Water Supply (if needed)	
5	Partial Excavation with On-Site Consolidation and ISS of Remaining CCR			
6	In Situ Encapsulation			

The process of selecting a proposed remedy involves screening them against certain criteria and comparing them to each other. EPA has defined threshold and balancing criteria to compare remedial technologies at all facilities in a consistent manner. All remedies must meet the threshold criteria and the balancing criteria can be used to further refine the best possible technology based on site-specific factors. The remedies presented above were all compared to these criteria and the proposed remedies presented in this document represent the best possible options. See Attachment D for additional balancing criteria information.

EPA's three remedial Threshold Criteria are the following:

1) Protect human health and the environment based on reasonably anticipated land use(s), both now and in the future
2) Achieve media cleanup objectives appropriate to the assumptions regarding current and reasonably anticipated land use(s), and current and potential beneficial uses of water resources
3) Control the sources of releases to achieve elimination or reduction of any further releases of hazardous wastes or hazardous constituents that may threaten human health and the environment

The seven remedial Balancing Criteria are the following:

1) Long-term reliability and effectiveness (long-term effectiveness should consider reasonably anticipated future land uses)
2) Reduction of toxicity, mobility, and volume of waste
3) Short-term effectiveness
4) Implementability (technical feasibility and availability of services and materials)
5) Cost
6) Community acceptance of remedy
7) State/support agency acceptance

Proposed Final Remedy

The proposed remedies for each SWMU are described in more detail below followed by a table presenting the threshold and balancing criteria as they pertain to the proposed remedies.

SWMU 15: The corrective measures alternatives for SWMU 15 were developed to manage CCR and its impact on groundwater entering the IDNP. Six alternatives were evaluated. The alternative being proposed is Alternative 4: partial excavation and off-site disposal of CCR with ISS of CCR below the water table. Attachment E is a fact sheet that describes ISS, solidification and stabilization, in more detail.

Full excavation and off-site disposal was evaluated but was not selected as the proposed remedy for several reasons. Excavation of CCR below the water table presents certain risks and challenges. Excavation below the water table, particularly in a sandy environment, would require extensive de-watering. The volume of water that would need to be pumped out of the ground, in combination with the length of time it would be necessary, raises concerns over the sensitive hydrology of the IDNP and nearby wetlands. Minimizing damage to IDNP is a significant consideration.

In order to de-water an excavation as deep as SWMU 15, the soil would require shoring (such as sheet piling). The installation of sheet pile for wall stability and water management during excavation of CCR to the depths required at SWMU 15 would require large overhead equipment for positioning and driving the sheet pile. Driving sheet pile would not be allowed within a certain distance of energized power lines and would not be possible beneath the power lines (energized or de-energized). The high voltage lines are 138 kilovolts and require a clearance of 15 feet in accordance with OSHA[11]. The ISS option will not interfere with the high voltage power lines.

Many RCRA-regulated CCR surface impoundments across the country have been either closed in place or excavated for clean closure. This practice has identified a substantial hazard associated with the instability of wet CCR, including the loss of life in one situation. Full excavation of CCR from below the water table at SWMU 15 presents an extremely difficult and hazardous undertaking, which is a significant consideration for the recommended alternative of partial excavation of CCR from above the water table and solidification of CCR remaining below the water table.

The totality of issues associated with full excavation when compared with an equally effective option helped inform EPA's decision to propose Alternative 4. Approximate remedial quantities for SWMU 15 are summarized in the following table.

Area (acres)	**Perimeter (feet)**	**Volume (cubic yards)**	**Thickness of CCR (feet)**	**Thickness of Soil Cover (feet)**
16.6	4,500	227,000 – Total Volume (CCR & Soil) 178,000 – CCR • 86,000 below the water table • 92,000 above the water table	1 – 22	0 – 6

The proposed remedy includes excavation of CCR above the water table (92,000 cubic yards) at SWMU 15 and disposal at an off-site facility permitted to accept CCR. Remaining CCR below the water table (86,000 cubic yards) will be solidified in place by mixing in amendments designed to reduce the leachability of CCR contaminants through a reduction of both hydraulic conductivity and increased chemical fixation (also referred to as in-situ solidification and stabilization, ISS). As described in Attachment E, solidification binds the waste in a solid block of material and traps it in place. The stabilization component of ISS causes chemical reactions that make contamination less likely to be leached into the environment.[12] Upon completion of the work, the site will be backfilled and graded for proper drainage and restored to a condition that will more closely mimic surrounding dune topography compared to current conditions. This remedy will cut off the current source of groundwater contamination, allowing the groundwater plume to meet groundwater cleanup standards in a reasonable amount of time. Modeling suggests that timeframe will be around five years; however, cleanup timeframes are less precise when natural processes are involved.

Excavated CCR will be stockpiled and placed in trucks for transport to an off-site landfill. Truck traffic during this phase of the cleanup will increase temporarily. Low clearance equipment such as bulldozers would need to operate beneath the power lines to remove CCR with adequate clearance. An important consideration for CCR removal is the stability of the material. This alternative minimizes the concern relative to CCR stability by removing approximately one-half of the CCR from above the water table and solidifying the remaining CCR below the water table. This alternative also requires adequate dewatering below the working surface and shallow sidewall sloping.

[11] https://www.osha.gov/laws-regs/regulations/standardnumber/1926/1926.1408

[12] A Citizen's Guide to Solidification and Stabilization, EPA 2012

As discussed above, complete removal of the CCR would involve excavation to depths as great as 13 feet below the water table (22 feet below the land surface). These deeper excavations would require extensive dewatering to maintain water levels below the working surface and would present additional safety challenges due to excavation bottom and sidewall stability. Extracting that much groundwater would also have a potentially adverse effect on the IDNP wetland hydrology and sensitive ecological receptors. Due to those potential adverse effects, the practical technical difficulties, and the ISS' effectiveness in preventing contaminant migration, complete CCR excavation was rejected.

Other alternative cleanup technologies were also considered for SWMU 15. A series of technical memos from NIPSCO to EPA in Attachment F provides additional background on the process of selecting the proposed remedy[13]. In addition to studies specific to the proposed ISS technology, those memos also describe a remedy initially proposed by NIPSCO. In 2015, NIPSCO submitted to EPA a draft Corrective Measures Study that identified encapsulation with a slurry wall and cap as the proposed remedy. Due to concerns about the engineering of that technology, EPA requested NIPSCO to conduct a geotechnical investigation. Encapsulation requires barriers to completely surround the waste – sides, top and bottom - to prevent water from infiltrating into or through the waste and further contaminating groundwater. NIPSCO's investigation demonstrated encapsulation was not a feasible option because it required a thick clay bottom layer of soil, deep underground, beneath the entire SWMU 15. However, the geotechnical investigation discovered the bottom clay layer at SWMU 15 is not continuous and would not allow for a full encapsulation (additional information in Attachment F). NIPSCO subsequently reevaluated remedial options and demonstrated the proposed partial CCR removal and ISS proposed remedy in this SB is the best option for SWMU 15.

Greenbelt and Eastern Wetland: During the course of the investigation, CCR was discovered in a small area outside of SWMU 15 in the vicinity of the Greenbelt. It appears, based upon the location and limited quantity, the CCR was not placed or disposed of at this location but was accidently "dropped" or "spilled" during historic placement into SWMU 15. The area was delineated and consists of about 705 cubic yards of CCR and CCR-contaminated soil. The alternative being proposed for the Greenbelt and Eastern Wetland is Alternative 1. The proposed remedy of excavation and off-site disposal is the only remedial approach considered. For certain situations there are remedies that are proven to be effective; these are referred to as presumptive remedies. It is not necessary to evaluate multiple remedies if a presumptive remedy is proposed. EPA is proposing CCR removal and off-site disposal here because the CCR was not placed into the water table and the amount of CCR material is relatively minor.

The soil and CCR will be removed to a maximum depth of approximately 3.5 feet below grade based upon delineation sampling. Upon completion of the excavation, native dune sand and topsoil from an EPA-approved borrow pit will be imported for use as backfill. The backfilled area will then be re-vegetated with native species selected in consultation with the IDNP and monitored for 10 events over a period of 5 years, as part of the long-term stewardship plan.

[13] The technical memos in Attachment F include only the text of the documents due to document sizes. The full memos can be found in the Administrative Record.

IDNP Groundwater: The corrective measures alternatives for IDNP groundwater were developed to address elevated concentrations of boron (the risk driver) in groundwater that comes from SWMU 15. Areas of groundwater exceedances are depicted on Figures 6.

The following corrective measures alternatives were developed and evaluated to address the Corrective Action Objectives for IDNP groundwater:

- IDNP Groundwater Alternative 1 – In-Situ Remediation by Permeable Reactive Barriers
- IDNP Groundwater Alternative 2 – Groundwater Pump & Treat
- IDNP Groundwater Alternative 3 – Monitored Natural Attenuation with Source Control

Each alternative includes a potable water supply if the need arises before the alternative achieves the media cleanup levels. Implementation of institutional controls (e.g., deed restrictions) on National Park property is not an acceptable method of groundwater exposure control. It is assumed that a potable water source exists within one mile of the area affected by boron in groundwater and can be used to serve that area, if need be. Each alternative includes the trench excavation and pipe installation required to provide this service.

The first two alternatives involve physical disruption to the National Park, Cowles Bog and nearby wetland habitat. The third alternative relies on the SWMU 15 source control and natural processes documented to be occurring by routine periodic monitoring. All three alternatives will have a groundwater monitoring network. In consultation with the NPS, the proposed remedy reflects the least amount of physical disruption to the National Park. The alternative being proposed for this area is Alternative 3.

As mentioned above, the primary risk driver in the IDNP groundwater is boron from the CCR source material at SWMU 15. The use of MNA as a component of a remedy requires source control, which is being proposed at SWMU 15. MNA is being proposed for the off-site plume that extends down gradient from SWMU 15 based upon extensive study conducted in accordance with EPA guidance. The processes of natural attenuation rely on natural mechanisms to reduce or eliminate contamination. Natural attenuation mechanisms include physical, chemical or biological processes that, under favorable conditions, act without human intervention to reduce the mass, toxicity, mobility, volume, or concentration of contaminants in soil, sediment, or groundwater. In order to incorporate MNA into a cleanup remedy, an investigation is necessary to better understand the exact mechanisms and the viability of attenuation as a component of a remedy. EPA's guidance on MNA of inorganic contaminants identifies four tiers of activities that are required to use MNA as a component of a remedy:

- Tier I: Active Attenuation
- Tier II: Attenuation Mechanism
- Tier III: Attenuation Capacity
- Tier IV: Monitoring and Contingency

The MNA studies conducted in IDNP included an analysis of aquifer solids, mineralogical data and groundwater chemistry. Boron attenuation was demonstrated through two different extraction methods that demonstrated irreversible sorption processes occurring in IDNP. The observed feldspar weathering to clays in IDNP has increased the aquifer percentages of boron-sorbing material. In combination with SWMU 15 source control, MNA will have the capacity to remove the boron from IDNP.

Proposed Remedy Criteria Summary Table

Threshold Criteria	Evaluation
1) Protect human health and the environment	EPA's proposed remedies for the Facility protects human health and the environment by eliminating, reducing, or controlling potential unacceptable risk from the continued leaching of contamination from the CCR. Excavation will remove half the CCR from the Facility and place it in a regulated landfill. ISS will eliminate the risk from leaching CCR contamination to groundwater. During implementation, security fencing will be in place and dust control measures will be employed.
2) Achieve media cleanup objectives	EPA's proposed remedy meets the media cleanup objectives based on assumptions regarding current and reasonably anticipated land and water resource use(s). The remedy proposed in this SB is based on the current and future anticipated land use at the Facility as commercial or industrial. Dissolved metals concentrations will meet MCLs or GLI criteria in groundwater, and exposures to any remaining on-site soil contamination will be adequately controlled through land use restrictions.
3) Remediating the sources of releases	In all proposed remedies, EPA seeks to eliminate or reduce further releases of hazardous wastes and hazardous constituents that may pose a threat to human health and the environment. The Facility will meet this criterion by eliminating the source of groundwater contamination and eliminating the CCR present within IDNP. Therefore, EPA has determined that this criterion has been met.

Balancing Criteria	Evaluation
4) Long-term effectiveness	The long-term effectiveness of the proposed remedy, excavation and ISS, has been demonstrated. Eliminating the source of leachable material will allow uncontaminated groundwater to flow through IDNP and facilitate the remediation of the off-site groundwater.
5) Reduction of toxicity, mobility, or volume of the hazardous constituents	Pilot test information in Attachment F demonstrates the reduction in mobility of contaminants after ISS. Reduction of the volume of hazardous constituents in soil will be achieved by the excavation and off-site disposal of almost 100,000 cubic yards of CCR and contaminated soil. The reduction of toxicity will be

	demonstrated within the IDNP groundwater as MNA occurs.
6) Short-term effectiveness	EPA's proposed remedy will be partially effective in the short-term. The excavation and off-site disposal of CCR will exhibit the greatest short-term effectiveness. The short-term impacts of ISS will be more moderate since it's a remedy that relies on the immediate fixation of contamination to result in long-term benefits down gradient. The excavation and off-site disposal of the Greenbelt CCR will exhibit the greatest short-term effectiveness.
7) Implementability	EPA's proposed remedy is readily implementable. Once the proposed remedy is either selected or modified based on public comment, NIPSCO will be able to immediately plan for the implementation of the work.
8) Cost	The proposed remedy will cost over $20 million. A breakdown of the costs can be found in Attachment D.
9) Community acceptance	EPA will evaluate community acceptance of the proposed remedy during the public comment period, and it will be described in the Final Decision and Response to Comments. EPA recognizes many local stakeholders would prefer all CCR be removed and taken off-site; however, weighing safety, ISS effectiveness, and the impacts of dewatering to the IDNP wetlands during excavation influenced the selection of this proposed remedy.
10) State/support agency acceptance	It is anticipated that the State and local stakeholders will find this remedy acceptable.

Institutional Controls

Institutional Control ("IC") remedies restrict land or resource use at a Facility through legal instruments. ICs are distinct from engineered or construction remedies. ICs preclude or minimize exposures to contamination or protect the integrity of a remedy by limiting land or resource use through means such as rules, regulations, building permit requirements, well-drilling prohibitions and other types of ordinances. For an IC to become part of a remedy, there must be binding documentation such as land-use restrictions in a recorded environmental covenant, local zoning restrictions, or rules restricting private wells. There will be institutional controls consistent with Indiana Code 13-11-2-193.5 and 13-25-4-24 implemented at this Facility to prohibit interference with the remedy, prohibit the use of groundwater for drinking water and limit the future use of the Facility to a non-residential scenario, such as commercial or industrial.

Financial Assurance

NIPSCO must demonstrate a financial ability to complete corrective action, including constructing the proposed remedy and monitoring Facility conditions following remedy construction, as needed, by securing an appropriate financial instrument, consistent with the requirements of 40 C.F.R §§ 264.142 and 264.144. NIPSCO will develop a detailed cost-estimate as part of the corrective measures implementation work plan. NIPSCO may use any of the following financial mechanisms to make the demonstration: financial trust, surety bonds, letters of credit, insurance, and/or qualification as a self-insurer (corporate guaranty) by means of a financial test. After successfully completing the construction phase of the remedy, NIPSCO may request that EPA reduce the amount of the financial assurance to the amount necessary to cover the remaining costs of the remedy, including any yearly operation and maintenance costs. NIPSCO may make similar requests of EPA as the operation and maintenance phase of the remedies proceeds and ceases.

Long Term Stewardship

NIPSCO must ensure all controls and long-term remedies are maintained and operate as intended. NIPSCO will submit a Long-Term Stewardship (LTS) Plan. Components of a LTS Plan include: an Institutional Control Implementation and Assurance Plan (ICIAP), five-year remedy review procedures, operation, maintenance and monitoring details. An annual certification that all controls, including institutional controls, are in place and remain effective should be provided for in this plan. Long term remedies will be reviewed and inspected on a five-year basis to ensure the remedy is functioning as intended, the exposure assumptions, toxicity data, cleanup levels, and CAOs are still valid, and any information that comes to light that could call into question the protectiveness of the remedy is considered.

If any five-year review indicates that changes to the selected remedy are appropriate, EPA will determine whether the proposed changes are non-significant, significant, or fundamental changes to the remedy. EPA may approve non-significant changes without public comment. EPA will inform the public about any significant or fundamental changes to the remedy.

SECTION VII. PUBLIC PARTICIPATION AND INFORMATION REPOSITORY

EPA requests feedback from the community on this proposal to remediate the NIPSCO Bailly Generating Station. The public comment period will last forty-five (45) calendar days, from July 1, 2020 to August 15, 2020. In lieu of a public meeting, EPA will be posting a pre-recorded presentation on the site's webpage, located at: https://go.usa.gov/xvuqx. EPA invites you to view the presentation and submit your comments in one of the following ways:

- By confidential voicemail at 312-886-6015
- By fax to 312-697-2568
- By website, directly at: https://go.usa.gov/xvuqx
- By email to safakas.kirstin@epa.gov
- By mail to:

  Kirstin Safakas
  U.S. EPA Region 5
  External Communications Office
  77 W. Jackson Blvd
  Chicago, IL 60604-3590

We encourage community members to submit any comments regarding the proposed remedy in writing by August 15, 2020. Following the 45-day public comment period, EPA will prepare a Final Decision and Response to Comments document that will identify the selected remedy for the Facility. The Response to Comments document will address all significant comments sent to the EPA. EPA will make the Final Decision and Response to Comments document available to the public. If such comments or other relevant information cause EPA to propose significant changes to the currently proposed remedy, EPA will seek additional public comments on any proposed revised remedy.

The Facility Record contains all information considered when making this proposal and will include the Response to Comments document. The Facility Record may be reviewed at the website provided above or at these locations (please call for hours):

Local Document Repository Portage Public Library 2665 Irving Street Portage, IN (219) 763-1508	EPA Region 5 Office EPA Records Center 77 W. Jackson Blvd., 7th Floor Chicago, IL (312) 886-4253

If you have any additional questions, contact:
Michelle Kaysen (LR-16J)
77 W. Jackson Blvd
Chicago, IL 60604
(312) 886-4253
kaysen.michelle@epa.gov

Next Steps

Following issuance of the Final Decision and Response to Comments document, NIPSCO will prepare a Corrective Measures Implementation Work Plan. The Plan will identify any additional data collection needed to implement the corrective measures, along with the specifications for completing the selected corrective measures. The Plan will provide a detailed construction schedule. Based on the proposed corrective measures, it is anticipated that most of the remedial measures can be completed within two years of the Final Decision.

Site Location

Northern Indiana Public
Service Company

Bailly Generating Station
Chesterton, Indiana

Legend

- Bailly Generating Station Property Line
- Roads
- Wetland
- Natural/Forested Area
- Urban

Location of Site

Notes and Sources

FIGURE 1

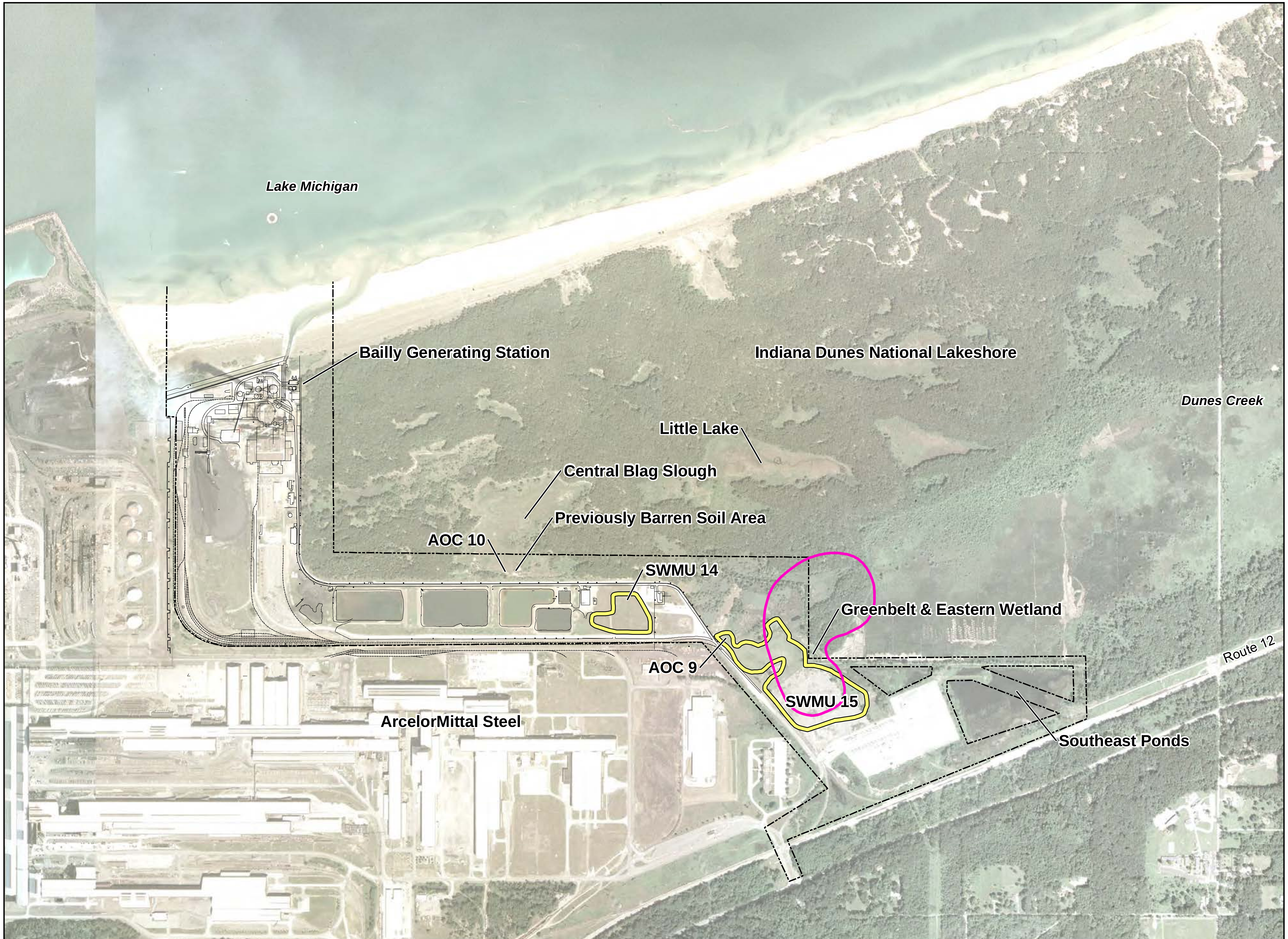
USGS DRG: March 2003
Courtesy of USA PhotoMaps
Cross Section: USGS Open File
Report 92-39, 1994

N

0 1,000 2,000
Feet

wood.
Wood Environment &
Infrastructure Solutions, Inc.
271 Mill Road
Chelmsford, MA 01824
(978) 692-9090

H:\NiSource\BaillyGenerating\Task81\MXD\Fig2-4_C_Geo_Cross_Sections.mxd November 25, 2019 DWN: ilana.ton CHKD: RAJ



Sitewide Overview and Site Features

Northern Indiana Public Service Company

Bailly Generating Station
Chesterton, Indiana

Legend

- Bailly Generating Station Property Boundary
- Solid Waste Management Unit Boundary
- Extent of Groundwater Contamination Above Clean-up Standards Based on 2018 Results

Location of Site

Notes and Sources

FIGURE 2

Aerial Photo: March 2003
Courtesy of Indiana Spatial Data Portal

0 1,000
Feet

N

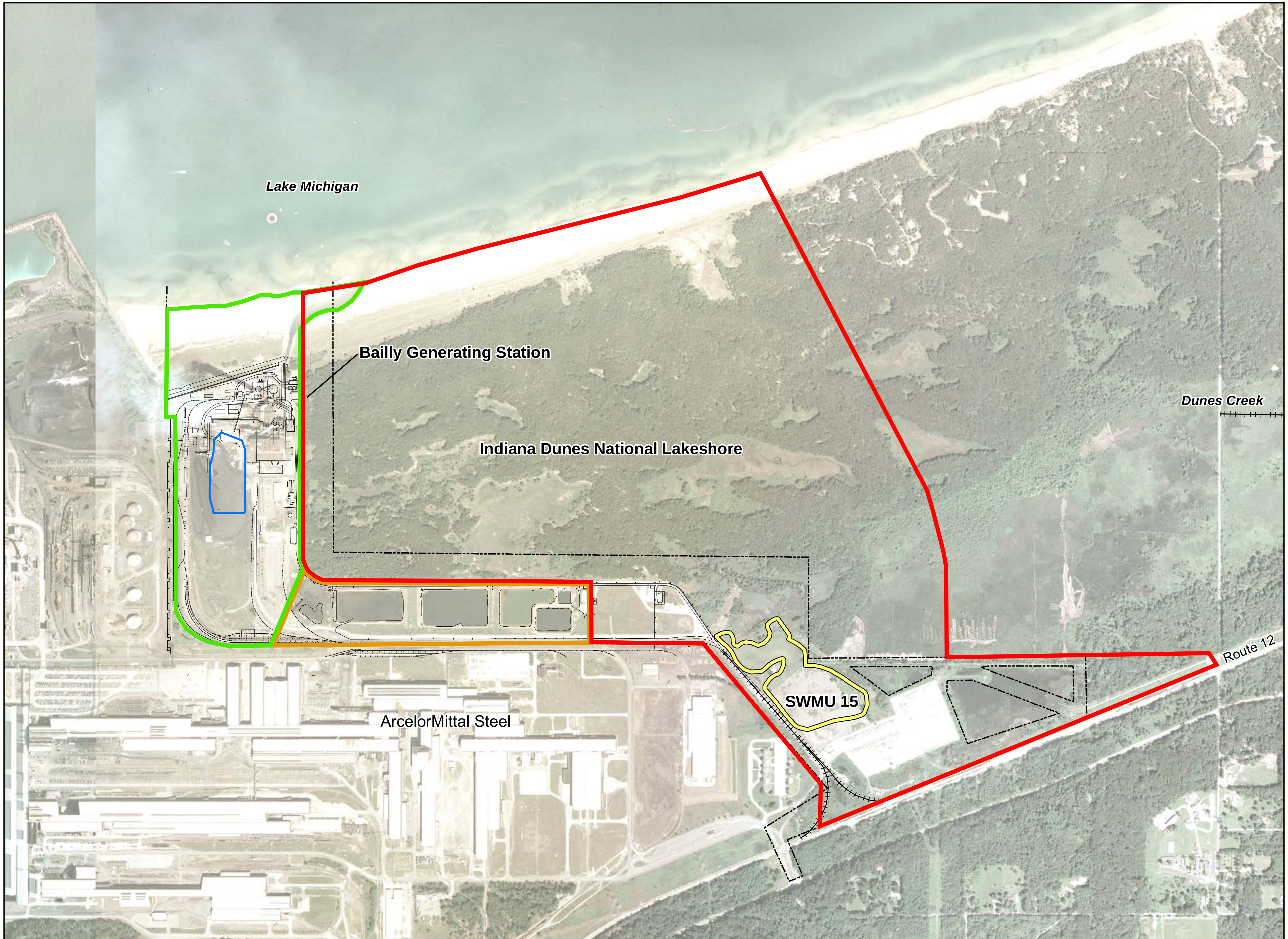
wood.
Wood Environment & Infrastructure Solutions, Inc.
271 Mill Road
Chelmsford, MA 01824
(978) 692-9090

H:\NiSource\BaillyGenerating\Task70\MXD\Fig2-1_A_SitewideOverview.mxd May 06, 2020 DWN: emily.gardiner CHKD: RAJ

Sitewide Overview and Site Features

Northern Indiana Public Service Company

Bailly Generating Station
Chesterton, Indiana



Legend

- Bailly Generating Station Property Boundary
- Approximate Slurry Wall Location
- Railroad
- Area A
- Area B
- Area C
- SWMU 15

Location of Site

Notes and Sources

FIGURE 3

Aerial Photo: March 2003
Courtesy of Indiana Spatial Data Portal

0 750 1,500 Feet

N

wood.
Wood Environment & Infrastructure Solutions, Inc.
271 Mill Road
Chelmsford, MA 01824
(978) 692-9090

Location of Geologic Cross Section A-A'

Northern Indiana Public Service Company

Bailly Generating Station
Chesterton, Indiana

Legend

- A—A' Cross Section Location
- Bailly Generating Station Property Line
- Roads
- Wetland
- Natural/Forested Area
- Urban

Location of Site

Notes and Sources

FIGURE 4

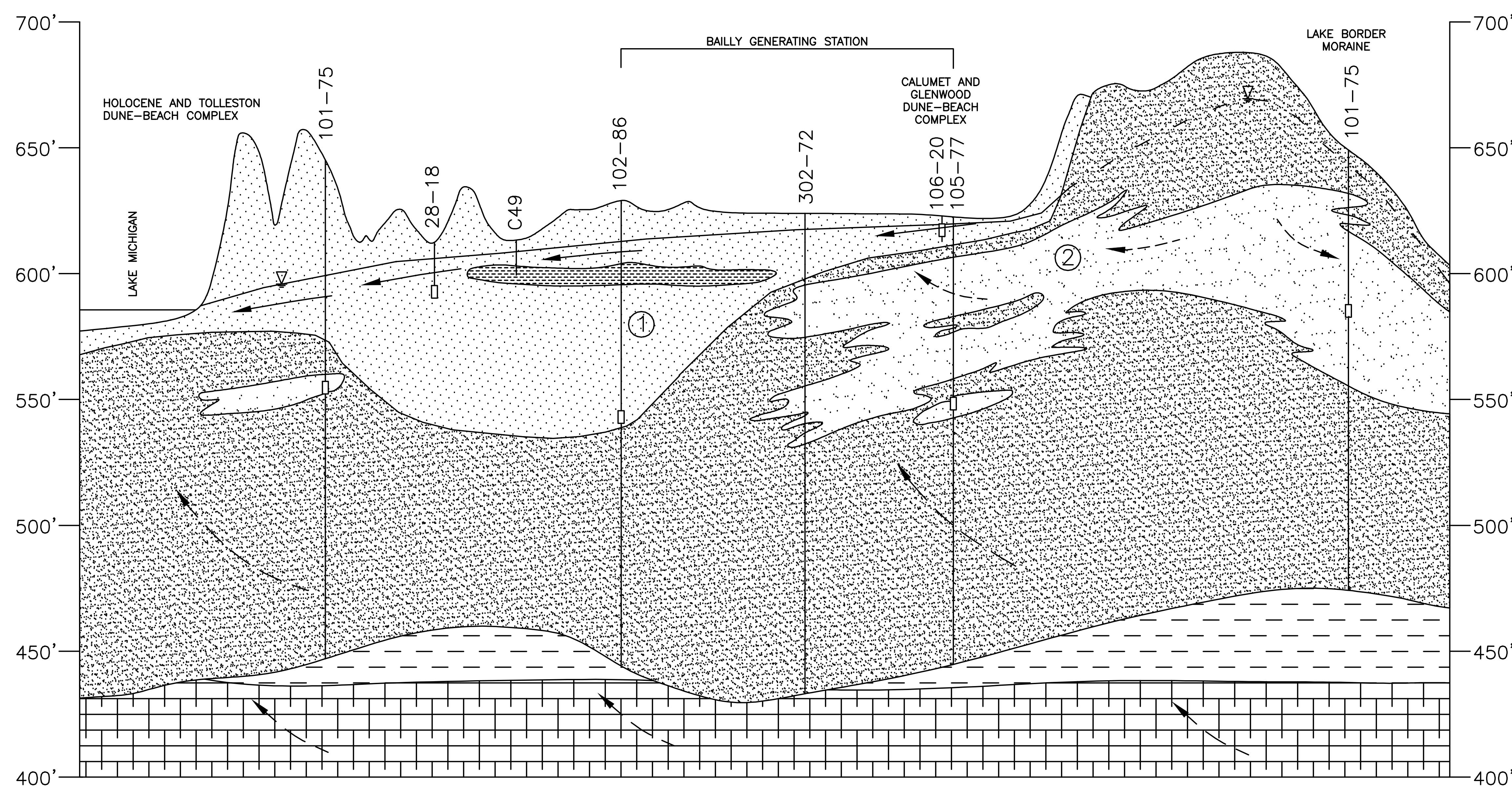
USGS DRG: March 2003
Courtesy of USA PhotoMaps
Cross Section: USGS Open File Report 92-39, 1994

N

0 1,000 2,000 Feet

wood.
Wood Environment & Infrastructure Solutions, Inc.
271 Mill Road
Chelmsford, MA 01824
(978) 692-9090

CROSS SECTION



NOTES:

1. WATER LEVELS MEASURED BY AMEC PERSONNEL ON OCTOBER 12 THROUGH OCTOBER 26, 2010.
2. LAKE MICHIGAN WATER LEVEL IS AVERAGE FROM OCTOBER 12 THROUGH OCTOBER 26, 2010 AS MEASURED AT CALUMET HARBOR, LAKE MICHIGAN, IL.
3. 20 X VERTICAL EXAGGERATION.

SOURCE:
SHEDLOCK, R.J., COHEN, D.A., IMBRIGIOTTA, T.E., AND THOMPSON, T.A., 1994, HYDROGEOLOGY AND HYDROCHEMISTRY OF DUNES AND WETLANDS ALONG THE SOUTHERN SHORE OF LAKE MICHIGAN: U.S. GEOLOGICAL SURVEY OPEN-FILE REPORT 92–139.

LEGEND:

- DUNE–BEACH AND LACUSTRINE SAND
- CALCAREOUS CLAY INCLUDES PLANT AND SHELL FRAGMENTS
- TILL AND GLACIAL–LACUSTRINE CLAY AND SILT
- GLACIAL LACUSTRINE SAND
- SHALE
- CARBONATE ROCKS
- WATER TABLE (INFERRED)
- WATER TABLE (KNOWN)
- OBSERVATION WELL
- CONTINOUS CORE

DIRECTION OF FLOW:

- LOCAL FLOW SYSTEM
- INTERMEDIATE FLOW SYSTEM
- REGIONAL FLOW SYSTEM
- ① SURFICIAL AQUIFER
- ② SUBTILL AQUIFER

HORIZONTAL SCALE: 1" = 1000'
0 1000' 2000'
0 50' 100'
VERTICAL SCALE: 1" = 50'

CLIENT LOGO

CLIENT: NORTHERN INDIANA PUBLIC SERVICE COMPANY

PROJECT: NORTHERN INDIANA PUBLIC SERVICE COMPANY
BAILLY GENERATING STATION
CHESTERTON, INDIANA

DRAWN BY: D. DEMPSEY
CHECKED BY: R. JOHNSON
DATUM: NONE
PROJECTION: NONE
SCALE: AS SHOWN

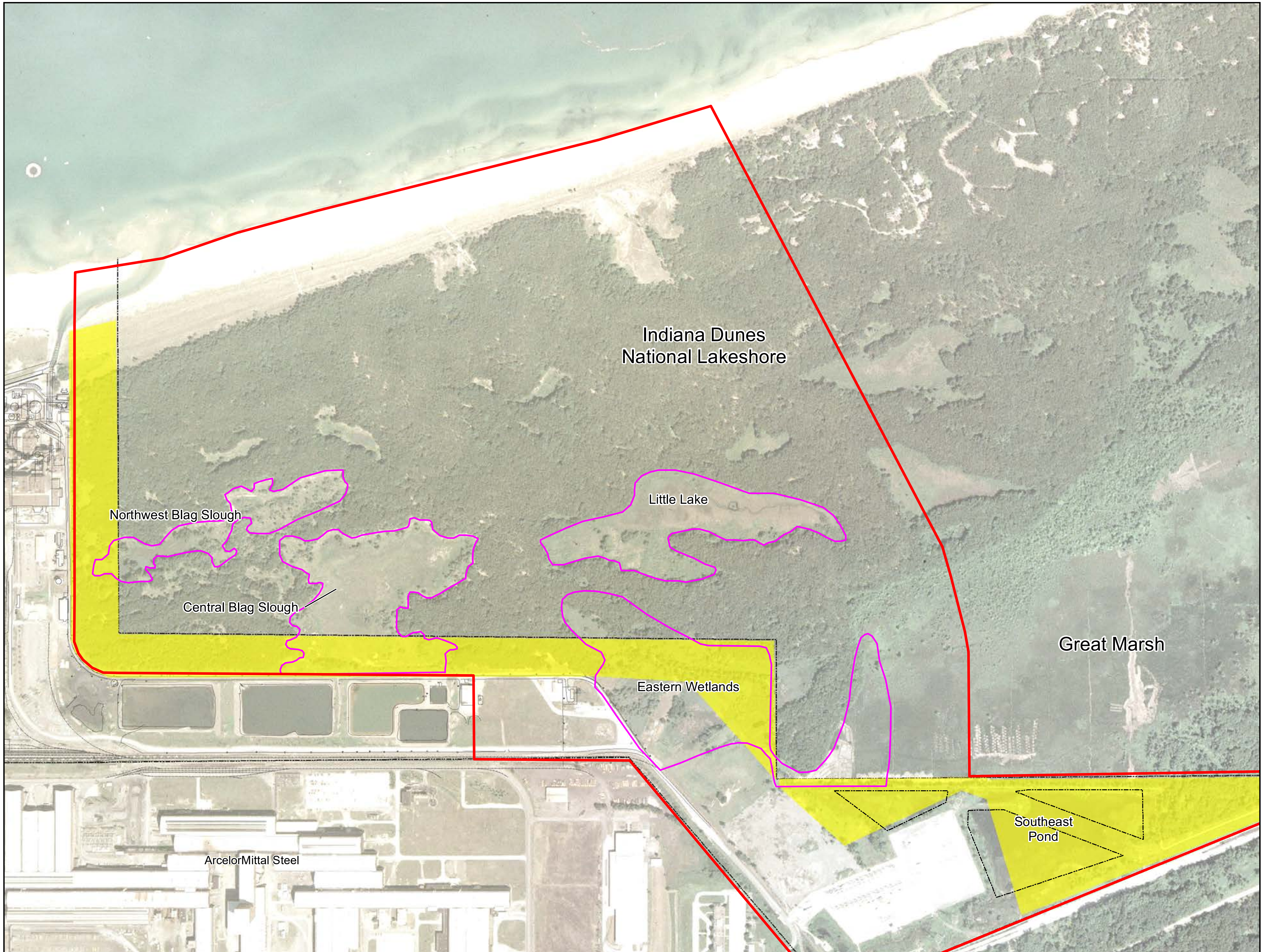
wood.

271 MILL ROAD
3RD FLOOR
CHELMSFORD, MA 01824

TITLE: REGIONAL GEOLOGIC CROSS SECTION A-A'

DATE: FEBRUARY 18, 2019
PROJECT NO: 3651180080
REV. NO.: A
FIGURE No. 5

P:\old_WFD-FS1_Data\Projects\NiSource\BaillyGeneratingStation\CAD\2015-03-16\SECTION A-A 2019-02-18.dwg – Layout1 – Nov. 26, 2019 8:20am – dana.dempsey



Indiana Dunes National Lakeshore Adjacent to Bailly Generating Station

Northern Indiana Public Service Company

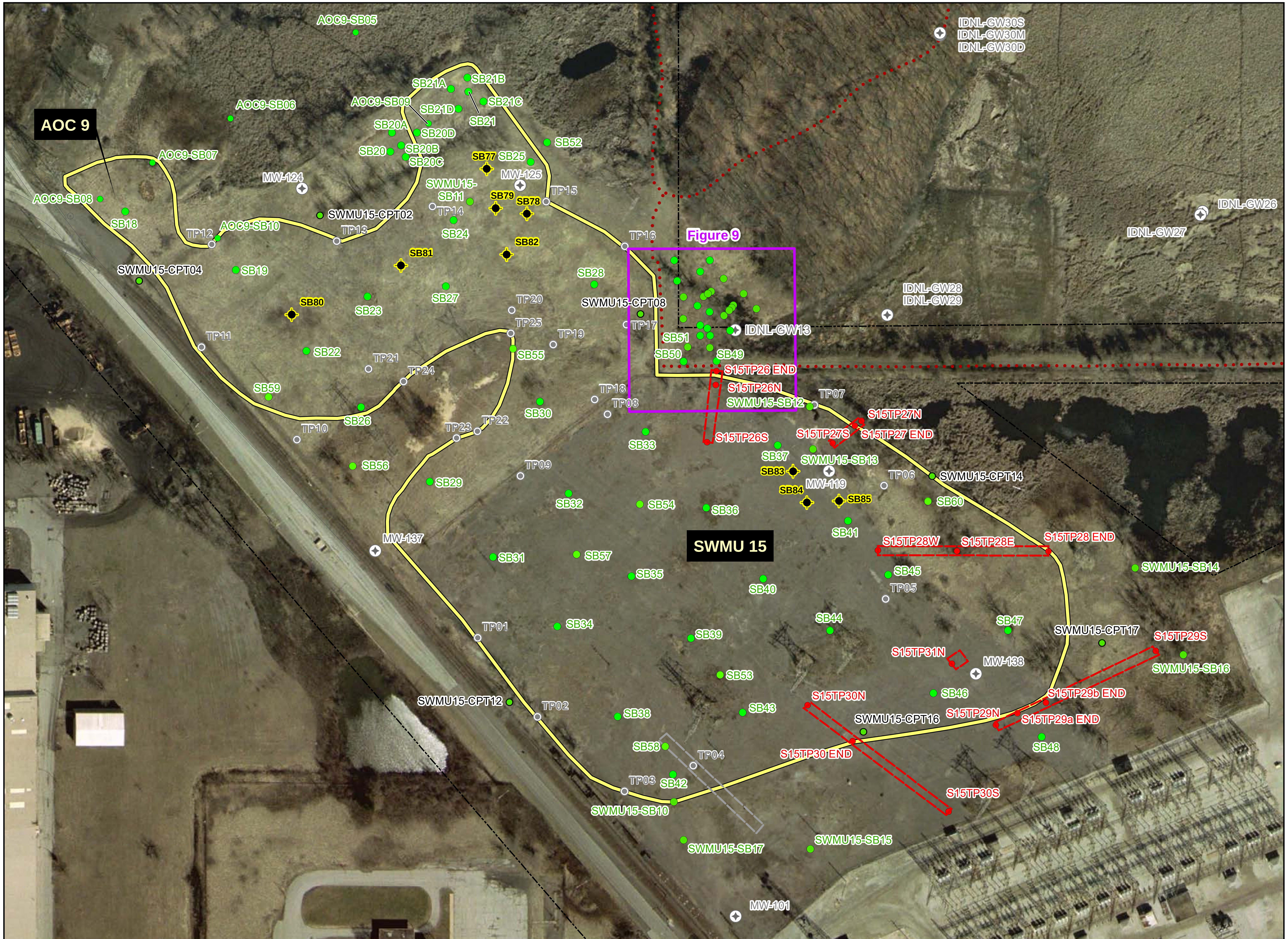
Bailly Generating Station
Chesterton, Indiana

Notes and Sources

FIGURE 6

Aerial Photo: March 2003
Courtesy of Indiana Spatial Data Portal

wood.
Wood Environment &
Infrastructure Solutions, Inc.
271 Mill Road
Chelmsford, MA 01824
(978) 692-9090



SWMU 15 Investigation Locations

Northern Indiana Public Service Company

Bailly Generating Station
Chesterton, Indiana

Legend

- Soil Boring Location 2017
- Soil Boring Location
- Test Pit End Location 2009
- Test Pit End Location 2005
- Monitoring Well Location
- Trail
- Bailly Generating Station Property Line
- Test Pit Location 2009
- Test Pit Location 2005
- Coal Combustion Residual Fill Area

Location of Site

Notes and Sources

FIGURE 7

Aerial Photo: 2005.
Courtesy of LizardTech, Inc.

- Area of SWMU 15 landfill is 16.56 acres.

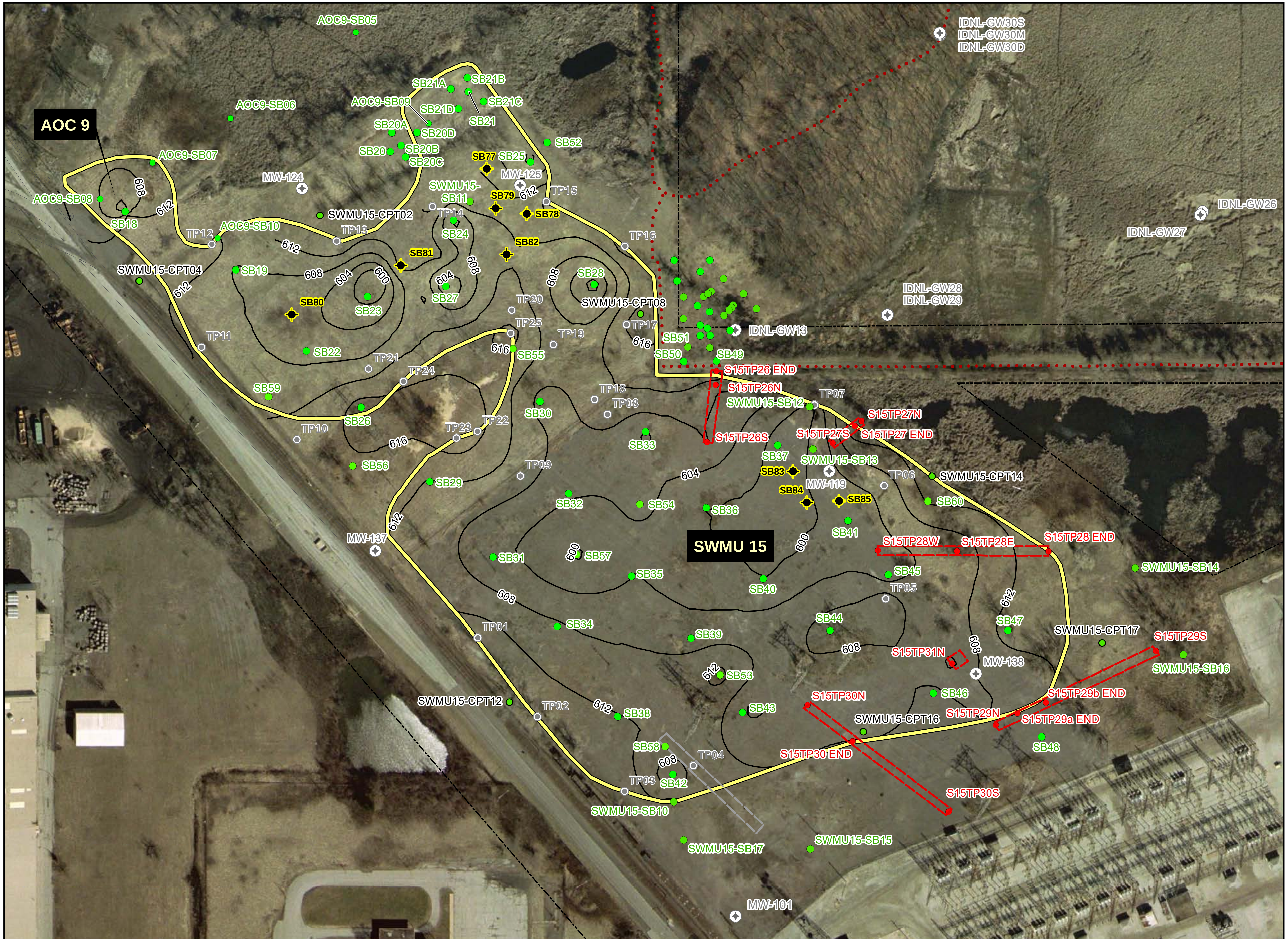
-For abbreviated soil boring locations, the full location name is SWMU15-SB##.

N

0 150 Feet

wood.
Wood Environment & Infrastructure Solutions, Inc.
271 Mill Road
Chelmsford, MA 01824
(978) 692-9090

H:\NiSource\BaillyGenerating\Task81\MXD\Fig7_SWMU15ProposedDirectPushBorings_Sept2014 - 12.2.2014.mxd November 26, 2019 DWN: emily.gardiner CHKD: RAJ



SWMU 15
Bottom Elevation of Coal Combustion Residuals

Northern Indiana Public Service Company

Bailly Generating Station
Chesterton, Indiana

Legend

- Soil Boring Location 2017
- Soil Boring Location
- Test Pit End Location 2009
- Test Pit End Location 2005
- Monitoring Well Location
- Elevation Contour (4 foot)
- Trail
- Bailly Generating Station Property Line
- Test Pit Location 2009
- Test Pit Location 2005
- Coal Combustion Residual Fill Area

Location of Site

Notes and Sources

FIGURE 8

Aerial Photo: 2005.
Courtesy of LizardTech, Inc.

- Area of SWMU 15 landfill is 16.56 acres.

-For abbreviated soil boring locations, the full location name is SWMU15-SB##.

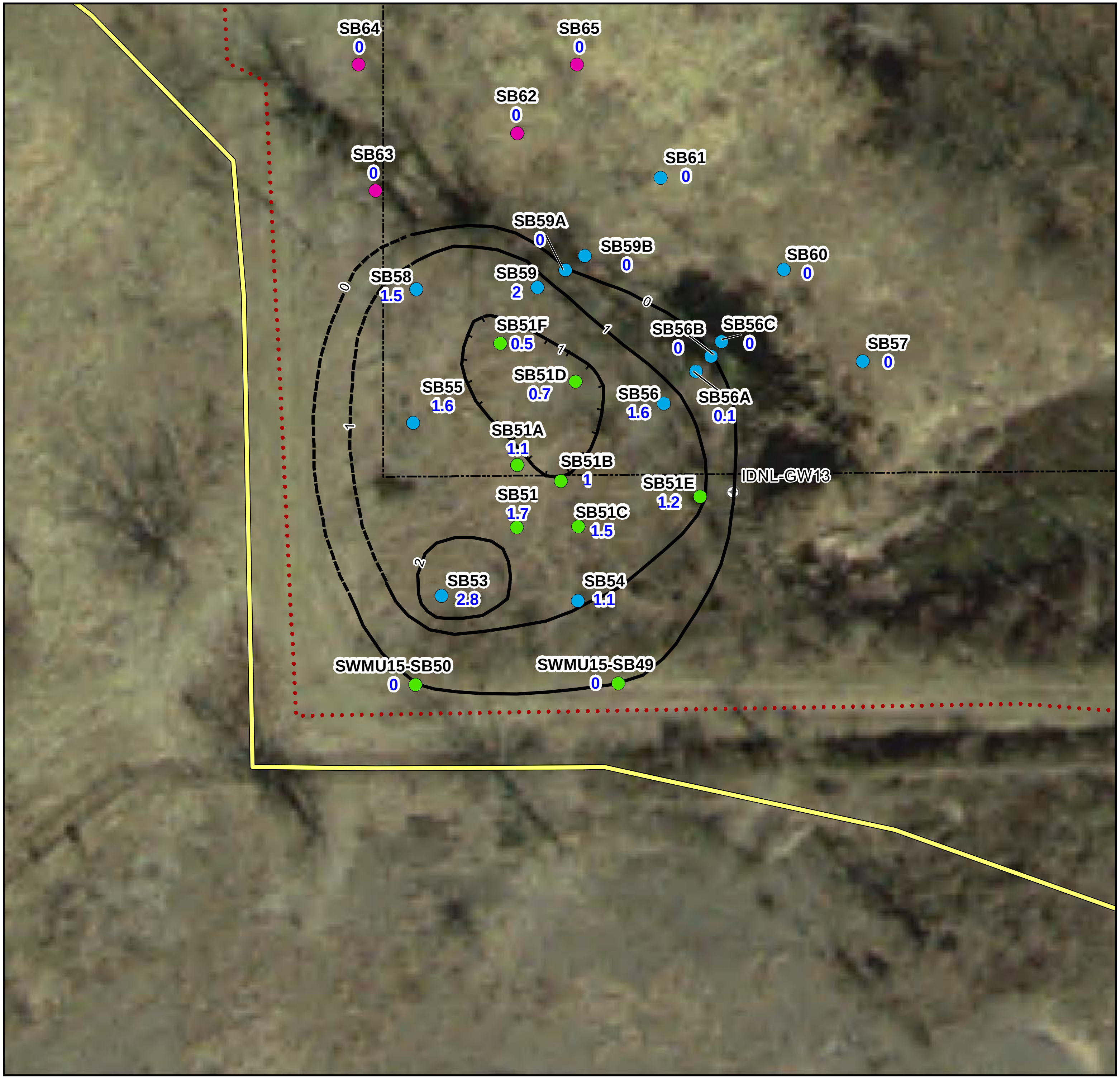
N

0 150 Feet

wood.

Wood Environment & Infrastructure Solutions, Inc.
271 Mill Road
Chelmsford, MA 01824
(978) 692-9090

H:\NiSource\BaillyGenerating\Task81\MXD\Fig8_SWMU15ProposedDirectPushBorings_Sept2014 - 12.2.2014_V2-4ft-contours.mxd November 26, 2019 DWN: emily.gardiner CHKD: RAJ



Greenbelt and Eastern Wetland

Northern Indiana Public Service Company

Bailly Generating Station
Chesterton, Indiana

Legend

- October 2014 Soil Boring Location
- May & September 2014 Soil Boring Location
- March 2015 Soil Boring Location
- 1.7 CCR Thickness (feet)
- CCR Thickness Contour (dashed where inferred)
- Monitoring Well Location
- Bailly Generating Station Property Line
- Trail
- Approximate Boundary of SWMU 15
- CCR - Coal Combustion Residuals

Location of Site

Notes and Sources

FIGURE 9

1) For soil boring locations, the full location name is IDNL-SB##.

2) CCR thickness contour interval is 1'.
Aerial Photo: 2005.
Courtesy of LizardTech, Inc.

0 17.5 35 Feet

N

wood.
Wood Environment & Infrastructure Solutions, Inc.
271 Mill Road
Chelmsford, MA 01824
(978) 692-9090

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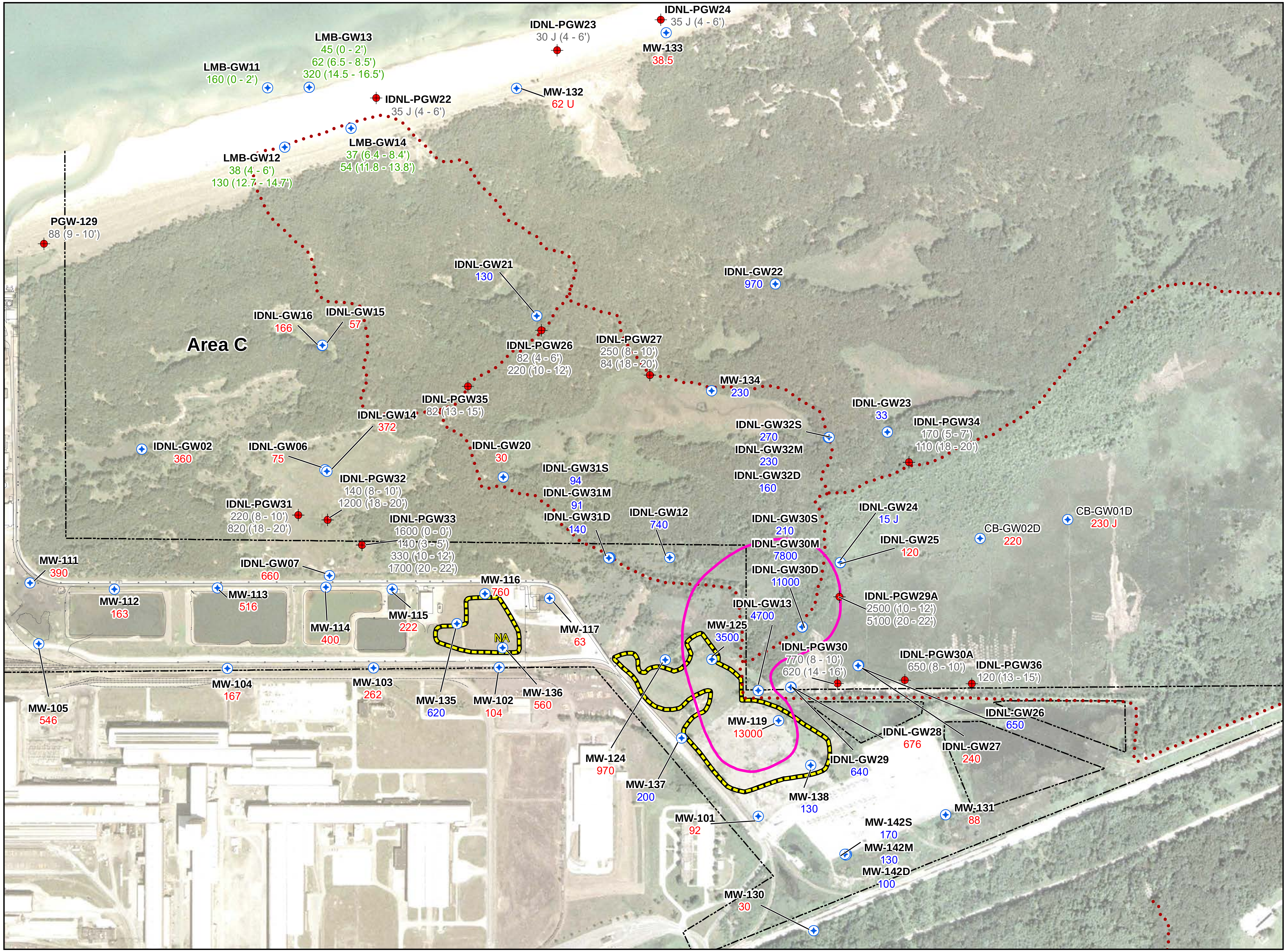

Area C
Boron Groundwater Results

Northern Indiana Public Service Company

Bailly Generating Station
Chesterton, Indiana

Legend

Monitoring Well Sample Result (µg/L)

130 October 2018
5100 Last Time Sampled (Various Dates)

29 (14-16') PGW - May and June 2006 Screening Sample Result (µg/L) and Depth (ft bgs)

160 (0-2') LMB - September 2009 Screening Sample Result (µg/L) and Depth (ft bgs)

Groundwater Monitoring Well

Direct Push Groundwater Sample Location

Trail

Coal Combustion Residual Fill Area

Extent of Groundwater Contamination Above Clean-Up Standards Based on 2018 Results

Location of Site

Notes and Sources

FIGURE 10

Aerial Photo: March 2003, Courtesy of Indiana Spatial Data Portal
- All concentrations are in ug/L.
- J = Estimated value.
- U = Non-detect at the reporting limit.

0 700 Feet

N

wood.

H:\NiSource\BaillyGenerating\Task88\MXD\Area C Boron Groundwater Results_2019.mxd November 25, 2019 DWN: emily.gardiner CHKD: RAJ

Table 1: Synthetic Precipitation Leaching Procedure Results for SWMU 15

Benchmark (mg/L)	Units	SWMU15SB18AA	SWMU15SB23AA	SWMU15SB25AA	SWMU15SB31AA	SWMU15SB31AB	SWMU15SB35AA	SWMU15SB38AA	SWMU15SB41AA
N/A	N/A	Fine CCR	Fine CCR	Fine CCR	Fine CCR	Fine CCR	Fine CCR	Coarse CCR	Fine CCR
N/A	N/A	1 - 2	1 - 2	1.2 - 2.2	1 - 4	1 - 4	3 - 4	1 - 2	3 - 4
N/A	N/A	8.47	9.53	7.52	10.03	10.03	9.26	11.11	9.63
0.14 [1]	mg/L	3.6	0.096 J	71	2.3 J	6.6 J	2.6	11	3.6
0.01 [2]	mg/L	0.089	0.066	1.5	0.039 J	0.078 J	0.11	0.015 U	0.11
N/A	mg/L	0.062	0.028	0.59	0.0063 UJ	0.05 J	0.0051 U	0.01 U	0.027
1.6 [3]	mg/L	0.58	0.77	1.2	0.26	0.37	0.42	0.082 U	0.46
N/A	mg/L	0.0024	0.002 U	0.04	0.002 U	0.0022	0.00089 J	0.002 U	0.0027
N/A	mg/L	0.022	0.004 U	0.51	0.004 UJ	0.019 J	0.004 U	0.0041	0.013
N/A	mg/L	0.02	0.0027 J	0.31	0.0051 J	0.021 J	0.0075 J	0.0044 J	0.018
N/A	mg/L	0.031	0.01 U	1.1	0.01 UJ	0.025 J	0.01 U	0.01 U	0.018
0.99 [1]	mg/L	0.028	0.0054	0.34	0.003 UJ	0.19 J	0.003 U	0.003 U	0.017
N/A	mg/L	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.00032	0.0002 U	0.0002 U	0.0002 U
0.8 [3]	mg/L	0.18	0.024	0.16	0.0081 J	0.017	0.022	0.01 U	0.06
0.00461 [3]	mg/L	0.025 U	0.017 J	0.017 J	0.056	0.055	0.1	0.025 U	0.034

Benchmark (mg/L)	Units	SWMU15SB26AA	SWMU15SB26AB	SWMU15SB42AA	SWMU15SB49AA
N/A	N/A	Sand	Sand	Sand	Sand (Trace CCR)
N/A	N/A	0.6 - 2.0	0.6 - 2.0	1.1 - 3.3	6 - 7
N/A	N/A	8.35	8.35	9.82	10.83
0.42	mg/L	0.53	0.46	5.3	1.5
0.03	mg/L	0.015 U	0.015 U	0.17	0.015 U
N/A	mg/L	0.024 U	0.017 U	0.015 U	0.021
4.8	mg/L	0.11 U	0.063 U	0.15 J	0.44
N/A	mg/L	0.002 UJ	0.002 UJ	0.002 UJ	0.002 U
N/A	mg/L	0.004 UJ	0.004 UJ	0.0014 J	0.0034 J
N/A	mg/L	0.01 U	0.01 U	0.005 J	0.0076 J
N/A	mg/L	0.01 U	0.01 U	0.0038 J	0.0033 J
2.8	mg/L	0.0032 J	0.012 J	0.00058 J	0.11
N/A	mg/L	0.0002 U	0.0002 U	0.0002 U	0.00022
2.4	mg/L	0.01 U	0.01 U	0.0065 J	0.15
0.014	mg/L	0.025 U	0.025 U	0.025 U	0.025 U

Aluminum, arsenic, and boron were identified as COPECs for both SWMU 15 and IDNL groundwater. Manganese was identified as a COPEC for IDNL groundwater. Molybdenum and selenium were identified as COPECs for SWMU 15 groundwater.

mg/L - milligram per liter; bgs - below ground surface; N/A - not applicable

Barium, cadmium, chromium, copper, lead, and mercury were initially identified as Contaminants of Potential Ecological Concern (COPECs), but there were no exceedances in IDNL groundwater downgradient of SWMU 15; therefore no benchmarks were established for these metals.

SPLP results for CCR are compared to benchmarks for groundwater with no dilution/attenuation factor because some CCR is below the water table.

[1] Background

[2] Maximum Contaminant Level

[3] Great Lakes Initiative (GLI) values derived from Criteria and Values for Selected Substances Calculated Using the Great Lakes Basin Methodologies (IDEM, 2002); boron value from IDEM Water Quality Standards Tier II 2004 update.

The SWMU 15 Media Cleanup Levels for unsaturated soil below CCR was derived by multipling the media cleanup level for groundwater by a dilution/attenuation factor of 3.

MCLs:

Barium	2	mg/L
Cadmium	0.005	mg/L
Chromium	0.1	mg/L
Copper *	0.28	mg/L
Lead	0.015	mg/L
Mercury	0.002	mg/L

* GLI for copper.

Qualifiers:
U - Not detected above the reporting limit.
J - Estimated value.

(Yellow shading) Indicates an exceedance of the benchmark; non-detects were shaded if one-half the reporting limit was greater than the benchmark.

(Blue shading) For context only, blue shading indicates a reported SPLP value greater than an MCL.

Table 2: Summary of Physical Properties
SWMU 15 Coal Combustion Residuals

Location	SWMU15-SB22	SWMU15-SB23	SWMU15-SB25	SWMU15-SB33	SWMU15-SB41
Sample Interval (feet bgs)	0-8	5-12	5-12	5-12	5-11
Moisture Content (%)	23.2	20.4	27.9	18.4	37.6
Average Specific Gravity (at 20^{o} C)	2.86	2.78	2.68	2.83	2.79
Grain-Size Distribution					
Gravel (%)	0.76	8.16	0.04	0.29	0.69
Sand (%)	22.47	30.60	7.28	51.34	41.54
Silt & Clay (%)	76.77	61.24	92.68	48.38	57.76
USCS Classification	Silt with Sand	Sandy Silt	Silt	Silty Sand	Sandy Silt

Notes:
1. Samples summarized above were field classified as black, fine CCR.
2. All samples were determined by the laboratory to be non-plastic material.
3. Source: Geotechnics Project Number 2014-692-01, dated June 3, 2014.

Table 3: Summary of Physical Properties
SWMU 15 Native Soils

Location	**SWMU15-SB18**	**SWMU15-SB30**	**SWMU15-SB31**	**SWMU15-SB41**	**SWMU15-SB50**
Sample Interval (feet bgs)	28-35	10-18	21-28	28-35	22-29
Moisture Content (%)	17.6	19.2	19.8	15.7	17.5
Average Specific Gravity (at 20^{o} C)	2.68	2.70	2.71	2.79	2.72
Grain-Size Distribution					
Gravel (%)	0.70	1.2	1.44	0.69	2.02
Sand (%)	90.75	90.1	12.48	41.54	11.51
Silt & Clay (%)	8.55	8.7	86.08	57.76	86.47
USCS Classification	Poorly graded Sand with Silt	Poorly graded Sand with Silt	Lean Clay	Sandy Silt	Lean Clay

Notes:
1. Source: Geotechnics Project Number 2014-692-01, dated June 3, 2014.

Table 4: Untreated Material Physical Characterization
SWMU 15 Coal Combustion Residuals

TESTING PARAMETER	TEST METHOD	UNIT	SAMPLE
			SWMU-15 Composite
Moisture Content	ASTM D2216		
ASTM Moisture Content		%	20.92
Percent Solids		%	82.71
Bulk Density	ASTM D7263	pcf	130.2
Solid Specific Gravity	ASTM D854		2.77
Loss on Ignition (Organic Content)	ASTM D2974		
Average Moisture Content		%	21.22
Average Loss on Ignition			1.65
Particle Size with Hydrometer	ASTM D422		
Sample Description			Black sandy silt
Soil Classification	ASTM D2487		
Gravel		%	2.5
Sand		%	27.8
Silt		%	61.2
Clay		%	8.5
Atterberg Limits	ASTM D4318		
L.L.			NV
P.L.			NP
P.I.			NP

Notes:
Sample color determined by the Munsell Soil Color Chart
% = percent
pcf = pound per cubic foot
L.L. = Liquid Limit
P.L. = Plastic Limit
P.I. = Plasticity Index
NV = Non Viscous
NP = Non Plastic

Source: KEMRON Environmental Services, Inc., Project No. SH0549, December 19, 2014

Table 5: Untreated Material Analytical Results
SWMU 15 Coal Combustion Residuals

Analyte	Units	Benchmark	SWMU-15 Composite	MW-119 7/6/2011	IDNL-GW13 10/23/2014
			SPLP (1312/6010C)	Groundwater (6010B/6020)	
Arsenic	µg/L	10 [1]	203	480	16
Barium	µg/L	2000 [1]	151	36	37
Boron	µg/L	1600 [2]	723	29000	5100
Cadmium	µg/L	5 [1]	0.30 U	0.98	0.5U
Chromium	µg/L	100 [1]	2.10	4U	2.1J
Copper	µg/L	280 [2]	3.00	2U	10U
Lead	µg/L	15 [1]	3.30 U	5U	10U
Manganese	µg/L	994 [3]	2.60	16	340
Molybdenum	µg/L	800 [2]	110	3800	10
Selenium	µg/L	4.61 [2]	82.2	2.4	1U
Silver	µg/L	N/A	0.60 U	3U	6U
			SPLP (1312/7470A)	Groundwater (7470A)	
Mercury	µg/L	N/A	0.01 U	0.2U	0.2U

Notes:
SWMU 15 Composite - flyash sample collected from multiple borings from 9/8/14 through 9/11/14
MW-119 - the lastest groundwater sample results for this source well are included for comparison
IDNL-GW13 - the latest groundwater sample results for this downgradient well is included for comparison
Arsenic, boron, molybdenum, and **selenium** were identified as Contaminants of Potential Environmental Concern (COPECs) for SWMU 15 groundwater and **arsenic, boron** and **manganese** were identified as COPECs for IDNL groundwater.
µg/L = microgram per Liter
[1] Maximum Contaminant Level (MCL)
[2] Great Lakes Initiative (GLI)
[3] Background
Benchmark Exceedance
N/A - Not applicable; silver and mercury were not detected in IDNL groundwater
U = Analyte was not detected
J = Estimated value

ATTACHMENT A

U.S. ENVIRONMENTAL PROTECTION AGENCY

ADMINISTRATIVE RECORD
FOR THE

NIPSCO BAILLY GENERATING STATION
CHESTERTON, PORTER COUNTY, INDIANA
EPA ID NO: IND000718114

STATEMENT OF BASIS
JUNE 22 2020
SEMS ID: 955953

NO.	SEMS ID	DATE	AUTHOR	RECIPIENT	TITLE/DESCRIPTION	PAGES
1	953142	3/31/05	U.S. EPA	Maassel, M., NIPSCO Bailly Generating Station	Administrative Order on Consent (AOC), Docket No. RCRA-05-2005-0005	18
2	954805	4/13/05	NIPSCO Bailly Generating Station	U.S. EPA	Current Conditions Report	87
3	951442	4/21/05	NIPSCO Bailly Generating Station	U.S. EPA	Sampling Rationale Spreadsheet	1
4	951443	5/19/05	Sullivan, D., NiSource and Haney, M., AMEC	Majack, M., U.S. EPA	Technical Memorandum - Supplement to the Current Conditions Report	9
5	954813	5/25/05	AMEC	NIPSCO - Northern Indiana Public Service Company	RCRA Facility Investigation Work Plan (Redacted)	121
6	953145	7/1/05	Sullivan, D., NiSource and Haney, M., AMEC	Majack, M., U.S. EPA	Technical Memorandum 05-02 - Test Pit Program Summary of Findings	33

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7	951444	7/13/05	Sullivan, D., NiSource and Haney, M., AMEC	Majack, M., U.S. EPA	Technical Memorandum re: 5/3/05 Technical Memorandum	3
8	951479	3/31/06	AMEC	U.S. EPA	NIPSCO Responses to EPA Review of the Evaluation of the Nature and Extent of Compounds in Soil	7
9	954819	2/21/07	Sullivan, D., NiSource and Haney, M., AMEC	Majack, M., U.S. EPA	Technical Memorandum 07-01 - Summary of Findings from Fall 2006 Soil and Plant Sampling	73
10	953146	3/1/07	AMEC	NIPSCO - Northern Indiana Public Service Company	2007 Sampling and Analysis Plan	31
11	954820	7/27/07	AMEC Earth & Environmental, Inc.	NIPSCO Bailly Generating Station	Human Health Risk Assessment	212
12	953147	8/30/07	Nisource	NIPSCO Bailly Generating Station	RFI Report Tables	29
13	954804	8/30/07	AMEC Earth & Environmental, Inc.	NIPSCO Bailly Generating Station	RFI Report Figures	53
14	954809	4/10/09	AMEC Earth & Environmental, Inc.	NIPSCO Bailly Generating Station	2009 IDNL Vegetation Survey Plan	50
15	954810	7/16/09	AMEC Earth & Environmental, Inc.	NIPSCO Bailly Generating Station	2009 IDNL Vegetation Survey Plan and Related Investigations, Rev 1	54
16	954837	4/30/10	AMEC Earth & Environmental, Inc.	NIPSCO Bailly Generating Station	2010 Amphibian Toxicity Study Plan (Redacted)	74

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17	954821	6/21/10	AMEC Earth & Environmental, Inc.	NIPSCO Bailly Generating Station	2010 Plant Toxicity Study Plan - Final	63
18	954811	11/17/10	AMEC Earth & Environmental, Inc.	NIPSCO Bailly Generating Station	Final 2010 Amphibian Toxicity Study Report	160
19	955890	11/22/10	AMEC Earth & Environmental, Inc.	NIPSCO Bailly Generating Station	Final 2009 Amphibian Survey Report	333
20	951481	1/14/11	AMEC	U.S. EPA	Rhizome and Soil Testing Results	8
21	954814	2/18/11	AMEC Earth & Environmental, Inc.	NIPSCO Bailly Generating Station	RFI Appendix F - Validated Area C Groundwater Analytical Data	1117
22	955891	2/18/11	AMEC Earth & Environmental, Inc.	NIPSCO - Northern Indiana Public Service Company	RFI Area C - Appendices I-J - Charts, Tables, Maps	41
23	954838	4/29/11	AMEC Earth & Environmental, Inc.	NIPSCO Bailly Generating Station	Human Health Risk Assessment for Area C	213
24	954835	4/29/11	AMEC Earth & Environmental, Inc.	NIPSCO Bailly Generating Station	Baseline Ecological Risk Assessment for Area C	188
25	954812	4/29/11	AMEC Earth & Environmental, Inc.	NIPSCO Bailly Generating Station	Baseline Ecological Risk Assessment for Area C - Appendices I-M	447
26	954853	4/29/11	AMEC Earth & Environmental, Inc.	NIPSCO - Northern Indiana Public Service Company	RCRA Corrective Action Program - RCRA Facility Investigation Report for Area C	143

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27	954807	4/29/11	AMEC Earth & Environmental, Inc.	NIPSCO Bailly Generating Station	RCRA Corrective Action Program - RCRA Facility Investigation Report for Area C - Figures	60
28	954854	4/29/11	AMEC Earth & Environmental, Inc.	NIPSCO Bailly Generating Station	RCRA Corrective Action Program - RCRA Facility Investigation Report for Area C - Tables	353
29	955887	4/29/11	AMEC Earth & Environmental, Inc.	NIPSCO Bailly Generating Station	RFI Area C Appendices A - C	2546
30	954815	4/29/11	AMEC Earth & Environmental, Inc.	NIPSCO Bailly Generating Station	RFI Area C Appendix D - Boring Logs	129
31	955880	4/29/11	AMEC	NIPSCO - Northern Indiana Public Service Company	SWMU 14 and 15 - 3D Model of Subsurface Conditions (Re-issued Appendix K)	16
32	953143	7/9/12	Guerriero, M., U.S. EPA	NIPSCO - Northern Indiana Public Service Company	Final Decision/Response to Comments	36
33	953149	7/30/13	AMEC	NIPSCO - Northern Indiana Public Service Company	Risk Assessment for SWMU 14	29
34	954808	7/30/13	AMEC Earth & Environmental, Inc.	NIPSCO Bailly Generating Station	Final Corrective Action Program - SWMU 14 Attachment	54
35	953150	9/16/13	Johnson, R. and Cooke, D., AMEC	Kaysen, M., U.S. EPA	Memo - Baseline Ecological Risk Assessment - SWMU 14 Revised Calculations	27
36	951483	9/26/13	Johnson, R., AMEC Foster Wheeler	Kaysen, M., U.S. EPA	Memo - Corrective Measures Study for Area C - Central Blag Slough pH Measurements	19

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37	953151	11/6/13	AMEC	U.S. EPA	Area C Corrective Measures Study Conceptual Corrective Actions - IDNL	30
38	951474	2/28/14	Johnson, R. and Miller, G., AMEC	Kaysen, M., U.S. EPA	Memo - Corrective Measures Study for Area C - SWMU 15 Supplemental Landfill Delineation	7
39	951476	2/28/14	Johnson, R. and Miller, G., AMEC	Kaysen, M., U.S. EPA	Memo - Corrective Measures Study for Area C - IDNL Investigation Work Plan	12
40	953144	4/3/14	Johnson, R. and Cooke, D., AMEC	Kaysen, M., U.S. EPA	Memo - SWMU 14 Groundwater Plume Evaluation and Exposure Parameters - Baseline Ecological Risk Assessment	23
41	951475	5/8/14	Johnson, R. and Miller, G., AMEC	Kaysen, M., U.S. EPA	Memo - Corrective Measures Study for Area C - Revised IDNL Investigation Work Plan	12
42	953152	6/17/14	Johnson, R., AMEC	Kaysen, M., U.S. EPA	Memo - NIPSCO Response to EPA Comments on the Area C Human Health Risk Assessment	19
43	953153	7/10/14	Johnson, R. and Cooke, D., AMEC	Kaysen, M., U.S. EPA	Memo - Corrective Measures Study for Area C - Proposed Media Cleanup Standards	16
44	951477	9/26/14	Johnson, R., AMEC and Sullivan, D., NIPSCO	Kaysen, M., U.S. EPA	AMEC Memo - Corrective Measures Study for Area C - Revised Work Plan Addendum - SWMU 15 Supplemental Landfill Delineation	5
45	954799	9/30/14	Johnson, R., AMEC and Sullivan, D., NIPSCO	Kaysen, M., U.S. EPA	AMEC Memo - Proposed Additions and Reductions - October Annual Sampling Event	35
46	954839	12/4/14	AMEC Environment & Infrastructure, Inc.	NIPSCO Bailly Generating Station	Revised Risk Assessment for SWMU 14	121

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47	954800	12/4/14	Johnson, R., AMEC and Miller, G., Geochemical LLC	Kaysen, M., U.S. EPA	AMEC Memo - Geochemistry of Groundwater and Aquifer Solids Related to Boron Attenuation Observed at IDNL in May 2014: Demonstration of Monitored Natural Attenuation Tier I	36
48	953154	4/20/15	Johnson, R., AMEC Foster Wheeler and Miller, G., Geochemical LLC	Kaysen, M. and Ford, R., U.S. EPA	AMEC Foster Wheeler Memo - Response to Comments - Review of Initial MNA Evaluation Corrective Measures Study	20
49	953136	5/11/15	Johnson, R., AMEC Foster Wheeler and Miller, G., Geochemical LLC	Kaysen, M. and Ford, R., U.S. EPA	AMEC Foster Wheeler Memo - Irreversible Sorption of Boron in Sediments, Soils, and Aquifer Materials	9
50	954803	5/11/15	Johnson, R., AMEC Foster Wheeler and Miller, G., Geochemical LLC	Kaysen, M. and Ford, R., U.S. EPA	AMEC Foster Wheeler Memo - Analysis of Boron Breakthrough Curves - Wells IDNL-GW02 and MW-134	25
51	955886	6/1/15	AMEC Foster Wheeler Environment & Infrastructure, Inc.	NIPSCO - Northern Indiana Public Service Company	Appendix J - Numerical Modeling of Boron Fate & Transport in Groundwater Remedial Alternatives Analysis	44
52	951446	6/15/15	Johnson, R., AMEC Foster Wheeler	Kaysen, M., U.S. EPA	Memo - Response to EPA Comments Corrective Measures Study for Area C Proposed Media Cleanup Standards	12
53	954841	6/24/15	AMEC	NIPSCO Bailly Generating Station	Corrective Measures Study Area C - Appendix F - Previously Barren Soil Areas pH Analysis	21
54	954802	7/1/15	AMEC	NIPSCO Bailly Generating Station	Draft Corrective Measures Study Report Appendix K - Summary of Cost Estimate	20
55	951473	8/13/15	Kaysen, M. and Moore, T., U.S. EPA	NIPSCO Bailly Generating Station	Documentation of Environmental Indicator Determination - Interim Final	12

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56	954840	8/14/15	AMEC Environment & Infrastructure, Inc.	NIPSCO Bailly Generating Station	Area C Corrective Measures Study	117
57	953137	8/14/15	AMEC	NIPSCO Bailly Generating Station	Final Corrective Measures Study Report Tables	28
58	954801	8/14/15	AMEC Foster Wheeler	NIPSCO Bailly Generating Station	Final Corrective Measures Study Figures	38
59	951482	2/4/16	Kaysen, M., U.S. EPA	Johnson, R., AMEC Foster Wheeler	E-mail Response - Groundwater Flow and Boron Transport Modeling	2
60	951445	6/30/16	Johnson, R., AMEC Foster Wheeler	Kaysen, M., U.S. EPA	AMEC Foster Wheeler Memo - SWMU 15 Geotechnical Investigation	8
61	954842	1/23/17	Guerra, P. and Johnson, R., AMEC Foster Wheeler	Kaysen, M., U.S. EPA	Memo - SWMU 15 Geotechnical Investigation Summary - Corrective Measures Study for Area C	125
62	951478	6/2/17	Guerra, P. and Johnson, R., AMEC Foster Wheeler	Kaysen, M., U.S. EPA	Memo - Revised Costs for SWMU 15 Corrective Measures Study for Area C	22
63	951447	9/18/17	Johnson, R., AMEC Foster Wheeler	Kaysen, M., U.S. EPA	Memo - Response to EPA Comments Revised Costs for SWMU 15 Corrective Measures Study for Area C	8
64	954806	12/21/17	Delano, T. and Johnson, R., AMEC Foster Wheeler	NIPSCO Bailly Generating Station	Treatability Study Work Plan - SWMU15	47
65	951480	12/21/17	Johnson, R. and Delano, T., AMEC Foster Wheeler	Kaysen, M., U.S. EPA	Memo - Response to EPA Comments - Corrective Measures Study for Area C - Treatability Study Work Plan	9

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66	954852	7/9/19	Johnson, R. and Delano, T., Wood Environment & Infrastructure Solutions, Inc.	NIPSCO - Northern Indiana Public Service Company	Final Area C Corrective Measures Study	1633
67	955889	7/19/19	AMEC Foster Wheeler	NIPSCO - Northern Indiana Public Service Company	Corrective Measures Study Area C - Appendix H - Groundwater Chemistry	49
68	955952	6/22/20	U.S. EPA	File	Statement of Basis for Area C	155

Attachment B

Investigation Summary

Since completion of the Area C RFI (2011) several additional investigations have been conducted to better understand the horizontal and vertical distribution of CCR in SWMU 15, groundwater geochemistry and soil mineralogy, and hydrology, particularly near Cowles Bog and Little Lake. Detailed field and laboratory studies were conducted to quantify boron attenuation on aquifer solids, define the attenuation mechanisms (both temporary sorption and permanent fixation), and the capacity of the aquifer to remove boron from the dissolved phase. Findings from these investigations were used to refine the CSM for groundwater flow and boron transport. Beginning in 2016 a series of studies were completed at SWMU 15 to assist in the selection of the proposed remedy. Each investigation is described in the following subsections.

Aerial Review: Development of SWMU 15

A series of aerial photographs (included in this attachment) were reviewed to better understand the history of SWMU 15 development. An annotated photograph from 1938 shows conditions prior to development of the Facility and includes a trace of the dike (labeled "Berm") that now separates the site from the IDNP. The photograph includes Cranberry Marsh, of which only a remnant remains north of SWMU 15. The Dune Acres Substation was constructed over a portion of the historic Great Marsh. A drainage feature is clearly visible in the bottom of Little Lake, which is still evident today during extended dry periods.

An aerial from 1961 shows early construction activities. For the SWMU 15 area, a light-colored area presumed to be sand is noted where the Dune Acres Substation was eventually constructed. Just to the north is a paddle-shaped, light-colored feature that runs approximately east west and appears to have been constructed of sand for the electric transmission line towers (Tower Set #1). Further north, a second paddle-shaped feature that trends southwest to northeast was constructed for Tower Set #3. In between the two paddles is what appears to be the top of a natural dune used to support Tower Set #2.

A 1963 oblique-angle aerial photograph (looking southeast) shows the Dune Acres Substation, the two paddles for Tower Sets #1 and #3, and the natural dune used to support Tower Set #2. The substation and transmission towers have not yet been constructed. Although not obvious in the aerial, subsequent information indicates that there were low-lying areas between the substation and each tower set. The dike that is present today was not yet constructed.

The 1977 oblique-angle aerial was taken facing northwest towards Lake Michigan and shows the three tower sets and the dike. Visible also are Little Lake in the right-central portion of the photograph, the settling ponds in the left central portion of the photograph, with Central Blag Slough beyond the settling ponds. The land surface is now almost completely flat between the Dune Acres Substation (just off the photograph to the lower right) and Tower Sets #1 and #2. The sand paddle of Tower Set #1 is no longer distinguishable from the filled areas, and just the top of the dune can be seen at Tower Set #2.

A 1979 aerial clearly shows the Dune Acres Substation and dike that separates the Southeast Ponds and SWMU 15 from the Cowles Bog Wetland Complex. The dike also separates four numbered ponds from what remains of Cranberry Marsh. The sand paddle for Tower Set #3 separates Ponds #2 and #3. Pond #4 was an area where CCR was placed and appears to be filled in this photo. The rectangular feature adjacent to and just north of Pond #4 was not filled and is a now a vegetated, low-lying area that was included in the SWMU 15 investigations. Ponds #1, #2, and #3 were not filled, and are currently densely-vegetated, shallow water bodies.

SWMU 15 CCR Delineation and Characterization

The SWMU 15 CCR delineation and characterization was completed in three mobilizations. The investigations were performed in accordance with the Revised SWMU 15 Supplemental Landfill Delineation work plan dated May 8, 2014, which proposed 34 soil borings to clay (see **Figure 7**). The plan focused mainly on the vertical dimensions of the landfill interior (i.e., thickness of CCR, relative position of CCR to the water table, thickness of sand above clay, and depth to clay). In addition to investigation activities within the interior portion of the landfill, three borings (SWMU15-SB49, SWMU15-SB50, and IDNL-SB51) were proposed between SWMU 15 and the IDNP, near monitoring well IDNL-GW13. The purpose of those three borings was to determine if CCR might extend into the area near or in IDNP. Borings SB49 and SB50 were proposed within the dike that separates SWMU 15 from the surrounding land, and SB51 was proposed northeast of the dike, in the direction of INDL-GW13.

Delineation and Characterization Summary

Investigation activities were initiated on May 12, 2014 but were hindered when rainfall made portions of the landfill and Greenbelt inaccessible. As a result, 15 out of the 34 proposed borings were completed using a direct-push drill rig, including borings at SB49 and SB50, which were advanced to 35 and 30 feet bgs, respectively. The dike materials were verified as largely comprised of sand underlain by clay; no CCR was encountered at boring SB50, whereas trace amounts (i.e., <5%) of coarse CCR were encountered in the upper 6.5 feet of boring SB49. The remaining 13 soil borings were advanced to refine the extent of CCR in SWMU 15, improve understanding of site stratigraphy, and collect samples for analysis of soil chemistry and physical properties. Nine soil samples were collected, including one duplicate, for analysis of metals following the Synthetic Precipitation Leaching Procedure (SPLP) at TestAmerica in Amherst, NY. Ten soil samples were submitted to Geotechnics in Raleigh, NC for physical characteristics.

The boring program was resumed in September 2014. As discussed during a July 16, 2014 site walk with EPA, NIPSCO and NPS, boring SWMU15-SB52 was added in the northeast portion of SWMU 15. This boring was positioned on the dike to investigate materials used to construct the dike and to establish the northeast boundary of SWMU 15. DLZ Industrial, LLC (DLZ) performed a survey on September 5, 2014 to acquire horizontal and vertical positions of the land surface at each of the borings advanced during the May mobilization, and to stake the proposed locations for the September mobilization (i.e., survey-determined horizontal locations). The land surface elevation at each of the proposed boring locations was also surveyed. The horizontal precision of the survey is 0.1 foot and the vertical precision is 0.01 foot.

A total of 17 soil borings (i.e., 16 of the remaining 18 proposed borings and SB52) were advanced in September 2014 using a Geoprobe direct-push drill rig. It was not possible for the GeoProbe rig to access locations SB20 and SB21 in the northeast, low-lying portion of SWMU 15. Here, hand-auger borings were advanced 10 feet bgs with relative ease. Therefore, a series of hand-auger borings (SB20A through SB20D and SB21A through SB21D) were also advanced to 10 feet bgs around the two proposed borings. Two soil samples were collected from sand below CCR at direct-push borings SWMU15-SB26 and SWMU15-SB42 for analysis of metals following the SPLP at TestAmerica in Amherst, NY. One 6-gallon, composite sample of fine CCR was collected from four direct-push borings within SWMU 15 (including SWMU15-SB27, SWMU15-SB28, SWMU15-SB32 and SWMU15-SB45) and submitted to Kemron Environmental Services (Kemron) for bench-scale testing of various formulations to evaluate the In-Situ Solidification and Stabilization (ISS) technology.

Stratigraphic data obtained from the 33 direct-push borings advanced in May and September 2014 (excluding IDNL-SB51 located outside the SWMU 15 footprint) were entered into the Environmental Visualization System (EVS) Software 3D model to evaluate potential data gaps. Transmission tower plans and historic aerial photographs from the 1960s and 1970s (discussed above) were also reviewed to better understand the sequence of tower construction and CCR disposal at SWMU 15. The information reviewed suggested that the towers were constructed on an existing dune in the northern portion of SWMU 15 and that earthen material may have been imported prior to tower construction in the southern portion of SWMU 15. Based on this information and the updated EVS 3D model, eight additional borings (SWMU15-SB53 through SWMU15-SB60) were positioned to address identified data gaps related mainly to the stratigraphy and presence/absence of CCR near the towers.

A 3D model of SWMU 15 was developed using visualization software to help integrate all the data collected. The model includes diagrams depicting the horizontal and vertical distribution of the CCR, peat and sand units, and can be manipulated by the user to change the viewing angles and zoom in on areas of interest. **Figure 8** provides a plan-view map of SWMU 15, including contours developed by the EVS model depicting the bottom elevation of the deepest (and most often the thickest) CCR interval. The surface of SWMU 15 ranges from 615 feet to 618 feet NAVD88 (North American Vertical Datum 1988). Elevations are lower at the perimeter ranging from 613 feet to 614 feet NAVD88. There are shallower intervals of CCR, but these are typically thinner than the deepest CCR interval and separated by sand or peat intervals. In some areas the CCR was deposited as a continuous interval from depth to the land surface. The deepest areas of CCR would therefore have the lowest bottom elevations shown in **Figure 8**. For example, CCR extends to depths of 22 feet, 20 feet, and 18 feet bgs at borings SWM15-SB23, SWMU15-SB28 and SWMU15-SB36, respectively. The EVS model was also used to develop volume estimates for the corrective action alternatives evaluated for SWMU 15.

SPLP Results

Table 1 provides results for CCR and soil samples collected at SWMU 15 and analyzed using the SPLP method. The plan anticipated collecting six samples of CCR for SPLP analysis and 12 samples of unsaturated (dry) sand from below CCR for SPLP analysis to determine if the underlying soils had become a secondary source. The boring program, however, revealed that there were very few places were unsaturated soil was present below CCR. At most locations, CCR extended below the water table. Only two samples were collected from unsaturated soil below CCR within the SWMU 15 footprint: SWMU15-SB26 collected from 0.6 to 2.0 feet bgs and SWMU15-SB42 collected from 1.1 to 3.3 feet bgs.

A third sample of unsaturated soil was also submitted for SPLP analysis from dike boring SWMU15-SB49. The interval targeted at boring SWMU15-SB49 (6-7 feet bgs) includes a pocket of sand with a small amount of coarse CCR and trace slag.

The top portion of **Table 1** presents SPLP results for the seven CCR samples collected (six proposed, one additional collected), whereas the bottom row presents SPLP results for unsaturated sand. For context, SPLP results for CCR are conservatively compared to screening levels that are developed from proposed media cleanup levels for SWMU 15 and IDNL Groundwater. No dilution/ attenuation factor (DAF) is included for the comparison of CCR to these screening levels, as a large proportion of the CCR is in direct contact with groundwater. Exceedances of the groundwater screening levels are shaded yellow. (Note that the CCR is the source material to be eliminated or controlled by the Corrective Action.) Also, for context CCR SPLP results are compared to the Maximum Contaminant Levels (MCLs) for barium, cadmium, chromium, copper, lead and mercury as these metals do not have media cleanup levels because the frequency of detection in IDNL groundwater was so low. The bottom portion of **Table 1** compares SPLP results for the underlying sand to these screening levels after applying a DAF of three (calculated in accordance with EPA guidance). Non-detects are identified as possible exceedances if one-half the reporting limit was greater than the screening level benchmark. **Table 1** results show that:

Aluminum concentrations in the SPLP samples are higher for CCR than sand and all reported values for CCR and sand exceed the screening levels of 0.14 and 0.42 mg/L, respectively. Note that the field measurements of pH for the CCR and soil samples selected for SPLP analysis ranged from 7.52 to 11.11 standard units, whereas the SPLP test simulates precipitation having a pH of 4.2. The actual pH of the SPLP effluent was not measured. Aluminum is very sensitive to pH, the solubility of aluminum increases as pH either increases or decreases from neutral conditions (i.e., having a pH between 6.5 and 7.5). The SPLP results indicate that CCR has a higher potential to leach aluminum than sand; however, groundwater data show that there have been no exceedances of the site-specific background level for aluminum in IDNL groundwater at wells located immediately downgradient of SWMU 15.

Arsenic was detected in all fine CCR samples above the reporting limit, ranging from 0.066 to 1.5 mg/L. Arsenic was not detected in the one sample of coarse CCR. All the arsenic detections for CCR exceed the screening level (which is the MCL). Arsenic was detected above the reporting limit in one of four sand samples at 0.17 mg/L, almost 10-fold lower than the maximum result for CCR. The one arsenic detection for sand exceeds the screening level.

Selenium was detected in six of eight CCR samples, and all reported values (including one-half the reporting limit for the two non-detect values) exceed the media cleanup level for selenium, which is the GLI value. Selenium was not detected in the SPLP effluent for the sand samples, and one-half the reporting limit is below the SWMU15 media cleanup level.

Physical Properties

Five samples of CCR, three samples of underlying sand, and two samples of fines (i.e., silt- and clay-sized particles) at depth in the aquifer were collected in May 2014 and submitted to Geotechnics in Raleigh, NC for physical characteristics. **Table 2** presents the physical properties for the CCR samples, all of which include a high percentage of fines, ranging from 48 to 93 percent. The next most abundant grain-size category is sand, with minimal gravel-sized material. The higher percentages of sand-sized particles indicate the mixing of fine CCR with coarse CCR and/or native sands. Moisture content ranges 18.4 to 37.6 percent and the specific gravity is similar to and slightly denser than quartz.

Table 3 presents physical properties for native materials underlying the fine CCR, all of which were collected from the saturated zone. Samples SWMU15-SB18 and SWMUSB–SB30 were comprised of over 90% sand, whereas one sample (SWMU15-SB41) was characterized as sandy silt, containing 42% sand and 58% silt and clay. Samples SWMU15-SB31 and SWMU15-SB-50 were collected from the confining unit that defines the lower boundary of the surficial aquifer and contained over 86% silt and clay.

Bench-Scale Testing

One six-gallon, composite sample of fine CCR was collected from four direct-push borings within SWMU 15 (including SWMU15-SB27, SWMU15-SB28, SWMU15-SB32 and SWMU15-SB45) between September 8 and 11, 2014, and submitted to Kemron for bench-scale testing of various formulations to evaluate the ISS technology. **Table 4** summarizes the untreated physical properties of the composite CCR sample. The moisture content and specific gravity of the composite sample fall within the range of results for the individual CCR samples. The grain-size distribution for the composite CCR sample is also very similar to that for the individual CCR sample results, with a silt- and clay-sized fraction of approximately 70%, and a sample description of "black sandy silt".

Table 5 presents the SPLP results from the untreated CCR. The purpose of these SPLP data for untreated material (i.e., fine CCR) was to establish baseline conditions for comparison with various ISS formulations. Note that the solidified CCR samples were crushed to create a granular material prior to the SPLP analysis, so the results likely over-estimate the actual leachate generation from a solidified mass. Groundwater benchmarks and groundwater results from source-area well MW-119 and well IDNL-GW13, located immediately downgradient of SWMU 15, were included in the table for context and to allow the following remarks:

Arsenic (203 ug/L) and selenium (82.2 ug/L) are the only metals in the SWMU 15 composite sample that had SPLP leachate concentrations greater than the benchmarks of 10 ug/L (MCL) and 4.61 ug/L (GLI), respectively. Arsenic was also detected in groundwater above the benchmark in source-area well MW-119 (480 ug/L) and downgradient well IDNL-GW13 (16 ug/L). Although arsenic exceeds the groundwater benchmark by a small margin at IDNL-GW13, there is more than a 10-fold decline compared to the composite sample results and source-area well MW-119, indicating rapid attenuation of arsenic in groundwater. Selenium was not detected at downgradient well IDNL-GW13, which also indicates rapid attenuation.

For the identified site constituents, the most concentrated SPLP result is for boron (723 ug/L), followed by arsenic (203 ug/L), molybdenum (110 ug/L), selenium (82.2 ug/L), and manganese (2.60 ug/L). Similarly, the three highest concentrations in source-area well MW-119 are boron (29,000 ug/L), molybdenum (3,800 ug/L), and arsenic (480 ug/L).

Boron persists in groundwater during transport and was detected at a concentration of 5,100 ug/L in downgradient well IDNL-GW13. Arsenic, molybdenum, and selenium are rapidly attenuated in the aquifer, and were detected in groundwater from IDNL-GW13 at concentrations that are 10-fold (or more) less concentrated than the composite sample results and source-area well MW-119. Conversely, the concentration of manganese in groundwater collected from IDNL-GW13 (340 ug/L) is substantially higher than either the composite sample SPLP results (2.6 ug/L) or source-area well MW-119 (16 ug/L). SWMU 15 was eliminated as a source of manganese to groundwater in the IDNL due to concentration gradients and source material concentrations.

Barium, cadmium, chromium, copper, and lead were either non-detect in the SWMU 15 composite sample results or had SPLP concentrations well below the benchmarks. The same is true for source-area well MW-119 and downgradient well IDNL-GW13, which justifies the exclusion of these five metals as constituents in groundwater for SWMU 15 and the IDNL.

As summarized below, additional treatability testing was performed since the initial study summarized above was completed, using a more advanced EPA approach for assessing the leachability of solidified CCR called the Leaching Evaluation Assessment Framework (LEAF).

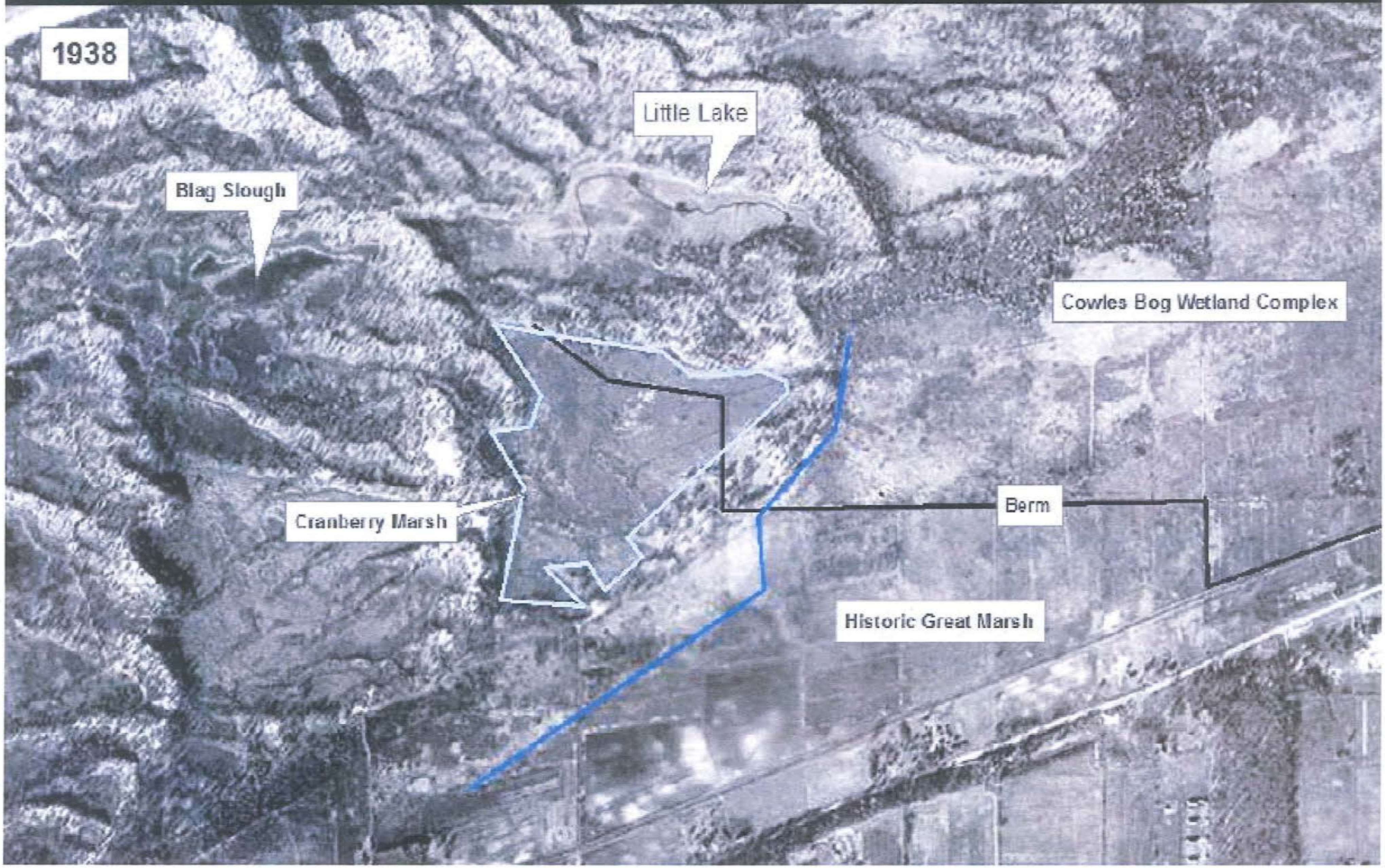
Additional SWMU 15 Remedy Evaluation Studies

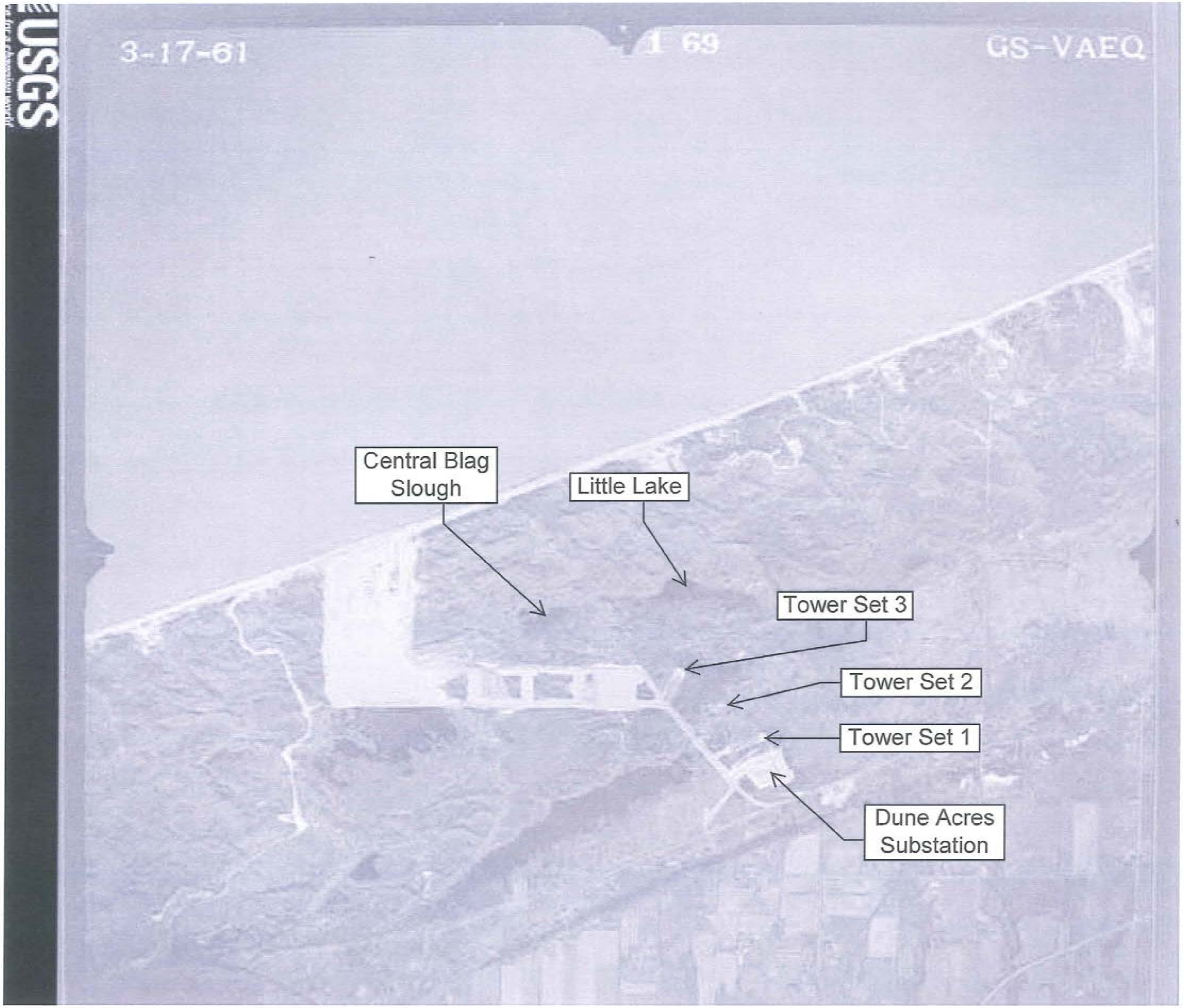
On March 18, 2016, a draft proposed remedy was submitted to EPA by NIPSCO, which recommended encapsulation of CCR in SWMU 15. The conceptual design for encapsulation included a perimeter slurry wall keyed into underlying clay and an engineered, impermeable cover. EPA requested additional information to confirm the conceptual design would work prior to officially proposing the remedy to the public. A geotechnical investigation was conducted between July and September 2016 to address that request. The primary objective of that investigation was to better understand the presence and depth of the clay layer(s) underlying SWMU 15, particularly along the potential slurry-wall path. Findings from that investigation were documented in a memo to EPA dated January 23, 2017. The investigation findings had significant cost implications on the encapsulation remedy for SWMU 15 because the depths to clay were greater than assumed and the clay layers encountered were thin or discontinuous. NIPSCO proposed to revise the conceptual design and associated costs for encapsulation, full excavation, and partial excavation with ISS in a separate memo to EPA so that an informed decision could be made on a recommended remedy for SWMU 15.

Revised costs were presented in a memo to EPA dated June 2, 2017. As detailed in that memo, based on the geotechnical investigation findings and the cost re-evaluation, NIPSCO changed its prior recommendation of encapsulation to partial excavation with ISS for SWMU 15. EPA recommended that NIPSCO perform ISS feasibility evaluations to better evaluate ISS effectiveness and determine the dominant mechanism in leachate retardation (i.e., geochemical stabilization or physical solidification). A Treatability Study Work Plan for SWMU 15 was prepared for EPA review and approval, and the final was filed on December 21, 2017. Based on the initial testing of unconsolidated CCR collected from three areas within the SWMU 15 footprint, the most representative material was solidified using five mix designs and tested using LEAF monolith leach testing procedures. Resulting data were used to evaluate the reduction in mass flux from the solidified monoliths, which showed that Portland Cement (6%) generally performed well, having the lowest hydraulic conductivity value and passing the durability tests for wet/dry and freeze/thaw. Additional detail on the treatability study can be found in the November 16, 2018 memo submitted to EPA by NIPSCO.

Indiana Dunes National Lakeshore
Figure 1

National Park Service
U.S. Department of the Interior

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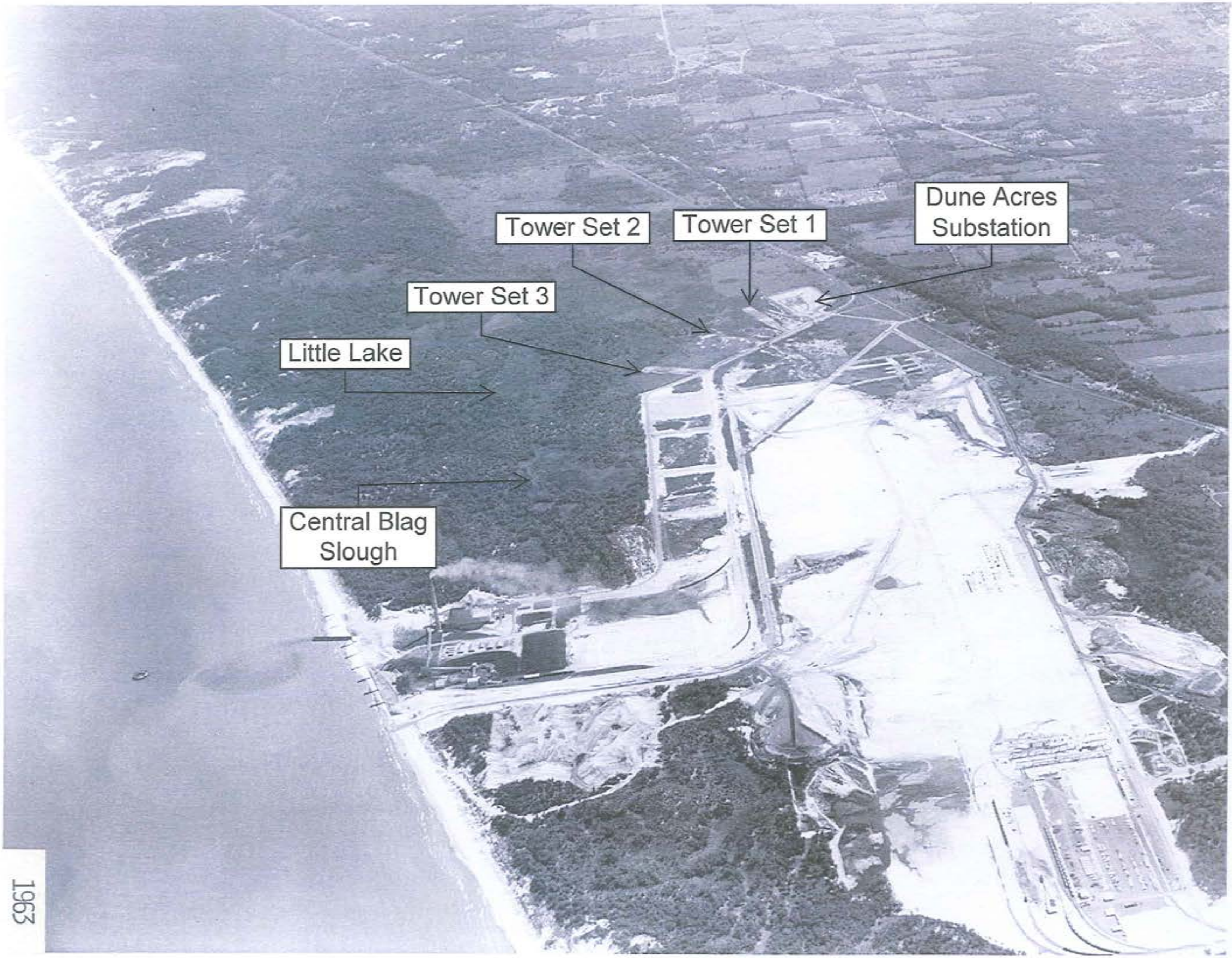
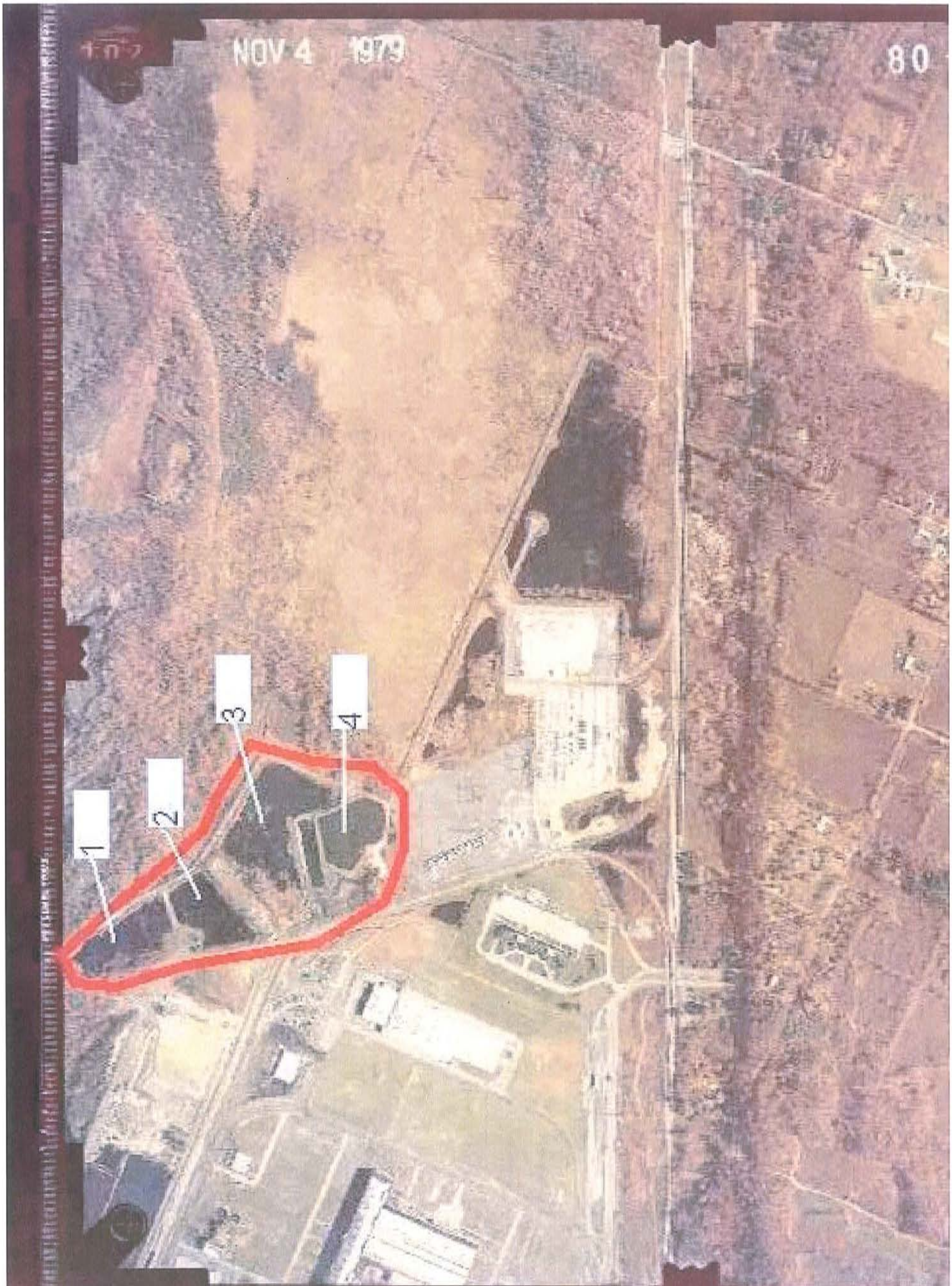
GS-VAEQ
Central Blag Slough
Little Lake
Tower Set 3
Tower Set 2
Tower Set 1
Dune Acres Substation


Dune Acres
Substation
Tower Set 1
Tower Set 2
Tower Set 3
Little Lake
Central Blag
Slough
1963


Aerial photograph
from 1977
Central Blag
Slough
Little Lake
Dike
Tower Set 3
Tower Set 2
Tower Set 1
Source: Pavlovic, et. al., 2009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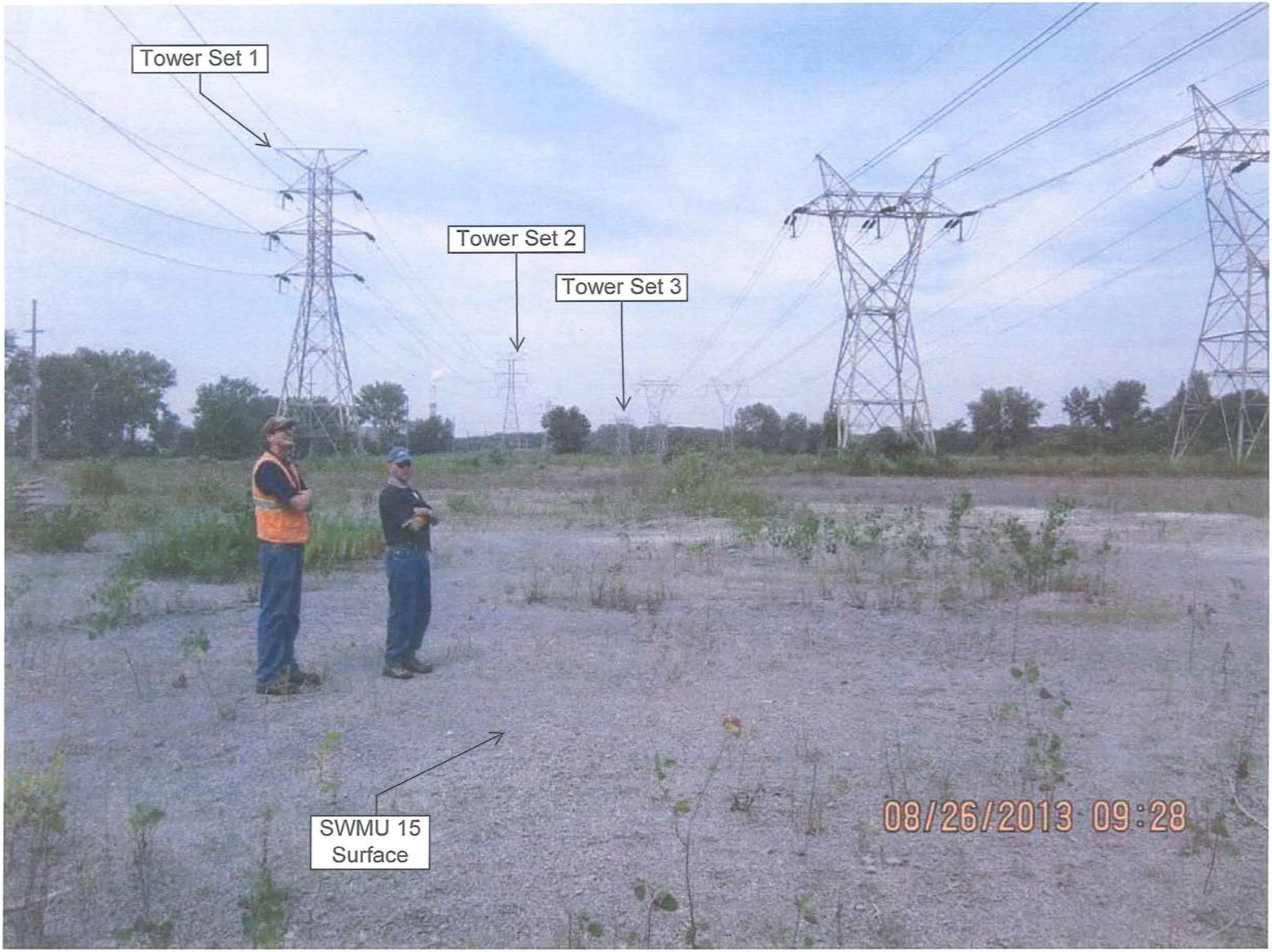
Tower Set 1
Tower Set 2
Tower Set 3
SWMU 15
Surface
08/26/2013 09:28

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 5
77 WEST JACKSON BOULEVARD
CHICAGO, IL 60604-3590

March 15, 2013
Via Email

Dan Sullivan
Northern Indiana Public Service Company
NIPSCO Bailly Generating Station
246 Bailly Station Road
Chesterton, Indiana

RE: NIPSCO Bailly Generating Station
EPA Area C BERA Comments
EPA ID: IND 000718114

Dear Mr. Sullivan:

US EPA has completed its review of NIPSCO's Area C Baseline Ecological Risk Assessment (BERA). EPA conferred with the National Park Service (NPS) during our review. The attached comments present concerns and conclusions from both Agencies.

In general, we do not concur with NIPSCO's conclusions in the BERA. NIPSCO concluded that there are no unacceptable risks to any receptors in any area of study. We believe, and have outlined in our comments, that through a "multiple lines of evidence" approach there exists an abundance of uncertainty associated with the potential ecological risks in Area C. We have also identified specific areas within the BERA's methodologies where potential risk was likely underestimated.

In addition to our BERA comments, attached you will find a recent report on a study of the vegetation found in the Cowles Bog complex (*Potential Impact of Fly-ash Groundwater Contamination on Vegetation of Cowles Bog, Indiana Dunes National Lakeshore, 2011*). The study presents findings that suggest boron, specifically, is causing adverse effects to the affected area of Cowles Bog. In combination with other lines of evidence, this report suggests that damages have occurred within the National Park and to the National Natural Landmark as a result of on-site sources. EPA and NPS believe there is enough evidence and uncertainty to demonstrate that there is unacceptable ecological risk within Area C.

EPA looks forward to discussing these comments with you; however, we will not be requesting a revised BERA. In order to mitigate risks, control sources, and proceed with the corrective action process, we believe the appropriate next step is to collaborate on a risk management decision.

An acceptable risk management decision would include source control, limited off-site remediation, and long-term monitoring. EPA and NPS anticipate working closely with you to achieve these goals. We believe the 2009 Eastern Landfill Pre-Design Investigation prepared by NIPSCO is a good starting point.

We recognize there are potential technical challenges to implement a remediation of this kind and look forward to working with you to find an acceptable solution. In an effort to keep the corrective action process moving forward, please propose a date to discuss these comments and the path forward.

Please feel free to contact me with any questions.

Thank you,

Michelle Kaysen

Michelle Kaysen
US EPA
LCD RRB CAS2
(312) 886-4253

cc: Jennifer Dodds, US EPA
Reginald Pallesen, US EPA
Charles Morris, National Park Service
Robert Daum, National Park Service
Gia Wagner, National Park Service
Dan Mason, National Park Service
Dan Sparks, US Fish and Wildlife Service
Liz McCloskey, US Fish and Wildlife Service
Dale Helmers, NiSource
Russ Johnson, AMEC

Attachments: NIPSCO Area C BERA Comments, EPA and NPS

EPA review of recent vegetation study as it applies to the BERA

Potential Impact of Fly-ash Groundwater Contamination on Vegetation of Cowles Bog, Indiana Dunes National Lakeshore, Paul E. Rothrock, Ph.D. and George C. Manning, August 2011

US Environmental Protection Agency
Review of NIPSCO Area C BERA
March 15, 2013

I. General Comments:

1. Overall, EPA does not agree with the conclusion drawn in the BERA that there are no risks for any receptors in any of the evaluated areas. In particular, the amount of uncertainty surrounding many of the studies (Ex: plant toxicity study, amphibian toxicity study, amphibian survey) and corresponding results, leads EPA to conclude that unacceptable risks to ecological receptors are possible based upon a multiple lines of evidence approach. Below is a brief summary of our conclusions based on review of the BERA and other information. Detailed rationale for our conclusions is provided in the Specific Comments section.

    a. Plants: For plants in at least some parts of the Indiana Dunes National Lakeshore (IDNL) (e.g., Central Blag Slough [CBS]), the weight of evidence suggests that risks are unacceptable and negative impacts may be occurring. This conclusion is based on: (1) soil and/or groundwater concentrations that exceed plant toxicity reference values (TRVs), (2) the presence of barren soil at CBS that has been linked to low pH and elevated metals concentrations, and (3) our analysis of the 2010 plant survey data, which suggests that plant community composition is impacted at some of the site-related areas in comparison to reference areas. As presented in the BERA, the results of the plant toxicity study provides the only line of evidence that conflicts with the above three lines of evidence. However, our review of the plant toxicity study shows that the study was performed with relatively uncontaminated soils and had poor reference area plant survival. We therefore consider the toxicity test results to be highly uncertain and not a supportive line of evidence for a lack of plant impacts. Our detailed reasons are discussed in the specific comments on Appendix G. Additionally, the attached study conducted on Cowles Bog area vegetation appears to contradict this particular line of evidence.
    b. Benthic Invertebrates and Wildlife in Aquatic Habitats: In most of the aquatic habitats in the IDNL, the BERA does not evaluate risks to benthic invertebrates or risks to wildlife through aquatic food web pathways. These are major gaps in the assessment, and we have conducted some preliminary calculations for key chemicals and areas to fill these gaps (detailed in Specific Comment 15). The results of our calculations indicate potential risk to benthic receptors and to invertivorous birds.
    c. Amphibians: Based on the available data and current analyses, the weight of evidence suggests that risks to amphibian receptors may be low. However, we believe that the amphibian assessment is not "definitive", as characterized in the BERA, and that there are important uncertainties that should have been acknowledged in the BERA and carefully considered by risk managers. Also, additional analyses of the amphibian survey data

may change the conclusions of the survey. Refer to comments on Appendices C and E.

d. Terrestrial Invertebrates: The only available line of evidence for terrestrial invertebrates is the comparison of soil concentrations to TRVs or screening values. The results of this comparison do suggest potential for risk in some areas: SWMU 14 and 15 from arsenic, boron, manganese; Little Lake from chromium, manganese; and Eastern Wetland from boron, manganese. It's also noted that although CBS did not demonstrate exceedances of the TRVs, the position that HQs in CBS are lower than the reference area HQs is not appropriate. This risk should not be dismissed based solely on suggestions that screening values are highly conservative or uncertain. Note that the low pH soils in much of the study area may tend to increase the toxicity of some metals in comparison to soils used in standard laboratory tests.

e. Wildlife in Terrestrial Habitats: While risks for most wildlife receptors exposed through the terrestrial food web pathway may be lower than risks for other receptors in the IDNL, there are risks to receptors like shrews and robins that should not be dismissed without additional evaluation or further justification. We also are concerned that the use of literature-derived bioconcentration factors (BCFs) may be resulting in underestimated exposures at this site (refer to Specific Comment 23 and Attachment 3). In addition, note that we recalculated risks to robins for key areas/metals in order to incorporate many of the changes recommended in the comments below (see further discussion in General Comment 5, and complete calculations in Attachment 2). Based on our recalculated risks, hazard quotients (HQs) for robins are as high as 5.8 for boron in the Eastern Wetland (EW) and 14 for cadmium in solid waste management unit (SWMU) 14/15.

2. This assessment could have been greatly strengthened through the collection and evaluation of additional tissue residue data, which is normally an important component of a BERA. Currently, tissue residue data are only available for plants, and these data suggest that uptake in the IDNL study area is greater than uptake predicted by standard literature-based BCFs (refer to Specific Comment 23 and Attachment 3), perhaps due to low soil pH in the study area. This causes concern that modeled concentrations in other organisms may also be underestimated. Collection and analysis of tissue residue samples for terrestrial invertebrates, benthic invertebrates, amphibians, small mammals, and/or bird eggs is typically a component of a BERA, especially in such an ecologically sensitive area.
3. For receptors with no or limited mobility, such as plants and invertebrates, a spatial evaluation of the risk in the risk characterization section would have reduced uncertainty and been more accurate. In contrast to wildlife receptors that are exposed to contaminants over their entire home range (and so, a 95 percent upper confidence limit on the mean [95% UCL] may more accurately represent

exposures to individuals), plants and invertebrates are exposed to very localized concentrations.

4. Given the importance of boron and molybdenum as contaminants of potential ecological concern (COPECs) in the Area C BERA, and the relative paucity of toxicological data available for these two metals, we believe NIPSCO should have prepared detailed toxicological profiles to be included as attachments to the BERA. We noted that the BERA does include references to primary literature for some of the toxicity values used for these metals, but it is unclear how comprehensive the literature search was or how any given study was selected for use in TRV derivation. Additionally, there are some data gaps in TRVs and BCFs for these metals, and it is unclear whether a literature search was conducted in an attempt to fill these data gaps. These data gaps are important uncertainties in the BERA.

5. The specific comments below recommend numerous changes to exposure parameters and toxicity reference values for the wildlife risk calculations. Risks to some receptors in some areas are sufficiently low (e.g., all HQs are less than 0.01) that recalculation is not needed. We do believe, however, that the recommended changes will impact conclusions for some receptors in some areas. To illustrate, we recalculated risks to robins in SWMUs 14/15 and the EW. A summary of results is presented in the table below, and complete calculations are presented in **Attachment 2**. As shown below, our calculated HQs for many analytes are appreciably greater than HQs presented in the BERA

Area	**Analyte**	**Robin HQ from BERA Appendix L**	**Recalculated Robin HQ**
Eastern Wetland	Arsenic	0.25	0.5
	Boron	**2.84**	**5.7**
	Cadmium	0.23	**5.4**
	Chromium	0.16	0.6
	Manganese	**1.13**	**2.1**
	Molybdenum	0.5	**1.0**
	Selenium	0.41	**1.3**
SWMU 14/15	Arsenic	0.68	**1.5**
	Boron	0.66	**11**
	Cadmium	0.1	**14**

II. Specific Comments:

Page 3-3, Section 3.4.1, Refined Selection of contaminants of potential ecological concern (COPECs) in Soil

6. This section does not include any discussion regarding the adequacy of detection limits for nondetected chemicals, and detection limits are not reported in Table 3-

1. EPA guidance (USEPA 1997) recommends retaining nondetected chemicals as COPECs if detection limits are greater than screening values. This comment is also applicable to other media discussed in later text sections (i.e., surface water, groundwater and sediment).

7. The second paragraph that discusses aluminum should have been expanded to include some of the discussion presented in the RFI Section 6.5.2.2, to expand upon a weight-of-evidence approach. Although soil pH data are graphically represented in the RFI, they should have been tabulated in the BERA as an important line of evidence in the ecological risk evaluation.
8. EPA does not agree with the statement, "glyphosate is acutely toxic to both plants and amphibians, and can be considered a contributing factor..." Although some laboratory studies have been provided to EPA which support the conclusion that glyphosate can be acutely toxic, without more site specific studies, it is more accurate to state that glyphosate... "may be" a contributing factor to any observed impacts at NIPSCO.

Page 3-4, Section, 3.4.2, Refined Selection of COPECs in Surface Water and Groundwater

9. This section describes the derivation of the surface water screening value for aluminum. However, the screening value identified in the text (i.e., 750 μg/L) is inconsistent with the screening values listed in Tables 3-3 and 3-5 (i.e., 87 μg/L).
10. This section should have included rationale for using trivalent chromium screening values only, and excluding screening values for hexavalent chromium. If no data on the valence state of chromium in site-specific waters are available, then screening values for hexavalent chromium should have been included. This represents an area of uncertainty. See also Table 3-4.

Page 3-7, Section 3.4.3, Refined Selection of COPECs in Sediment

11. This section indicates that selenium was not selected as a COPEC in the Southeast Pond, but Table 3-6 indicates that selenium was selected as a COPEC in the Southeast Pond. Note that we do not concur with the justification provided for excluding selenium from the Southeast Pond, and we recommend retaining selenium as a COPEC in Southeast Pond sediment. The lack of detection of dissolved selenium in surface water does not preclude the possibility that selenium in sediment could cause toxicity either directly to benthic invertebrates or indirectly through foodweb exposures to wildlife because pore water concentrations of selenium are likely to be greater than surface water concentrations.

Page 3-9, Section 3.5.2, Habitat Areas

12. This section omits discussion of the "Other Wetlands," for which assessment and measurement endpoints are listed in Table 3-12.

Page 3-11, Section 3.5.2.2, Indiana Dunes National Lakeshore (IDNL) Habitats

13. Figure 3-4 is referenced and includes soil/sediments invertebrates as one of the ecological receptor groups for Northwest Blag Slough (NBS), CBS, Little Lake, and the EW. However, the text appears to omit the benthic invertebrates when listing the ecological receptors and feeding guilds in the four IDNL wetland areas. They are however, included as ecological receptors for the Southeast Pond.

    Additionally, in previous correspondence (i.e., letter from NIPSCO to EPA dated February 13, 2009), NIPSCO agreed to evaluate additional receptors in the IDNL (e.g., benthic invertebrates). These receptors do not appear to have been added to the BERA, and we maintain that additional receptors would have been appropriate to reduce uncertainty of risk. Specifically, benthic invertebrates should have been evaluated in all of the evaluated aquatic habitats at the IDNL. During the meeting on June 23, 2011, NIPSCO noted that benthic invertebrates were not evaluated because of the ephemeral nature of most of the Area C wetlands in the IDNL. We do not concur with this rationale, as many invertebrates are adapted to ephemeral pools and wetlands. If hydroperiods are sufficiently long to support larval amphibian development, then hydroperiods are also sufficiently long to support benthic invertebrate development.

    Also, evaluation of a representative invertivorous and/or omnivorous bird and mammal that would forage in aquatic habitats would have been appropriate and would have further reduced uncertainty. Based on personal communication with Randy Knutson (wildlife biologist at IDNL), wildlife species that have been observed in the NIPSCO-affected areas of the IDNL include the Virginia rail, sora, sandpipers (which are most commonly observed at the Lake Michigan shoreline, but sometimes venture inland), mallard, sandhill crane, great blue heron, raccoon, and muskrat. (Note that this list is not intended to be comprehensive.) Breeding populations of Virginia rail and sora occur at the IDNL. Based on this information, the Virginia rail, which feeds by probing in sediments, would have been appropriate and protective of other shorebird species. In areas where sediment concentrations for some metals are greater than soil concentrations (e.g., cadmium in CBS, molybdenum and selenium in EW), an herbivorous bird or mammal should have been selected for evaluation.

    To better understand the possible impacts of the addition of these receptors to the BERA, we conducted risk calculations for benthic invertebrates and the Virginia rail for a few selected analytes/areas (see summary in table below and more detailed information in **Attachment 1**). We attempted to include the analytes/areas that were most likely to result in the greatest risk. We also selected analytes that appeared to be present in the site-impacted areas at concentrations that exceed background concentrations.

Area	Analyte	Sediment EPC from Table 6-2 of the BERA (mg/kg)	Benthic Invertebrate TRV (mg/kg)*	Benthic Invertebrate HQ	Virginia Rail HQ**
Central Blag Slough	Cadmium	24.59	0.99	**25**	**9.1**
	Chromium	19.42	43.4	0.4	0.8
	Molybdenum	42.59	NA	NA	>0.4
Eastern Wetland	Arsenic	47.14	9.79	**4.8**	**3.0**
	Boron	28.65	NA	NA	>0.03
	Chromium	20.98	43.4	0.5	0.9
	Molybdenum	139.4	NA	NA	**>1.2**
	Selenium	4.304	2	**2.2**	**6.6**
Northwest Blag Slough	Chromium	31.75	43.4	0.7	**1.3**
	Mercury	0.658	0.174	**3.8**	0.7 to **52**
	Molybdenum	73.64	NA	NA	>0.6

*TRVs for cadmium, arsenic, chromium and mercury are Region 5 Ecological Screening Levels for sediment. TRV for selenium is from Lemly (2002) and was developed to protect both benthic invertebrates and wildlife. Benthic invertebrate TRVs for boron and molybdenum are not readily available from standard sources, and a literature search should have been conducted for benthic invertebrate toxicity data.
**Virginia rail HQs for mercury were calculated using TRVs for both inorganic mercury (HQ=0.7) and methylmercury (HQ = 52) to bracket the range of possible mercury risk. The HQs for boron and molybdenum are based on sediment ingestion only; prey ingestion should have been incorporated into the calculation in the BERA. Refer to Attachment 1 for additional information on these calculations.

Also note that the HQs for boron and molybdenum do not include the ingestion of contaminated prey, and include ingestion of sediment only, due to the lack of chemical-specific uptake factors into prey. Risks from prey ingestion could be 2-10 times greater than HQs from sediment ingestion, and prey ingestion should have been incorporated into the calculation in the BERA (refer also to General Comment 5 regarding data gaps for molybdenum and boron).

As shown in the table above, HQs for both benthic invertebrates and the Virginia rail exceeded 1 for several analytes in multiple areas, with highest HQs substantially greater than 1. These results confirm that it is important to quantify risks to these receptors in the BERA, and that risks to these receptors may be unacceptable for some analytes. Note that the table above is for illustration purposes only; the BERA should have included all COPECs in all areas, and should not have been limited to the analytes/areas included above. This represents a significant uncertainty in the risk.

14. If data are available, additional information about the hydroperiod for CBS, EW, NBS, and Little Lake should have been provided in this section.

Page 3-12, Section 3.5.2.3, Southeast Pond Habitat Area

15. Rather than just fish, this section should specify "fish and aquatic invertebrates" as receptors in this area. Also, it is unclear whether other avian species may have been needed in the Southeast Pond. NIPSCO should have clarified what bird species have been observed or are expected to occur in the Southeast Pond. If any wading birds or dabbling ducks are likely to occur, then a representative receptor should have been selected and evaluated.

Page 4-5, Section 4.1.3, IDNL Plant Toxicity Study

16. This section states, "For each Study Area and Reference Area wetland, sampling locations with the highest metals concentrations were selected in order to obtain the most conservative (i.e., worst case) toxicity testing results." However, it appears that locations with highest metals concentrations were not actually used; in fact the soils used had metals concentrations that were more similar to those in the reference areas. Refer to the discussion and table in the specific comments on Appendix G. We assume that locations with higher concentrations were omitted from the plant toxicity study because they were inundated at the time of sampling. This is an important uncertainty, and should have been highlighted in this section as well as Sections 7 and 8 and Appendix G.

Page 6-5, Section 6.2.1.1, Soil EPCs

17. It is unclear whether the depth-weighted averaging approach described in this section is appropriate. In cases where COPEC concentrations in the 0.5 to 2 ft interval are greater than concentrations in the 0 to 0.5 ft depth interval, then the depth-weighted approach may be needed to ensure protection of plants with deeper root systems. However, if COPEC concentrations are typically greater in the 0 to 0.5 ft depth interval, data from this depth interval alone should be used to ensure protection of plants with shallow root systems and to better characterize exposure for other receptors (e.g., invertebrates and wildlife). Risks to many receptors now have an added layer of uncertainty from not using the 0 to 0.5 ft data set.

Page 6-6, Section 6.2.1.2.1, Surface Water Outlier Samples

18. Additional analysis would have been appropriate to show that the concentrations designated as outliers are impacted by suspended sediment solids and are not representative of a truly elevated concentration. If high hits are due to suspended sediment, then most metals in the water sample should be elevated, not just one or two metals. With the exception of the April 2007 SW-07 sample, it is not clear that the outliers identified in this section should be removed from the dataset.

Page 6-8, Section 6.2.1.6, Dietary Component EPCs

19. This section should have specifically listed the dietary items and areas where concentrations were measured, rather than modeled (e.g., CBS plants). Also, Tables 3-7 through 3-12 should have indicated when tissue concentrations were measured rather than modeled.
20. In general, Section 6.2.1.6 and Table 6-3 do not provide enough information to allow reviewers to verify the acceptability of the BCFs used in the ERA. The following questions and comments illustrate the degree of uncertainty associated with this issue:
    - Were site-specific soil-to-plant BCFs used in all areas except SWMU 14/15? What was the rationale for using literature-derived soil-to-plant BCFs in preference to site-specific BCFs?
    - It appears as if water-to-plant bioconcentration factors were omitted; where these values exist, particularly for significant COCs such as boron (DOI, NIWQP Report #3, 1998), why were water-to-plant BCFs not considered?
    - How were reference area plant concentrations determined (metals for which measured concentrations were used)? References should have been provided to indicate where Reference Area plant data were tabulated. We could not find ProUCL output for Reference Area plants in Appendix J.
    - What soil concentrations were used in the calculation of the literature-derived plant BCF values? (For most metals, these values are calculated based on an equation that is dependent on the soil concentration.) Area-specific 95% UCL soil concentrations should have been used to calculate area-specific BCFs (i.e., literature-derived plant BCFs should vary by exposure area).
    - What wet weight-to-dry weight conversion factors were used?
    - Were water-to-aquatic invertebrate BCFs used exclusively in the Lake Michigan Beach area?
21. In order to better understand the differences between site-specific uptake factors and literature-derived uptake factor for plants, we tabulated soil-to-plant BCFs from three different sources: (1) Ecological Soil Screening Level (Eco-SSL) guidance documents (USEPA 2007), (2) literature-derived BCFs used by NIPSCO (from Table 6-3 of the BERA), and (3) site-specific BCFs (from Table 6-3 of the BERA). These values appear in Table 1 of **Attachment 3**. As shown in this table, the Eco-SSL BCFs and the literature-derived BCFs used in the BERA are generally fairly similar. However, the site-specific BCFs are often considerably different (usually greater) than the literature-derived BCFs. Of particular concern are the site-specific BCFs for boron and cadmium, which are about an order of magnitude greater than the literature-derived BCFs. These results suggest that the use of literature-derived BCFs may not be providing conservative estimates of exposures at the site.

In Table 2 of Attachment 3, we also tabulated plant concentrations for CBS, as calculated using the three different BCFs discussed above. For comparison, we included in Table 2 the plant concentrations that NIPSCO actually used in the wildlife risk calculations (from BERA Appendix L). As shown in Table 2, the plant concentrations used in wildlife risk calculations were different from (and usually less than) any of the plant concentrations that we calculated using the three different BCFs. It is unclear how NIPSCO determined these plant concentrations.

22. For aquatic exposure pathways, Table 6-3 includes only BCFs based on uptake from water. In general, depending on local chemistry, metals can partition more to sediments than surface water, and uptake to aquatic prey often should be estimated based on biota-sediment accumulation factors (BSAFs). (Note, however, that we concur that water-to-aquatic invertebrate BCFs should be applied to groundwater at Lake Michigan Beach.) A few good sources of information for BSAFs include Bechtel Jacobs (1998), USACE (2000), and USEPA (2000).

    Unfortunately, to our knowledge there are no comprehensive compilations of BSAFs for metals in fish. Our suggested approach would be to first use the Bechtel Jacobs (1998) reference to calculate metals BSAFs for benthic invertebrates. The USEPA (2000) reference can then be reviewed for fish BSAFs and to determine whether there is potential for biomagnification of any given metal in aquatic systems (refer to the "Food Chain Multipliers" sections under the "Aquatic Organisms" headings in the appendices of this document). In general, USEPA (2000) indicates little potential for biomagnification of most metals. For metals with little potential for biomagnification, fish concentrations can be estimated using the higher of values calculated using: (1) surface water concentrations and water-to-fish BCFs, and (2) sediment concentrations and Bechtel Jacobs (1998) BSAFs for benthic invertebrates. The latter calculation essentially assumes that fish concentrations will be equivalent to benthic invertebrate concentrations. Other ERAs we have reviewed have used primary literature sources to develop fish BSAFs for metals. For selenium, a useful reference is Lemly (2002). A more comprehensive literature review may be needed for any metals that may biomagnify (e.g., mercury).

23. For soil-to-plant, soil-to-earthworm, and soil-to-deer mouse BCFs, EPA's preferred source of literature-derived uptake factors is the Eco-SSL guidance document (Attachment 4-1) (USEPA 2007). Section 6.2.1.6 indicates that this source was used, but based on Table 6-3, it appears that it was not used for all constituents (cadmium, copper, and selenium).

24. Based on Table 6-3, NIPSCO used soil-to-earthworm BCFs for boron and molybdenum that are based on the geometric mean of other available metal BCFs. Considering the importance of these two metals at this site and the high site-

specific plant BCF that was calculated for boron (i.e., BCF of 34, from Appendix K and Table 6-3), this uncertainty is cause for concern. A literature search to determine whether any soil-to-earthworm BCFs for these metals are available would have been appropriate. The collection and analysis of tissue samples for terrestrial and benthic invertebrates as well as other potential receptors would have allowed for more site-specific data to be generated. This is a substantial data gap and area of uncertainty.

Page 6-12, Section 6.2.2.2, Habitat Use Factors

25. The application of Seasonal Use Factors (SUFs) for robins, woodcocks, and hawks at this site is not appropriate. An SUF should only be used in cases where the receptor is absent during the breeding season (the most toxicologically sensitive lifestage) and the toxicity studies on which the TRVs are based used exposure durations that are longer than the exposure durations experienced by receptors at the site. All three of these species (and other species within the same guild) occur locally during the breeding season. Also, it is likely that most of the toxicity studies used to derive TRVs employed relatively short exposure durations (i.e., from a few days to a few months). For example, a review of the avian data included in the Eco-SSL dataset for cadmium indicates that none of the 50 test results for reproduction, growth, and survival endpoints was based on exposure durations greater than 3 months. SUFs should have been omitted from the BERA, or an SUF of 1 should have been used for all receptors. Risks have likely been underestimated and this represents an uncertainty.

Page 6-14, Section 6.3.2, Mammalian TRVs

26. This section indicates that allometric scaling was used to derive mammalian TRVs. Refer to Allard et al. (2010) for a recent discussion of methods for interspecies extrapolation of toxicity data and reasons why allometric scaling is no longer recommended. Section 6.3.2, Table 6-9, and affected tables and text sections are not acceptable due to the use of allmostric scaling and represent an area of uncertainty.

Page 6-15, Section 6.3.3.3, Terrestrial and Wetland Plant TRVs

27. It appears that the molybdenum TRVs derived from the McGrath et al. (2010a, as cited in the BERA) study may not be adequately protective of plants in Area C. First, NIPSCO derived TRVs based solely on data from the Zegveld area. The molydbdenum ED10 values (i.e., doses causing 10% inhibition) for the Zegveld area (i.e., 1502 to 3476 mg/kg) are markedly greater than the ED10 values for any of the other nine tested locations (i.e., 3 to 330 mg/kg) (McGrath et al., 2010a). Based on a comparison of soil properties in Table 1 of McGrath et al. (2010b, as cited in the BERA) and those included in Table 3 of the plant toxicity study report (Appendix G) and Tables 4 through 24 of Appendix I, the Zegveld soils do not

appear to be adequately similar to IDNL study area soils to justify the use of the Zegveld data for TRV development. For example, pH in Zegveld soils is 4.4, while pH in the IDNL study area is higher (typically 5 to 7) in all areas except the southern portion of CBS. Also, the organic carbon content in Zegveld soils (30.7%) is greater than organic carbon in IDNL soils, based on data in BERA Appendices G and I. In Table 3 of the plant toxicity study report (Appendix G), total organic matter measurements range from 1.2% to 7.3% in IDNL study area soils. Total organic matter (based on data included in Appendix I) ranges from 7% to 26% for soils in the IDNL study area. Although grain size data are not presented in the BERA for IDNL study area soils, the text in Section 6.3.3.3 indicates that the grain size distribution in IDNL soils is different from Zegveld soils.

Taken together, this information indicates that the Zegveld soils are not similar to IDNL study area soils, and should not be used to derive TRVs in the Area C BERA. Summary statistics for available soil properties parameters (including grain size distribution, pH, organic matter content, and other relevant parameters) for the IDNL study area should have been tabulated by area to facilitate comparisons with soils tested by McGrath et al. and to more rigorously support the selection of a molybdenum TRV for plants.

Also, we do not agree that TRVs should be derived by calculating the geometric mean of ED10 values for the four species tested by McGrath et al. (2010). Considering the paucity of available toxicity data for molybdenum, it appears that very little is known about the relative species sensitivity of plants to molybdenum. When data are only available for such a small number of species (i.e., four species tested by McGrath et al.), it is more appropriate to use the lowest value for all species tested, particularly for use in a protected area like the IDNL study area. To the extent possible, the TRV should be derived using a methodology that attempts to protect all plant species at the IDNL study area and that minimizes the likelihood that risks are underestimated. That does not appear to have been done in the BERA and represents significant uncertainty.

Page 7-1, Section 7.1, Approach to Risk Characterization

28. In general, we advise against the BERA's approach to using reference area data in the risk characterization, in which reference area HQs are calculated using 95% UCL concentrations and compared to HQs in site-related study areas (as described in this section). This approach may not be appropriate if population distributions in site-related study areas are different from distributions in reference areas. To avoid this problem, risks should be characterized based primarily on: (1) site-related study area HQs and (2) a statistical comparison of study area and reference area media concentrations, rather than a direct comparison of study area and reference area HQs. Refer to EPA guidance (USEPA 2002) for detailed recommendations regarding statistical methodologies.

Using this alternative approach, the risk characterization can then discuss risks calculated based on study area HQs, but can qualify these risks by indicating which chemicals are present at concentrations comparable to reference area concentrations and which are present at concentrations exceeding reference area concentrations.

Page 7-3, Section 7.2, Risk Characterization Findings

29. This section states, "For food chain exposure models, because no site-specific tissue samples had been collected, all prey item tissue concentrations were modeled using highly conservative literature based BCFs." However, site-specific plant tissue samples were collected and site-specific soil-to-plant BCFs are derived in Appendix K and summarized in Table 6-3. This section, and other later sections that make similar statements, are inaccurate. Also, text describing the literature-derived BCFs as "highly conservative" is not appropriate (refer to Specific Comment 16).

Page 7-5, Section 7.2.1.2, Risk Characterization of Potential Exposures of Plants

30. The statement that the SWMU14/15 habitat area is on the industrial Facility property and therefore the NOAEL-based HQs may have overestimated the risk is not acceptable. One of the modes of contaminant migration is GW from SWMU 14/15 migrating into the IDNL. According to EPAs Superfund Ecological Risk Assessment Guidance (ERAGs), the National Landmark status of the IDNL and its designation as a National Park means NOAEL-based HQs are acceptable for estimating risks from COCs in this area. ERAGs considers this type of environment as one that merits special protections along the same lines as a T&E species. Provided the hydrologic connection between the source area, SWMU 14/15, and the receptor, IDNL, NOAEL-based HQs are appropriate for purposes of estimating risk.

31. Although HQs exceed one for several metals in SWMU 14/15, this section concludes, "Because of the levels of conservatism used in this BERA (see Section 7.2), the HQ results do not indicate that the SWMU 14/15 Upland Successional Meadow poses any risk to the survival, growth and viability of conservative plant communities." Without additional lines of evidence or further justification, we do not concur with this conclusion. A more appropriate conclusion might be, "The HQ results indicate a potential for risk to plant communities, but the uncertainty associated with these HQs is high." Below is a list of NIPSCO's arguments for this conclusion (in italics) and our responses to these arguments.
    - *EPCs overestimate exposure concentrations over much of the habitat and EPCs are biased toward higher values because the sampling approach was intentionally biased toward areas with greater potential impact.* A spatial approach to risk characterization for plants (e.g., a map delineating

areas with HQs>1) would allow risk managers to better understand the spatial extent of the potential risk.

- *Screening levels are based on no-effects levels and are more conservative than TRVs.* Efroymson et al. (1997, as cited in the BERA) screening levels are developed based on low-effect levels, not no-effect levels. Similarly, Eco-SSLs for plants and invertebrates are typically derived from low-effect levels, maximum acceptable toxicant concentrations, and EC20 values. Statements characterizing all screening levels as no-effect levels are inaccurate throughout the BERA, which frequently cites the conservatism of "NOAEL-based" screening values. Additionally, these screening levels are not necessarily any more conservative than TRVs, and the basis for this statement is unclear. In the absence of any other information, risks should not be dismissed due solely to the fact that they were calculated based on a screening value or a no-effect level. Further, the conceptual site model presents an on-site area of contamination directly up-gradient and in hydrologic communication with the off-site National Park and National Natural Landmark. The National Park Service has expressed an expectation that their land will not be impacted from site-related constituents above background levels in an effort to avoid damages to the Park. As such, conservative screening levels were deliberately selected as an appropriate risk measurement endpoint towards the protection of the National Park. This comment is applicable throughout the risk characterization section of the BERA.
- *Screening levels based on only a few toxicity studies (and characterized as "low confidence screening levels") can be disregarded.* These data are the best available data, and cannot be dismissed in the absence of other data. A screening value based on a small dataset is not necessarily a conservative value; rather, a small dataset could bias a screening value either high or low (depending on the available data). Determining whether the bias is high or low will vary from chemical to chemical, and cannot be determined without a detailed review of the data on which each screening value is based (an effort that may be outside of the scope of the BERA). This comment is applicable throughout the risk characterization section, which dismisses risks multiple times because of low confidence screening values.
- *Boron risks to plants from groundwater (HQ of 26) can be dismissed because the screening level (1 mg/L) is based on "unspecified toxic effects on plants".* Efroymson et al. (1997, as cited in the BERA) also summarized results from another study in which 35-45% decreases in root and leaf weights were observed at a test concentration of 5.4 mg/L. Risks calculated based on this other study's effect level (which should be considered under-protective due to the 35-45% reductions) would still result in an HQ of approximately five. This risk cannot be dismissed, particularly in light of the additional line of evidence provided by the recent study of vegetation (Attached).

Page 7-9, Section 7.2.2.3.2, Plant Toxicity Study Results

32. There are multiple issues with the plant toxicity test and the interpretation of the results. These issues are well articulated in the contractor's comments. Based on all these issues, this line of evidence should not be the primary measurement endpoint used to assess the level of protection of the survival, growth, and viability of conservative plant communities in the IDNL. In addition to the issues articulated in the contractor's comments, the NPS has also reviewed the data and expressed similar concerns with the study and the interpretation of its results. In particular, the NPS notes the lack of natural botanical diversity in areas within or directly adjacent to the most heavily contaminated soils. Those areas are dominated by exotic and invasive species while adjacent habitats maintain a more natural assemblage of plants. In addition, the NPS noted the lower level of plant fitness in restoration plantings within Cowles Bog versus other areas. At this time, the plant toxicity study cannot be used to point to metals as the definitive cause of poor survival and fitness in some of the wetland plants, therefore its overall usefulness is in question.

33. The BERA states, "it is likely that other wetland plants...would have shown better survival and growth rates". EPA had requested that a wetland species of plant be used as part of the plant toxicity study and was met with much resistance for numerous reasons. A compromise was reached to use the red clover, which survived and grew better in both the study and reference areas. However, it is clear that the use of a wetland species would have proved invaluable in this study and would have rendered the results more useful. Overall, the plant toxicity test is not a strong line of evidence and represents uncertainty in this area.

Page 7-12, Section 7.2.2.4.2.2, 2009/2010 Amphibian Survey Results

34. We do not concur with this section's conclusions, particularly the following statement, "The assessment endpoints have been conclusively addressed to demonstrate that BGS- related metals are not impacting amphibians in the IDNL." Refer to comments on Appendix C for rationale. This comment is also applicable to risk characterizations for other IDNL areas.

Page 7-13, Section 7.2.2.4.3, Amphibian Toxicity Study Results

35. This section states, "Toxicity study results are a definitive indication that Northwest Blag Slough sediments pose no BGS-related risk to amphibians in the IDNL." The use of the word "definitive" is inappropriate. Uncertainty associated with the toxicity tests should be acknowledged. Refer to comments on Appendix E. This comment is also applicable to risk characterizations for other IDNL areas.

36. EPA questions the validity of the test results given the statistically significant differences in length and width of the test species exposed to NBS sediment samples as compared to those exposed to the lab control. All of the test species exposed to reference area sediment samples measured statistically significant differences in length and in the case of REF-07, width as well. Because of these issues, EPA does not consider the amphibian toxicity study results reliable and their usefulness as a measurement endpoint is in question. This comment is also applicable to all of the other areas sampled in the study; the CBS, the EW, and Little Lake all reported statistically significant differences in length of the test species exposed to site sediments as compared to those exposed to the lab control, while reporting no differences when compared to the reference areas.

Page 7-15, Section 7.2.2.5, Overall Northwest Blag Slough Risk Conclusion

37. EPA does not agree with the conclusion as stated. This statement is not supported by the available data and is further called into question through the comments provided above.

Page 7-17, Section 7.2.3.3.1, Hazard Quotients for Plants

38. This section omits discussion of plant HQs for selenium in soil. Any HQs greater than one should be noted.

Page 7-19, Section 7.2.3.3.3, Assessment of Barren Soil and Vein Clearing

39. Refer to Appendix I comments regarding conclusions related to the Vein Clearing and Barren Soil Report. Also, this section states that there was "a slight elevation of molybdenum and cadmium in the barren soils relative to reference area rooting zone soil". Based on Figure 9 of Appendix I, these differences should not be characterized as "slight" elevations, as molybdenum concentrations in the barren soils were as much as 50 times greater than concentrations in the reference soils, and cadmium concentrations in the barren soils appear to be about four times greater than concentrations in the reference soils. Finally, the last sentence of this section, "The concentrations of COPECs in soil and groundwater do not pose any BGS-related risk to the survival, growth and viability of conservative plant communities in Central Blag Slough", is not supported by the available data (refer to Appendix I comments).

40. At one point in this discussion, low pH in surface soil was closely linked to the low fertility of the soil and therefore the barren areas in the CBS. However, later in the discussion, a USGS report is cited stating, "that the pH of the soil has increased an order of magnitude...improving growing conditions". In addition, the Vein Clearing and Barren Soil Report, as found in Appendix I, lists two NIPSCO-related historical sources, the formerly unlined surface impoundments, as possible causes for the low soil pH. The issue of pH and the low fertility of the

soil in CBS should have been discussed further. Given these data gaps, the statement that "concentrations of COPECs in soil and groundwater do not pose any BGS-related risk to...plant communities in CBS", is not valid and should be removed. Further, it should be noted, that NIPSCO's 2007 Corrective Measures Proposal concluded, "low pH levels in soil may pose an unacceptable potential risk to plants in localized areas..." Based on the weight of evidence presented, EPA concludes that there is unacceptable risk to plants in the CBS.

Page 7-23, Section 7.2.3.4.4, Conclusion for Risk Characterization of Amphibians

41. EPA does not agree with the conclusion that surface water and sediment in CBS ephemeral pools poses no BGS-related risk to the survival, growth reproductive success and population sustainability of the amphibian community in the IDNL. This statement is not supported by the available data and is further called into question through the comments provided above.

Page 7-24, Section 7.2.3.5, Summary of Central Blag Slough Risk Characterization

42. This section states, "None of the HQs for plants exposed to COPECs in soil or groundwater exceeded 1 for any COPEC." This statement is not accurate, as HQs for aluminum and selenium exceeded 1 (Table L-38).

43. Paragraph 3 states "the naturally low soil pH levels in the greenbelt portion of the CBS may pose risk to terrestrial and wetland plant in this small portion of CBS". There is not enough evidence presented to determine that the low pH levels found in this area of the CBS are "naturally" low. In fact, as mentioned above, the Vein Clearing and Barren Soil Report, as found in Appendix I, lists two NIPSCO-related historical sources as possible causes for the low soil pH. Again, NIPSCO's own 2007 Corrective Measures Proposal states, "The low pH values measured in settling pond surface water in the 1970s (Hardy, 1981) suggest the historic seepage may have contributed acidity to southern Central Blag Slough barren soils."

Page 7-25, Section 7.2.3.5, Overall Central Blag Slough Risk Conclusion

44. EPA does not agree with the overall CBS risk conclusion of no risk to wildlife, invertebrates, plants or amphibians. The evidence provided does not support such a conclusion. NIPSCO's own 2007 report does not support such a conclusion, as it concluded remediation was necessary in CBS to reduce the acidity of soil.

Page 7-30, Section 7.2.4.4.1, Comparison of Surface Water COPEC Concentrations to Amphibian Screening Values

45. Given EPA's above mentioned concerns with the amphibian field survey and amphibian toxicity study, the screening level comparisons of manganese in surface water must be weighted more heavily than other lines of evidence. Therefore, EPA does not agree with the statement that the HQ results do not indicate that surface water from Little Lake poses any risk to the survival, growth, reproduction, and population sustainability of amphibians. The evidence provided, an HQ of 68 for manganese, does not support such a conclusion. This comment applies to Section 7.2.4.4.4 as well.

Page 7-32, Section 7.2.4.4.3, Amphibian Toxicity Study Results

46. Given EPA's above mentioned concerns with the amphibian toxicity study, EPA does not agree with the statement that "toxicity study results are a definitive indication that Little Lake sediment poses no BGS-related risk to amphibians in IDNL".

Page 7-34, Section 7.2.4.5, Overall Little Lake Risk Conclusion

47. EPA does not agree with the conclusion as stated. This statement is not supported by the available data and is further called into question through the comments provided above.

Page 7-45, Section 7.2.5.6, Terrestrial and Wetland Plants

48. EPA does not agree with the plant toxicity testing being weighted more heavily than the other lines of evidence. Given the flaws inherent in the study, primarily the lower survival and growth weights of the plants due to the study not including a wetland species of plant for testing in the wetland soils and the resultant compromised study results, this line of evidence must be weighted less heavily than the others.

Page 7-45, Section 7.2.5.6, Overall Eastern Wetland Risk Conclusion

49. EPA does not agree with the conclusion as stated. This statement is not supported by the available data and is further called into question through the comments provided above.

Page 7-49, Section 7.2.6.5, Overall Southeast Pond Risk Conclusion

50. EPA does not agree with the conclusion as stated. A statement of low risk or acceptable risk would be more accurate than stating there is no risk.

Page 8-1, Section 8.0, Uncertainty Analysis

51. This section presents a very cursory discussion of the uncertainties in this risk assessment, and highlights only areas that may have overestimated risks. A more balanced and detailed discussion would have been appropriate, as number of additional uncertainties have been identified in these comments.

Table 6-4

52. It appears that the food ingestion rates used in Table 6-4 are not conservative estimates. For example, NIPSCO has selected a food ingestion rate for the robin of 0.89 kg diet ww/kg bw-d, but the Wildlife Exposure Factors Handbook (USEPA 1993, as cited in the BERA) lists two food ingestion rates, 0.89 kg diet ww/kg bw-d and 1.52 kg diet ww/kg bw-d. It is unclear why NIPSCO has selected the lower of these two values. Similarly, if an ingestion rate for the robin is calculated based on an allometric equation (from USEPA 1993), the resulting value is considerably greater than the value used by NIPSCO (see Attachment 2). Additionally, the food ingestion rates used for the shrew and the mourning dove are considerably less than the ingestion rates used in the development of the Eco-SSLs (USEPA 2007). The risk to applicable receptors has likely been underestimated and this represents an area of uncertainty.

Tables 6-6 and 6-7

53. Rather than using TRVs for inorganic mercury only, mercury risks to wildlife should be calculated using both inorganic mercury TRVs and a methylmercury TRVs, in order to bracket the range of possible mercury risks. Refer to Attachment 1 for example calculations.

Appendix C, 2010 Amphibian Survey Report for Area C

54. In general, we do not concur with conclusions that the amphibian surveys and toxicity tests have "conclusively addressed [assessment endpoints] to demonstrate that BGS-related metals are not impacting amphibians in IDNL". We consider the amphibian survey to be a very weak line of evidence in this BERA, and little weight should be placed on it in the weight-of-evidence evaluation. This comment discusses reasons why we believe the amphibian surveys are a highly uncertain piece of evidence.

    First, the Survey Report made no attempt to quantify the effectiveness of the sampling effort. The results often include observations of only one individual of a given species in a given wetland, which is an indication that the sampling effort may have been inadequate to capture true species richness (Colwell and Coddington, 1994, as cited in Werner et al., 2007).

Next, consistent with literature on amphibians in a similar metacommunity of ponds and wetlands (e.g., Werner et al., 2007), the results of the amphibian survey indicated that natural variability plays an important role in the dynamics of amphibians at the IDNL. Werner et al. (2007) reported that pond hydroperiod, surface area, and forest canopy cover were the most important variables in determining the presence or absence of a species in each pond/wetland. As noted in the Survey Report, the presence or absence of fish in ponds/wetlands also greatly affects amphibians. This effect can occur not only via predation, as noted in the Survey Report, but also via selection of oviposition sites by adult amphibians (i.e., adults of some species avoid ovipositing in ponds/wetlands with fish).

In the context of this study, these natural variables are confounded factors that will tend to obscure any potential toxicological effects of elevated metals concentrations. NIPSCO has not attempted to control these confounded factors, and it is not surprising that correlations were low between metals concentrations and amphibian metrics using a univariate statistical approach in this multivariate system. Conclusions have been drawn exclusively from these very simplistic regression analyses, which are insufficient to support the conclusion quoted above. Considering our concerns regarding sampling effectiveness and the variability in this dynamic system, it's not clear that conducting a more detailed statistical analysis of these data would produce any more reliable conclusions.

We also note that the analyses provided do indicate possible impacts in the EW, based on Sorensen's Quantitative Index at all EW locations except EW-01. Results for the Shannon Index are similar. These results should not be entirely dismissed based on the results at EW-01, which are different from results in the rest of EW.

It has also been noted the lack of discussion regarding visual observations of frog abnormalities as a potential uncertainty associated with the multiple lines of evidence approach. EPA was present in the field during some survey work and also observed these abnormalities.

Appendix E, Final 2010 Amphibian Toxicity Study Report, Section 4.0, Uncertainties, Pages 19-20

55. A number of important uncertainties have been omitted from this discussion. One of the key uncertainties in the amphibian toxicity study is uncertainty about the relative sensitivity of the test species, *Rana pipiens*, in comparison to other amphibian species at the IDNL. No information about relative species sensitivity has been provided in either Appendix E or Appendix D (2010 Amphibian Toxicity Study Plan). The most useful information that we have found regarding relative species sensitivity of amphibians to metals is a book chapter by Birge et al. (2000), who conducted a series of toxicity tests with numerous chemicals and

amphibian species. As summarized by Birge et al. (2000), amphibian species sensitivity varied by metal. Relative to other amphibian species, *R. pipiens* was tolerant of mercury. For several other metals (e.g., cadmium, copper, selenium), *R. pipiens* was among the more sensitive species, but *R. pipens* LC50 (50% lethal concentration) values were 2-3 times greater than LC50s for some other species (including species present at the IDNL wetlands) (Birge et al., 2000). Considering these indications that other amphibian species may be more sensitive to some COPECs than *R. pipiens*, coupled with the fact that this assessment is of a federally protected area with special status species, this uncertainty is critical for risk assessors and managers to consider.

Another important uncertainty is related to the fact that the test exposure duration was relatively short, and only larvae were exposed. Review of tabulated data in Sparling et al. 2000 (as cited in the BERA) indicates that, for some chemicals, amphibian embryos may be more sensitive than tadpoles. For example, a study that exposed *R. pipiens* tadpoles to mercuric chloride reported an LC50 of 1,000 µg/L, but tests using the same chemical and embryos of the same species reported LC50s of 7.3-10 µg/L (refer to Table 7-6 in Sparling et al. 2000). Note that, in some amphibian species (e.g., leopard frog, spotted salamander), eggs are often deposited on, or sink to, bottom substrates.

Another important uncertainty in the conduct of amphibian toxicity tests is that dietary exposures of metals are not included in the tests.

Additionally, although the uncertainty section notes that sediment sample manipulation and water quality characteristics of the laboratory water used can alter the toxicity of sediments in the tests (in comparison to toxicity that might actually occur in the field), the text does not discuss the direction of these possible impacts. For example, will oxidation of sediments tend to increase or decrease metals bioavailability in the toxicity test? Was the water hardness in the lab water higher than in the site surface waters, thereby decreasing bioavailability in the toxicity tests?

56. The last sentence of this section states, "Laboratory toxicity studies with amphibians yield a highly conservative measure of potential risk". In light of the factors discussed above, it is not clear that these tests are "highly conservative", and appear to represent a significant level of uncertainty.

Appendix G, 2010 Plant Toxicity Study Report

57. We believe that the usefulness of the plant toxicity study is compromised by the poor survival observed in ISBSP-11 and ISBAD-10. As noted in the study report, it does seem clear that some factor(s) other than metals must be a major contributor to the poor survival observed in at least some of the locations. The study report states that the variability in survival and growth responses is likely

related to the test species' ability to adapt to the sandy wetland soils used in the tests. Ultimately, it is impossible to know whether any toxicity may have been observed if a plant species better suited to the site's soils had been used for this particular test (see attached study on IDNL vegetation). All that can be concluded from this study is that metals-related toxic effects could not be differentiated from effects that likely occurred due to soil type. As a result, the report's conclusions, "...there are no BGS-related impacts apparent to IDNL vegetation community", are overstated and fail to reflect the important limitations of this study. See also Specific Comment 65 below regarding analyte concentrations in the tested samples. This is another critical limitation of this study that should have been made transparent in the study conclusions.

58. The Plant Toxicity Study Report does not provide information to allow reviewers to determine whether the tested locations adequately represent the study areas in terms of contaminant concentrations. In general, it is advisable to conduct tests at locations that span the range of concentrations observed in the study areas. We reviewed data presented in Table 3 of the Plant Toxicity Study Report (i.e., measured chemical concentrations in the toxicity test soil samples) and Tables 3-1 and 6-2 of the BERA (i.e., maximum and exposure point concentrations reported for soil in the BERA). The results of this review are concerning, as it appears that none of the samples used in the toxicity tests had contaminant concentrations that were similar to the maximum concentrations or, even more importantly, the EPCs in the study areas. In some cases, the BERA EPCs were more than an order of
59. magnitude greater than the concentrations in the toxicity test samples. Results for a few chemicals in CBS and the EW are listed in the table below for illustration. In addition, comparison of the maximum soil concentrations used in the plant toxicity study with reference area concentrations provided in Table 6-2 of the BERA indicates that many of the maximum analyte concentrations are close to or even below the reference area concentrations (e.g., maximum CBS molybdenum in plant toxicity tests was 2.6 mg/kg; reference area EPC for molybdenum was 2.7 mg/kg).

Area	Analyte	Maximum Concentration in the Plant Toxicity Study Soil Samples (mg/kg)	Maximum Concentration from Table 3-1 of the BERA (mg/kg)	EPC from Table 6-2 of the BERA (mg/kg)
Central Blag Slough	Arsenic	2.6	34	9.9
	Cadmium	1.9	29.3	5.5
	Copper	3.5	63.4	25.4
	Molybdenum	2.6	694	145.2
Eastern Wetland	Arsenic	10.8	200	34.1
	Boron	15.9	253	47.4
	Copper	7.6	63.4	21.5
	Manganese	889	23,600	3,078
	Molybdenum	2.7	804	75.7

The lack of toxicity tests at the upper end of the concentration range detected at the site appears to be a major source of uncertainty in the risk assessment for plants.

60. Table 5 presents and Section 3.6 discusses results of the plant species surveys that were conducted within 20-ft x 20-ft areas immediately surrounding the toxicity study soil sample locations. The analysis of these data is very cursory in the Plant Toxicity Study Report, and the report simply notes that plant species with high coefficients of conservatism were present (or, in some cases, dominant) in study area and reference area locations with low *Lolium* and/or *Trifolium* survival. These plant survey data could be more useful, and may yield different results, if subjected to a more comprehensive analysis. As noted by Charles Morris during the meeting on June 23, 2011, a simple visual inspection of the data in Table 5 does suggest that there may be important differences between study area and reference area locations. For example, the common invasive species Autumn olive (*Elaeagnus umbellata*) was frequently observed in survey plots but was never observed in reference area plots. In addition, for each of the samples in the Reference Areas, CBS and EW, we calculated a mean coefficient of conservatism (Mean C) and a Floristic Quality Index (FQI) using equations and coefficients from Rothrock (2004, as cited in the BERA). Mean C results are tabulated below; FQI results were similar to Mean C results and are not tabulated here. We calculated values for the CBS and EW samples because metals concentrations are highest in these two areas.

Reference Areas		**Central Blag Slough**		**Eastern Wetland**	
Sample Number	Mean C	Sample Number	Mean C	Sample Number	Mean C
ISBAD-08	3.5	AOC10-SB03	2.8	AOC9-SB04	0
ISBAD-010	3.6	IDNL-SD05	1.9	IDNL-SD15	1.7
ISBSP-11	3.3	IDNL-SD09	3.0	IDNL-SO13	1.8

Clearly, based on the limited dataset that is available, the above table shows that Mean C values in the Reference Areas tend to be higher than values in CBS and, particularly, EW. These results indicate that important differences in the plant communities may exist between the CBS and EW communities and those in reference areas, and it is not appropriate to conclude that no effects are occurring at this time. Also, Table 5 presents only presence/absence data from the surveys, but it appears that data regarding the relative abundances of each species within each plot are also available. These data should have been presented in Table 5. Finally, note that the concerns regarding the limited concentration range in the tested sample locations are also applicable to these plant survey data. Any conclusions drawn from these data must be qualified by the fact that sampled locations had relatively low concentrations of metals in comparison to the soil EPCs used in the ERA.

61. It would be useful if Tables 1 and 2 included some measure of the variability around the mean (e.g., standard deviation or standard error) for each of the endpoints to give reviewers some indication of the variability among replicates for each sample. Based on a cursory review of Appendix D, it appears that variability among replicates for any given sample was often quite high. This information should have been discussed more specifically in the uncertainty section, which included a paragraph about precision.

Appendix I, Vein Clearing and Barren Soil Report

62. This report concludes that barren areas in the southern portion of CBS are linked to low pH. Although not stated in the conclusions section, the report also describes two NIPSCO-related historical sources that may have caused the low pH. The report also concludes that metals concentrations in soils and plants are not good predictors of vein clearing. However, cadmium and molybdenum are elevated in barren soil rooting zones compared with reference area soils, and slight elevations of the same metals were found in soils of vein clearing vegetation compared with non-vein clearing vegetation collected from CBS. The report conclusions are not clear regarding the possible linkage of vein clearing to low pH and the possible linkage of metals concentrations to barren soil areas. In addition, the report does not attempt to explore the possible effect of low pH on metals availability as a cause, or contributing cause, of barren soil and/or vein clearing. This interaction may be important and could have been appropriately explored through multivariate statistical analyses.

    In general, the presentation of the data makes it difficult to evaluate possible relationships between metals/pH and barren soil/vein clearing. It would have been very useful to present box-and-whisker plots for some of the key metals and pH. For example, a series of box-and-whisker plots (e.g., showing median, 5th percentile, 25th percentile, 75th percentile, 95th percentile values) could be presented on a single page for molybdenum, including one box-and-whisker plot for concentrations in each of the following media: barren soil, vein clearing soil, reference area soil, vein clearing dewberry tissue, non-vein clearing dewberry tissue, reference area dewberry tissue, and so on for other plants.

63. This report concludes that areas of barren soil and vein clearing comprise 1-2% of the total area in CBS, and that this area is sufficiently small to assume that population-level risks to plants are acceptable. The data and analyses included in this report do not adequately support this conclusion. It is important to recognize that barren soil is a very severe effect (i.e., 100% mortality of all plant species). If severe effects are present in small areas, one must also be concerned that less severe, unmeasured effects (e.g., reduced density, changes in species composition) may be occurring over larger areas. Results from the 2010 plant survey (Appendix G) are suggestive that species composition may also be

affected (see Specific Comment 66). Conclusions should be reconsidered in light of these important points.

Appendix L, Hazard Quotient Calculation Tables

64. We were generally unable to replicate and verify hazard quotient calculations because Appendix L tables are inadequately annotated to facilitate verification. Refer to Attachments 1 and 2 for examples of how risk calculations can be presented to allow reviewers to verify calculations. Also note that in these attachments, there is very little need for wet weight/dry weight conversions because ingestion rates (from USEPA 1993, as cited in the BERA) are given on a dry weight basis and literature-derived bioaccumulation factors are typically given on a dry weight basis.

65. Based on review of Table L-26, amphibian exposures have been calculated by multiplying surface water exposure concentrations by a Water Use Factor (WUF) of 0.25. This methodology is not technically sound. The TRVs used in the HQ calculations are derived based on short-term (i.e., typically 10 days or less) toxicity studies in which amphibian embryos or tadpoles are exposed to water. A WUF would only be needed if amphibians at the site are normally exposed to water for less time than the amphibians exposed in the toxicity tests used to derive the TRVs. Clearly, with test exposure durations of 10 days or less, that is not the case here. Additionally, all of the wetlands and ponds evaluated in this BERA hold water (in at least some years) for sufficient time for amphibians to complete their larval development. Consequently, risks calculated based on measured surface water concentrations (without the application of a WUF) accurately represent risks in years that are hydrologically favorable to amphibians. It might be appropriate to note that risks due to toxics will be lower in years that are unfavorable hydrologically, but it is not appropriate to apply a WUF that would result in underestimated risks in the wetter years.

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ATTACHMENT 1

Virignia Rail: Risk Calculations for Selected Analytes and Areas

Food Ingestion Rate (FIR)	0.00817	kg/day (dry wt)
Proportion Sediment in Diet	0.18	Based on data for western sandpiper (USEPA 1993, as cited in the BERA)
Sediment Ingestion Rate (SIR)	0.00147	kg/day (dry wt)
Dietary Composition	100%	Benthic Invertebrates
Body Weight (BW)	0.049	kg (wet wt) from Cornell Lab of Ornithology, www.allaboutbirds.org, accessed October 7, 2011
Area Use Factor	1	

Analyte	Sediment EPC[1] (mg/kg)	BSAF[2]	Benthic Invertebrate Prey Concentration (mg/kg dw)	Sediment Dose (mg/kg-d)	Prey Dose (mg/kg-d)	Total Dose (mg/kg-d)	Toxicity Reference Value[3] (mg/kg-d)	Hazard Quotient[4]
<u>Central Blag Slough</u>								
Cadmium	24.59	3.073	75.6	0.738	12.6	13.3	1.47	**9.1**
Chromium	19.42	0.468	9.09	0.583	1.52	2.10	2.66	0.79
Molybdenum	42.59	NA	NA	1.28	NA	NA	3.5	0.37
<u>Eastern Wetland</u>								
Arsenic	47.14	0.675	31.8	1.41	5.31	6.72	2.24	**3.0**
Boron	28.65	NA	NA	0.860	NA	NA	28.8	0.03
Chromium	20.98	0.468	9.82	0.630	1.64	2.27	2.66	0.85
Molybdenum	139.4	NA	NA	4.18	NA	NA	3.5	**1.2**
Selenium	4.304	2.5	10.76	0.129	1.79	1.923	0.29	**6.6**
<u>Northwest Blag Slough</u>								
Chromium	31.75	0.468	14.86	0.953	2.48	3.43	2.66	**1.3**
Mercury (using MeHg TRV)	0.658	2.868	1.89	0.0197	0.315	0.334	0.0064	**52**
Mercury (using inorganic Hg TRV)	0.658	2.868	1.89	0.0197	0.315	0.334	0.45	0.74
Molybdenum	73.64	NA	NA	2.21	NA	NA	3.5	0.63

[1] Sediment EPCs are from Table 6-2 of the BERA.

[2] Biota-to-Sediment Accumulation Factors (BSAFs) for cadmium, arsenic, chromium, and mercury are 90th percentile values from Bechtel Jacobs (1998). The BSAF for selenium is from Lemly (2002). All BSAF units are mg/kg dw tissue / mg/kg sediment. BSAFs for boron and molybdenum were not available from standard sources and prey doses were not calculated.

[3] TRVs are from Table 6-6 of the BERA. The methylmercury (MeHg) TRV is from Sample et al. (1996, as cited in the BERA) and is included to bracket the range of mercury risk.

[4] HQs for boron and molybdenum are based on incidental sediment ingestion only. HQs for these metals in the revised BERA should incorporate prey doses, which should be calculated based on measured, site-specific benthic invertebrate tissue residue concentrations (preferably) or BSAFs developed from a comprehensive literature review.

<u>Equations:</u>

FIR (kg/day dw) = $0.0582*(BW)^{0.651}$ (from EPA 1993, as cited in the BERA)

ATTACHMENT 1

Virignia Rail: Risk Calculations for Selected Analytes and Areas

SIR (kg/d dw) = FIR (kg/d dw) * Proportion soil in diet

Benthic Invertebrate Prey Concentration (mg/kg dw) = Sediment EPC (mg/kg) * BSAF

Sediment Dose (mg/kg-d) = [Sediment EPC (mg/kg) * SIR (kg-d dw) * AUF]/BW (kg ww)

Prey Dose = [Prey Concentration (mg/kg dw) * FIR (kg/d dw) * AUF]/BW (kg ww)

Total Dose = Sediment Dose + Prey Dose

HQ = Total Dose/TRV

ATTACHMENT 2

American Robin: Risk Calculations for Selected Analytes and Areas

Food Ingestion Rate (FIR)[1]	0.01668 kg dw/day	[FIR (g dw/day) = 0.398*(BW)$^{0.850}$ (from USEPA 1993 as cited in the BERA), converted to kg/day by dividing by 1,000]
Proportion Soil in Diet	0.104	From BERA Table 6-4
Dietary Composition	49%	Plants
	51%	Invertebrates
Soil Ingestion Rate (SIR)	0.00173 kg dw/day	[SIR (kg/d dw) = FIR (kg/d dw) * Proportion soil in diet]
Plant Ingestion Rate (IR_p)	0.00817 kg dw/day	[IR_p = FIR * 0.49]
Invertebrate Ingestion Rate (IR_i)	0.00850 kg dw/day	[IR_p = FIR * 0.51]
Body Weight (BW)	0.081 kg (ww)	from BERA Table 6-4
Area Use Factor	1	

Analyte	C_{soil} (mg/kg)	Soil-to-Plant BCF (dry wt basis)	C_{plant} (mg/kg dw)[2]	Soil-to-Earthworm BCF or Equation (dry wt basis)[3]	$C_{earthworm}$ (mg/kg dw)	Soil Dose (mg/kg-d)	Plant Dose (mg/kg-d)	Earthworm Dose (mg/kg-d)	Total Dose (mg/kg-d)	TRV (mg/kg-d)	HQ
	From Table 6-2	Site-Specific BCFs from Table 6-3	= C_{soil} * Soil-to-Plant BCF	From Eco-SSLs and Table 6-3	Based on equations in Soil-to-Earthworm BCF column	=(SIR*Soil EPC*AUF) /BW	=(IR_p*C_{soil} *AUF)/BW	=(IR_e*C_{soil} *AUF)/BW	=Soil Dose + Plant Dose + Earthworm Dose	From Table 6-6	=Total Dose /TRV
Eastern Wetland											
Arsenic	34.11	0.056	1.9	ln(Ce) = 0.706*ln(Cs)-1.421	2.92	0.730	0.193	0.306	1.23	2.24	0.5
Boron	47.4	34	1612	Ce = Cs * 0.144	6.83	1.01	163	0.717	164	28.8	**5.7**
Cadmium	1.055	6.0	6.33	ln(Ce) = 0.795*ln(Cs)+2.114	8.64	0.0226	0.639	0.907	1.57	0.290	**5.4**
Chromium	26.16	0.048	1.26	Ce = Cs * 0.306	8.00	0.560	0.127	0.841	1.53	2.66	0.6
Manganese	3078	0.96	2955	ln(Ce) = 0.682*ln(Cs)-0.809	106.6	65.9	298	11.2	375	179	**2.1**
Molybdenum	75.69	0.094	7.11	Ce = Cs * 0.144	10.9	1.62	0.718	1.14	3.48	3.50	**1.0**
Selenium	2.334	0.67	1.56	ln(Ce) = 0.733*ln(Cs)-0.075	1.73	0.0500	0.158	0.181	0.389	0.290	**1.3**
SWMU 14/15											
Arsenic	97.87	0.056	5.48	ln(Ce) = 0.706*ln(Cs)-1.421	6.14	2.10	0.553	0.645	3.29	2.24	**1.5**
Boron	87.67	34	2981	Ce = Cs * 0.144	12.6	1.88	301	1.33	304	28.8	**11**
Cadmium	2.985	6.0	17.9	ln(Ce) = 0.795*ln(Cs)+2.114	19.8	0.0639	1.81	2.07	3.94	0.290	**14**

[1] Note that this value was derived differently from, and is considerably greater than, the Total Dietary Intake of 0.138 kg diet dw/kg bw-d that was used in the BERA. The FIR given here, when divided by the robin's body weight, gives a dietary intake of 0.206 kg diet dw/kg bw-d).

[2] Literature-derived soil-to-plant BCFs were used for SWMU 14/15 in the BERA, but we used site-specific BCFs here to determine the impacts of this possible change on hazard quotients.

[3] BCFs from EPA's Eco-SSL guidance (Attachment 4-1) were used in preference to other literature-derived BCFs. For chemicals lacking Eco-SSL BCFs (i.e., boron, molybdenum), the values from BERA Table 6-3 were used, adjusted to dry weight basis (i.e., dry wt BCF = wet wt BCF / proportion solids = 0.023/0.16). In the revised BERA, site-specific measured earthworm concentrations should be used for molybdenum and boron, or a literature search should be conducted for earthworm BCFs for these metals.

ATTACHMENT 3

Central Blag Slough: Comparison of Soil-to-Plant Bioconcentration Factors (BCFs) and Plant Concentrations Determined Via Varying Methods

Table 1. Comparison of Soil-to-Plant BCFs (all units in [mg/kg plant dw] / [mg/kg soil])

Analyte	Eco-SSL BCF Equations[1]	Calculated Eco-SSL BCFs[2]	Literature-Derived BCFs Used by NIPSCO (from BERA Table 6-3)	Site-Specific BCFs (from BERA Table 6-3)
Aluminum	NA	NA	0.0040	0.036
Arsenic	Cp = 0.03752 * Cs	0.03752	0.038	0.056
Barium	Cp = 0.156 * Cs	0.156	0.16	0.79
Boron	NA	NA	4.0	34
Cadmium	ln(Cp) = 0.546 * ln(Cs) - 0.475	0.286	0.59	6.0
Chromium	Cp = 0.041 * Cs	0.041	0.041	0.048
Copper	ln(Cp) = 0.394 * ln(Cs) + 0.668	0.274	0.12	0.36
Lead	ln(Cp) = 0.561 * ln(Cs) - 1.328	0.0411	0.039	0.018
Manganese	Cp = 0.079 * Cs	0.079	0.079	0.96
Mercury	NA	NA	0.90	0.43
Molybdenum	NA	NA	0.25	0.094
Selenium	ln(Cp) = 1.104 * ln(Cs) - 0.677	0.532	0.67	NA

[1] From USEPA. 2007. Guidance for Developing Ecological Soil Screening Levels. Attachment 4-1: Exposure Factors and Bioaccumulation Models for Derivation of Wildlife Eco-SSLs. OSWER Directive 9285.7-55. Office of Solid Waste and Emergency Response, Washington, D.C. Revised April 2007.

[2] For BCF values that are dependent on soil concentrations, plant concentrations (Cp) were calculated first as described in the footnotes to Table 2 below. The BCFs were then calculated as BCF = Cp/Cs based on the soil concentrations (Cs) and plant concentrations (Cp) listed in Table 2 below.

ATTACHMENT 3

Central Blag Slough: Comparison of Soil-to-Plant Bioconcentration Factors (BCFs) and Plant Concentrations Determined Via Varying Methods

Table 2. Comparison of Plant Concentrations[1] (all units in mg/kg dw)

Analyte	Soil Concentration[2]	Estimated Plant Concentrations Using Site-Specific BCFs	Estimated Plant Concentrations Using Eco-SSL BCFs[3]	Estimated Plant Concentrations Using NIPSCO's Literature-Derived BCFs	Estimated Plant Concentrations[4] (from BERA Table L-32)
Aluminum	3652	131	NA	14.6	18.42
Arsenic	9.897	0.554	0.371	0.376	0.097
Barium	NA	NA	NA	NA	NA
Boron	4.333	147	NA	17.3	9.85
Cadmium	5.534	33.2	1.58	3.27	2.34
Chromium	24.89	1.19	1.02	1.02	0.25
Copper	25.44	9.16	6.98	3.05	1.26
Lead	69.62	1.25	2.86	2.72	0.23
Manganese	286.4	275	22.6	22.6	54.13
Mercury	0.0659	0.0283	NA	0.05931	0.0043
Molybdenum	145.2	13.6	NA	36.3	1.70
Selenium	1.551	NA	0.825	1.04	0.11

[1] Except where oterwise noted, plant concentrations are calculated as Cp = Cs * BCF (using the applicable BCF from Table 1 above), where Cs = soil concentrations listed in this table.

[2] Soil concentrations listed here are the exposure point concentrations for Central Blag Slough, from Table 6-2 of the BERA.

[3] For cadmium, copper, lead and selenium, plant concentrations (Cp) were calculated according to the logarithmic equations given in Table 1 and using the soil concentrations (Cs) listed in Table 2.

[4] These concentrations were copied directly from Table L-32 of the BERA; it is unclear how these concentrations were calculated.

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March 15, 2013

Attached to EPA Area C BERA Comments

SUBJECT: United States Environmental Protection Agency (EPA) review of the August 2011 Report: Potential Impact of Fly-ash Groundwater Contamination on Vegetation of Cowles Bog, Indiana Dunes National Lakeshore (Report), prepared by Taylor University.

This Report documents the results of a preliminary two-fold research study conducted during the 2010-growing season on the effects of fly ash on the vegetation in the Cowles Bog area of the Cowles Bog Wetland Community Complex. Over the growing season, 34 observation sites were each visited three times to look for visible symptoms of heavy metal and nutrient toxicity in the wetland vegetation of Cowles Bog. Concurrently, a greenhouse experiment was conducted to determine the effects of varying concentrations of aluminum (Al), boron, (B), and molybdenum (Mo) on three wetland plant species. These three elements are commonly found in fly ash in elevated concentrations and have been found in elevated concentrations in the soils and groundwater of the study area.

The Report details symptoms of heavy metal and nutrient toxicity as including necrosis and marginal chlorosis in leaves from elevated Al, leaf tip and edge burn, necrotic spots in the leaf blade, and premature leaf drop and death from elevated B, and leaf malformations, golden-yellow discoloration of shoot tissue and inhibition of root and shoot growth from elevated Mo. Over the course of the study, the most frequently observed symptom in the plume area was leaf blade necrosis. However, symptoms of incomplete flowering, leaf tip burn and necrosis, necrotic spotting, chlorosis of the leaf blade and veins, marginal leaf curl, and purpling of the stem were observed in both the field observations and greenhouse experiments. In addition, qualitative inhibition of root growth was observed in all three plant species under all three nutrients.

The 2011 BERA, which was previously reviewed by EPA, had multiple lines of evidence pointing to uncertainties associated with the potential adverse risks to plants in the same study areas; Area C. In particular, the presence of barren soil was linked to low pH and elevated metals concentrations. For example, Mo concentrations in the barren soils were as much as 50 times greater than concentrations in the reference soils. In addition, important differences were apparent between the assemblages of plants in the impacted areas versus the reference areas. For example, the Mean C values for the Central Blag Slough and Eastern Wetland areas were lower than those in the reference areas. More specifically, more invasive species were found in the BERA survey plots than in the reference areas. Similarly, this Report documents a virtual *Typha latifolia* (cattail) monoculture in some areas of Cowles Bog. This fact coupled with the knowledge that the invasive cattail is inherently tolerant to elevated levels of heavy metals, such as B and Mo, points to this Report as yet another line of evidence suggesting that risks to plants in these areas are unacceptable and that negative impacts may be occurring. More specifically, it suggests that the elevated metal concentrations are impacting the plant community composition, leading to more invasive, pollution tolerant species at the site-related areas, as compared to reference areas.

In addition, EPA had several concerns with the plant toxicity study submitted as part of the BERA. One issue surrounded the lack of a wetland plant being included in the study and the possible implications that had on the non–wetland plants ability to perform in the study; i.e. non-wetland plants ability to grow in wetland soils. In addition, it was unclear whether the tested locations adequately spanned the range of concentrations observed at the site. In fact, it appeared that none of the samples used in the BERA toxicity tests had contaminant concentrations that were similar to the maximum concentrations or exposure point concentrations found in the study areas. In contrast, the Report subjected wetland species of plants to varying concentrations of contaminants. The maximum concentrations of B, 79 mg/L and Mo, 7.5 mg/L, applied in the Report study are substantially lower than the maximum concentrations of B, 253 mg/L and Mo, 804 mg/L, found in the Eastern Wetland as part of the BERA. Even with these lower contaminant concentrations, the Report found that B toxicity was uniformly expressed both in qualitative as well as quantitative measures of plant response across the range of concentrations. Mo and Al also exhibited toxicity qualitatively, but were less uniform across the range of concentrations and quantitative measures. Given these substantial negative effects were observed on plants more representative of those found at the site and given those plants were exposed to contaminant concentrations much lower than those observed at the site, this Report again suggests more negative effects are occurring at the site than are proposed in the BERA study.

Overall, this Report and its conclusions add to the already abundance of uncertainty associated with the potential ecological risks in Area C. Furthermore, it adds to the already numerous lines of evidence suggesting that risks that are unacceptable and negative impacts to ecological receptors may be occurring.

REPORT: Potential Impact of Fly-ash Groundwater Contamination on Vegetation of Cowles Bog, Indiana Dunes National Lakeshore.

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August 2011

ON THE COVER

Clockwise from top left: *Iris virginica* var. *shrevei* Cowles Bog site 5 (7/26/2010) with necrotic spotting, margin and tip burn on the leaves; *Asclepias incarnata* Cowles Bog site 5 (8/22/2010) with severe purpling of the leaf, necrotic spotting and margin burn; *Cephalanthus occidentalis* Blag Slough site 34 (8/22/2010) with pronounced chlorotic splotching; *Carex sp.* Cowles Bog site 3 (8/22/2010) with yellowing and necrotic spotting in all areas of the leaves.

CONTENTS:

INTRODUCTION:

Fly ash is a specific concern in the Cowles Bog Wetland Community Complex (CBWC) due to its composition, which includes silica oxides, aluminum, iron, and calcium along with trace elements such as boron and molybdenum (Wilcox and Hardy, 1988; Theis et al. 1978). The research in this report focuses on the potential effects that fly ash waste discharges from the Bailly Electrical Generating Station coal-fired power plant are having on the wetland vegetation of the CWBC. The Bailly power plant came online in 1963 and deposited its fly ash waste into drying ponds, which are separated from Blag Slough in the southwest of the CBWC by a sand dike. The drying ponds were left unsealed until 1980, at which time the direct flow of fly ash into the CBWC was halted (Pavlovic, 2009).

The CBWC is a mixture of various wetland and peatland communities, which occupy approximately 80-ha of the basin between the Calumet and Tolleston dunes on the southern shore of Lake Michigan in Porter County, Indiana (Reshkin, 1981). Eight vegetative communities have been identified within the CBWC, which are: a black oak (*Quercus velutina*) woodland; red maple (*Acer rubrum*) swamp; cattail (*Typha*) marsh; *Carex/Calamagrostis* marsh, a *Thuja occidentalis* swamp; (Tamarack) *Larix laricina* swamp; *Phragmities/Typha* marsh, and a shrub swamp (Wilcox et al. 1986).

Cowles Bog, the area of primary concern, is an approximately 22-ha fen located within the CWBC and has its water source of highly mineralized, artesian flow of ground water (Wilcox et al. 1986). According to recent testing, the southwest corner, due to its proximity to the Bailly Electrical Generating Station coal-fired power plant and the sand dike that separates the fly ash drying ponds from Cowles Bog, is considered a plume area where elevated levels of aluminum, boron, and molybdenum have been detected.

Preliminary two-fold research was undertaken to determine whether there is sufficient evidence to warrant further investigation of the effects of fly ash on the vegetation in the CBWC.

The first part of the study was conducted during the 2010-growing season. Over the growing season 34 observation sites were each visited three times to look for visible symptoms of heavy metal and nutrient toxicity in the wetland vegetation of Cowles Bog. Concurrently, a greenhouse experiment was conducted to determine the effects of varying concentrations of aluminum, boron, and molybdenum, which are elements commonly present in fly ash waste in elevated concentrations, on three native wetland species *Asclepias incarnata*, *Carex aquatilis*, and *Iris virginica*.

SITE HISTORY:

In 1963, Northern Indiana Public Service Company (NIPSCO) brought online a coal-fired power plant southwest of Cowles Bog to provide electricity to a steel mill being constructed by Bethlehem Steel Corporation (Pavlovic et al. 2009). Electrostatic precipitators, scrubbers, are routinely placed in smokestacks to collect fly ash from the gas stream to prevent much of the fly ash from entering the atmosphere (Wilcox and Hardy, 1988; Theis et al. 1978). The resulting fly ash waste, however, is mixed with water to form slurry that is then piped into settling ponds to dry out before being hauled away (Wilcox and Hardy, 1988).

From 1963 to 1978, the fly ash ponds were left unsealed and leachate from these ponds seeped into Blag Slough, a wet meadow immediately west of Cowles Bog and closest to the Bailly Electrical Generating Station fly ash ponds, through the sand dike at a rate of about 7.5 million liters per day (1.97 million gallons/day for ~ 17 years) until the ponds were completely sealed in 1980 (Pavlovic et al. 2009). Throughout the mid-70s studies were conducted on the hydrology, topography, stratigraphy, and water chemistry of CBWC. A hydrologic study by Meyer and Tucci (1978) provided evidence that ground water seepage from the fly ash pond was responsible for the regular flooding of Blag Slough. This seepage increased levels of calcium, potassium, sulfate, aluminum, boron, iron, magnesium, molybdenum, nickel, strontium, and zinc in ground- and surface water down gradient from the settling ponds (reviewed by Wilcox and Hardy, 1984).

A 1986 study examined the implications of seepage from fly ash settling ponds. This study concluded the seepage raised the water levels in the wetlands of the CBWC and posed a threat of contamination from chemical constituents that leached from the fly ash (Wilcox et al. 1986). A 2009 study examined the water and soil chemistry of Blag Slough for locations of toxicities, the implications these toxicities have had on the vegetative community development over time, and concluded that natural revegetation has taken place in the 23 year period of the investigation as pH levels have increased. However, areas with elevated heavy metal concentrations remain unvegetated and areas with elevated Al and B concentrations in the soil have vegetation suggesting phytotoxicity with symptoms of vein clearing and chlorosis (Pavlovic et al. 2009).

PART 1 – FIELD OBSERVATIONS:

2010 Field Observation Methods

Prior to beginning field observations, a literature search was conducted to determine commonly reported symptoms of aluminum, boron, and molybdenum. One prevalent symptom of heavy metal toxicity is the inhibition of root growth (Wong and Bradshaw, 1982), which can damage the root system and limit nutrient and water uptake into the plant (Gregory, 2009; Poozesh et al. 2007; Zhang et al. 2007). Observing this symptom was not practical for this field study; however, it was a focus of the greenhouse experiment (part 2). Aluminum toxicity symptoms include necrosis and marginal chlorosis in leaves (Roy et al. 1988), boron toxicity symptoms include leaf tip and edge burn (Brown and Hu, 1998), necrotic spots in the leaf blade (Sotiropoulos et al. 2002), and premature leaf drop and death (Goldberg, 1993), and molybdenum toxicity symptoms include leaf burning, and yellowing of the leaves (Gupta and Gupta, 1998) and an inhibition of root/shoot growth (Kevresan et al. 2001).

ARC View/GIS version 9.3 (ESRI) was used to apply a grid of 30-meter squares over a 2005 aerial image (Indiana Spatial Data Portal) of each wetland to be visited. In Cowles Bog, the area of interest was limited to the southwestern margin, extending from the upland transition to a distance of 60 m into the wetland. Each intersection on the grid was numbered and 30 observation sites, all of which were randomly chosen with a random number generator (random.org). Four targeted sites were chosen in addition to the 30 random observation sites.

In Cowles Bog there were a total of 19 observation sites, including all four targeted sites. Two targeted sites were in the southwest corner of Cowles Bog in the plume area of concern. An additional two targeted sites were in the northeast corner of Cowles Bog, distant from potential contamination but of similar habitat. The 15 observation sites that remained were located outside of Cowles Bog. Three observation sites were in Blag Slough, seven observation sites were in the wetland between Cowles Bog and Blag Slough, one observation site was in the small wetland west of Cowles Bog, one observation site was in the small wetland to the north of Cowles Bog, and the final three observation sites were in the larger wetland, still further north. These final four observation sites along with the targeted sites from the northeast corner of Cowles Bog were used as control sites because of their distance and disconnectedness from the plume area (Figure1) (Appendix A).

ARC/GIS was used to determine the approximate latitude and longitude for the 34 observation sites. The first of three visits was made on June 16, 2010 and a GPS unit was used to locate each proposed observation site. When a site was located it was flagged for precise relocation. The lat/long location was used as the center of the site and dominant vegetation was noted. Depending on the position of an individual observation site, a radius of approximately five meters was surveyed for visible symptoms of toxicity and documented photographically, if recognized. All attempts were made to locate each randomly chosen observation site. However, a site was discarded if the observation site was located entirely in open water or in an upland position, in these instances the next randomly generated site was used.

Field Results and Discussion

Symptoms of aluminum toxicity include necrosis and marginal chlorosis in leaves (Roy, 1988); boron toxicity symptoms include leaf tip and edge burn (Brown and Hu, 1998), necrotic spots in the leaf blade (Sotiropoulos et al. 2002), and premature leaf drop

Figure 1. Observation Site Map in the Cowles Bog Wetland Community Complex

and death (Goldberg, 1993); and molybdenum toxicity symptoms include leaf malformation, golden-yellow discoloration of shoot tissue, and inhibition root and shoot growth (Hamlin, 2007; Marschner, 1995). However, there are two potential problems with regard to recognizing symptoms of toxicity *in situ*. The first problem is that any natural environment, but arguably wetland ones in particular, will exert stresses on resident plant species. As a result, even vegetation in sites with maximum biotic integrity can often exhibit at least limited leaf necrosis, chlorosis, or misshapen structures. Additionally, root inhibition is a symptom that is impractical to observe in the field. The second problem is that many plant species exhibit similar visible symptoms to multiple problems and determining if the symptom being seen is, for example, a symptom of aluminum toxicity or a symptom of calcium, phosphorous, or iron deficiency, becomes less clear. The symptoms being witnessed may be the result of a nutrient deficiency, a nutrient toxicity, or the result of other naturally occurring stressors.

With the above limitations in mind, some observed symptoms could readily be eliminated by noting that they occurred in the same species in sites both near to and far from the plume area. For example, leaf burn and necrosis in *Symplocarpus foetidus*, was seen at site 14 (near to plume area) and site 18(far from plume area) (Figures 2 & 3), *Ilex verticillata* at site 14 and site 18 (Figures 4 & 5), and *Cephalanthus occidentalis* at site 16 (near) and site 19 (far)(Figures 6 & 7). These symptoms obviously were equivocal and were discarded. However, if a symptom was observed in the plume area, without being observed in the same plant species at one of the six control sites (sites 18-23), it was assumed to be a potential symptom of toxicity.

The most frequently observed symptom in the plume area was leaf blade necrosis. At observation sites 3, 5, 6, 7, 8, and 9, which were in the plume area of Cowles Bog, necrosis was present in a variety of species. At site 5 *Scirpus pungens* (Figure 8), *Iris virginica* (Figure 9), *Epilobium coloratum* (Figure 10), *Asclepias incarnata* (Figures 11 & 12), and *Verbena hastata* (Figures 13 & 14) were recognized as exhibiting necrotic spotting, chlorosis, and leaf burn. At site 3 *Schoenoplectus tabernaemontani* (Figure 15), *Sagittaria latifolia* (Figure 16), *Alisma subcordatum* (Figure 17), *A. incarnata* (Figure 18), and *Pontederia cordata* (Figure 19), at site 6 *Rumex* sp. (Figure 20) and *Persicaria* sp. (Figure 21), at site 7 *Scirpus cyperinus* (Figure 22) and *Eupatorium perfoliatum* (Figure 23), at site 8 *Sparganium eurycarpum* (Figure 24) and at site 9 *S. tabernaemontani* (Figure 25) were observed as having symptoms of toxicity. Over the course of the three visits necrosis was persistent but did not appear, in any individual plant, to worsen over time. Outside of Cowles Bog, sites 32-34 in Blag Slough displayed a splotchy leaf chlorosis on *Cephalanthus occidentalis* (see the cover of this Report) and to a more limited extent *Lycopus sp.* and *Pilea pumila.* Although sites 25-28 are proximal to the plume area, apparent toxicity symptoms were not observed. These sites are dominated by *Phragmites australis*, a clonal invasive species. This species, as well as another clonal invasive species, *Typha latifolia*, exhibits a remarkable capacity to tolerate heavy metal contamination (Ye et al. 1997a, 1997b). This capacity may explain the lack of visible symptoms at sites 25-28.

In summary, over the three visits made during the 2010-growing season to the CBWC evidence of potential heavy metal contamination in the vegetation was observed, especially in the southwest corner of Cowles Bog. The greenhouse experiment (part 2 of this report) showed that elevated levels of aluminum, boron, and molybdenum, similar to those observed at CBWC, have significant, deleterious effects on the growth of three native wetland species *A. incarnata, C. aquatilis,* and *I. virginica*. Furthermore, the symptoms witnessed in the greenhouse were frequently witnessed in the plume area vegetation. Additional study of the vegetation of the CWBC, including whether plant tissues are accumulating elevated levels of aluminum, boron, and/or molybdenum, is warranted.

Figure 2.—*S. foetidus* (Site 13, near plume)

Figure 3.—*S. foetidus* (Site 18, far from plume)

Figure 4.—*I. verticillata* (Site 14, near plume)

Figure 5.—*I. verticillata* (Site 18, far from plume)

Figure 6.—*C. occidentalis* (Site 16, near plume)

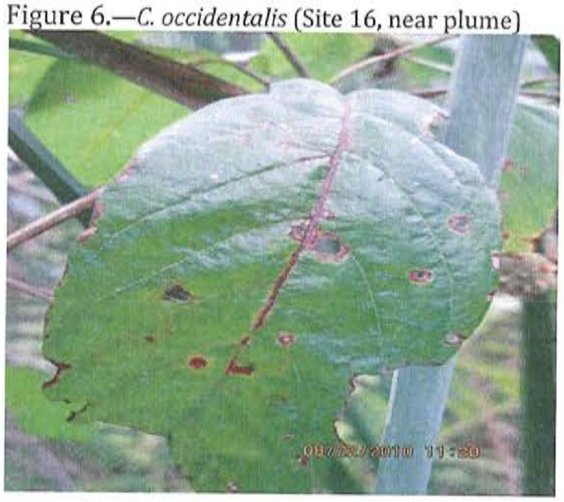


Figure 7.—*C. occidentalis* (Site 19, far from plume)

Figure 8.—*S. pungens* (Site 5)

Figure 9.—*I. virginica* (Site 5)

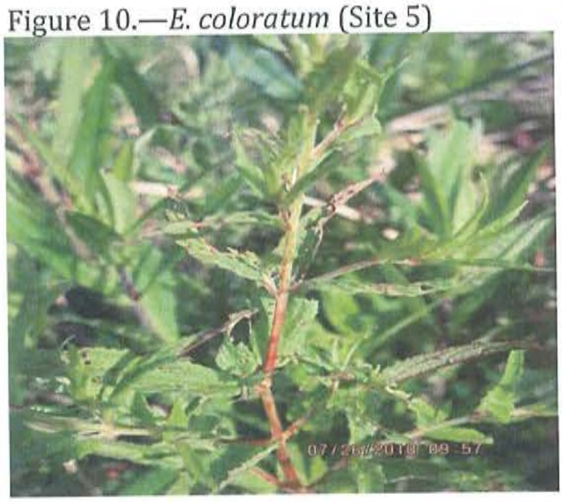


Figure 10.—*E. coloratum* (Site 5)

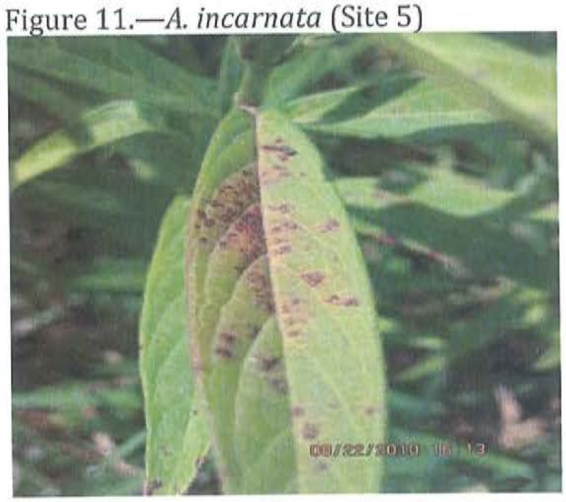


Figure 11.—*A. incarnata* (Site 5)

Figure 12.—*A. incarnata* (Site 5)

Figure 13.—*V. hastata* (Site 5)

Figure 14.—*V. hastata* (Site 5)

Figure 15.—*S. tabernaemontani* (Site 3)

Figure 16.—*S. latifolia* (Site 3)

Figure 17.—*A. subcordatum* (Site 3)

Figure 18.—*A. incarnata* (Site 3)

Figure 19.—*P. virginica* (Site 3)

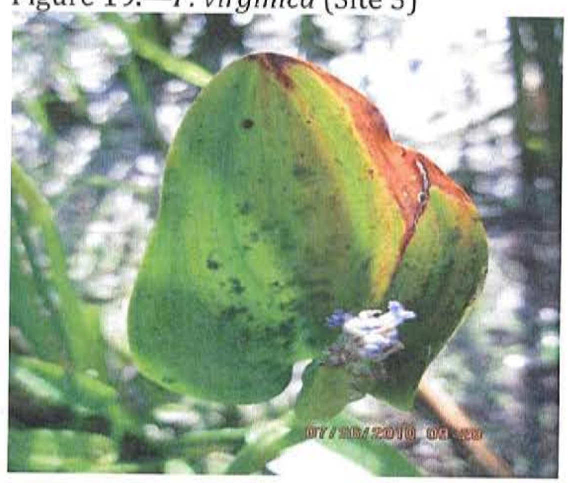


Figure 20.—*Rumex sp.* (Site 6)

Figure 21.—*Persicaria sp.* (Site 6)

Figure 22.—*S. cyperinus* (Site 7)

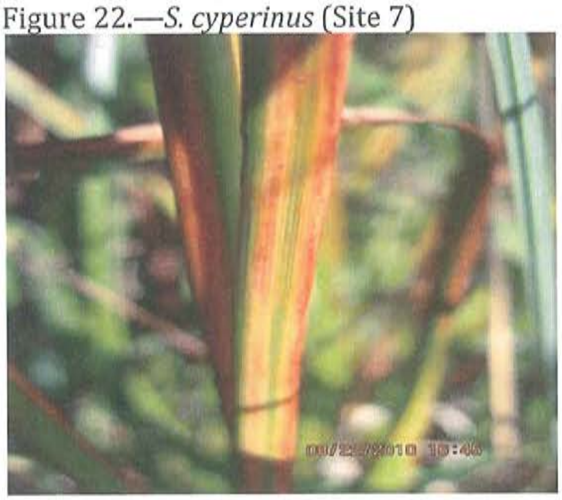


Figure 23.—*E. perfoliatum* (Site 7)

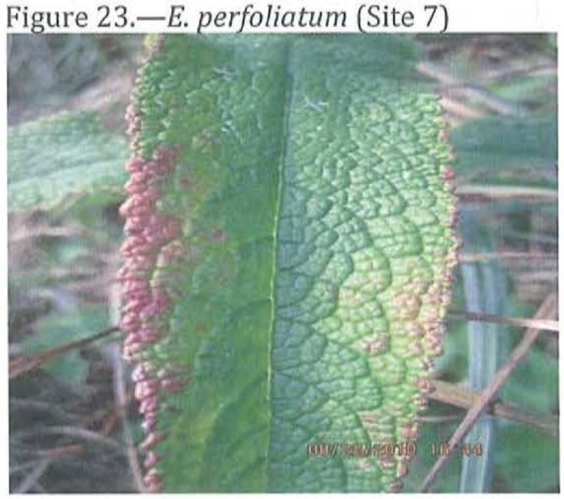


Figure 24.—*S. eurycarpum* (Site 8)

Figure 25.—*S. tabernaemontani* (Site 9)

PART 2 – GREENHOUSE EXPERIMENT AND EFFECTS OF Al, B, AND Mo:

Experiment Summary

Aluminum (Al), Boron (B), and Molybdenum (Mo) have been found in potentially toxic levels in the fly ash produced by coal-fired power plants. Varying concentrations of Al, B, and Mo were applied to three wetland plant species, *Asclepias incarnata, Carex aquatilis*, and *Iris virginica*. Plants were grown in a washed sand medium and received a modified Hoagland's solution every other day. Three concentration levels of Al (9 mg, 18 mg, and 27 mg/L), four concentration levels of B (14 mg, 26 mg, 47 mg, and 79 mg/L), and three concentration levels of Mo (2.5 mg, 5.0 mg, and 7.5 mg/L) were added as treatments. All three plant species showed visible symptoms of toxicity such as leaf tip necrosis and marginal leaf curl; the most severe and widespread occurring with the B treatments. Visual observations in the greenhouse revealed necrotic spotting in the leaf blade in most B treatments and highest Al concentration as early as day 15. Inductive Coupled Plasma Mass Spectrometry (ICP-MS), performed on the aboveground plant material of *A. incarnata* and *I. virginica*, indicates increasing boron uptake with concentration. While quantitative measures showed inhibition for all three species and nutrients, *Asclepias incarnata* was especially sensitive to B applications.

Literature Background

Minimal research has been conducted to determine at what concentrations constituents of fly ash may become toxic to and how they affect native wetland vegetation. Coal mines, whether active or abandoned, are significant sources of metal contamination and discharges (Batty et al. 2002). In addition, the burning of coal in electrical generation power plants can be a major source of heavy metal contamination, in particular aluminum, boron, and molybdenum (Wilcox and Hardy, 1998).

Vegetation can respond in one of three ways to increasing concentrations of heavy metals in the soil. Some are considered accumulators, which are species that accumulate and concentrate metals in the aboveground tissues. Others are called indicators, where internal concentrations reflect the external environment, a third group are excluders, which are plants that have shoot concentrations low in heavy metals and remain constant over many soil concentrations up to a critical soil level above which unrestricted transport, the point at which the plant can no longer prevent metals from entering, takes place (Baker, 1981).

Elemental uptake by wetland plants varies among species and is related to rooting depth and plant life form (Weis and Weis, 2004). In general, the inhibition of root growth is one of the most rapid responses to toxic concentrations of a heavy metal (Wong and Bradshaw, 1982). Trace elements often show an order of magnitude greater concentration in roots than in shoots. Boron is one exception. Boron is a passive mover throughout the transpiration stream and accumulates in the aboveground tissue, especially the leaves (Supanjani, 2006).

Aluminum. Soils contain, on average, 7 – 8% Aluminum (Al) and under acidic conditions Al becomes solubilized, increasing its mobility (Batty et al. 2002) and availability to plants (Miyasaka et al. 2007; Delhaize and Ryan, 1995; Rout et al. 2001; Abdalla, 2008). Runoff from coal stockpiles and coal-fired power plants are acidic and contain high levels of Al (Collins et al. 2004). High levels of Al in the soil can become a major limiting factor for plant production (Delhaize and Ryan, 1995).

Attempts have been made to establish critical Al concentrations for toxicity in plants (Foy, 1998). However, plant species respond in different ways to Al toxicity. Some plants have the ability to accumulate large amounts of Al in their foliage without any visible evidence of injury (Rout et al. 2001). However, Al toxicity also can induce deficiencies of other nutrients. Al toxicity can reduce the accumulation of calcium (Ca) in plant tissue to a level that Al toxicity resembles Ca deficiency (Rengel, 1992). Reduced Ca transport is expressed as curling of young leaves and collapse of petioles (Rout et al. 2001; Foy, 1984).

Al toxicity also can induce an iron (Fe) deficiency, which is expressed as chlorosis, and phosphorous (P) deficiency, which produces overall stunting, production of small dark green leaves and late maturity, purpling of the stem, leaf vein, and yellowing of leaf tips (Rout et al. 2001; Foy, 1998).

Al commonly accumulates in the roots in greater concentrations than in the shoots (Collins et al. 2004). The first, observable symptom of Al toxicity is the inhibition of root elongation (Miyasaka et al. 2007; Rengle, 1992; Roy et al. 1988; Delhaize and Ryan, 1995; Rout et al. 2001; Mossor-Pietraszewska, 2001). This inhibition damages the root system, limiting both nutrient and water uptake to the plant (Gregory, 2009; Poozesh et al. 2007; Zhang et al. 2007). Symptoms of Al toxicity can occur within hours of exposure (Miyasaka et al. 2007) and symptoms include stunted root growth, reduction in root hair development, and, swollen root apices (Matsumoto, 2002); in some cases, roots can become thickened and brown (Rout et al. 2001).

At the cellular level Al interferes with cytoskeleton structure and function, disrupts calcium homeostasis, phosphorous metabolism, and can cause oxidative stress (Miyasaka et al. 2007). Aluminum toxicity in leaves results in increased diffusion resistance, reduction of stomatal aperture, decreased photosynthetic activity, total decrease of leaf number and size, and a decrease of shoot biomass (Mossor-Pietraszewska, 2001). As a result, young leaves become small, curved along the margin and chlorotic and older leaves have marginal chlorosis (Roy, 1988).

Boron. Boron (B), an essential micronutrient (Gupta, 2007), is required for plant growth (Goldberg, 1993; Supanjani, 2006; Hu and Brown, 1997). Therefore, B is necessary in a continuous supply throughout the life of the plant and uptake is primarily through the roots. The species of B absorbed from the soil solution by the roots is often boric acid $B(OH)_3$ (Hu and Brown, 1997). Boric acid is a weak monobasic acid that acts as an electron acceptor (Gupta, 2007) in aqueous solution (Hu and Brown, 1997; Nable et al. 1997). Boron can become toxic in elevated concentrations (Miwa et al. 2007) and inhibit plant growth and development (Redington and Peterson, 1983).

Boron toxicity can occur when soils: 1) are naturally high in B, 2) are over-fertilized with minerals high in B, 3) receive fossil fuel combustion residues, which are produced from the burning of coal for electricity, or are used as disposal sites for waste materials containing B, such as fly ash and industrial chemicals (Nable et al. 1997) and 4) when irrigated with water high in B (Leyshon and James, 1993). Fly ash is of particular concern because of the high concentrations of B in fly ash may be readily available to plants and can prevent the establishment of vegetation on contaminated areas (Nable et al. 1997, Piha et al. 1995), especially during the first growing season (Wong and Bradshaw, 1982).

Plants vary in their B requirement, but the range of essential and toxic levels is smaller than for any other nutrient element (Goldberg, 1993; Reid et al. 2004). Research by Gupta et al. (1985) showed that boron is required in low concentrations for plant growth and becomes phytotoxic at concentrations only slightly higher than the optimal range (Sartaj and Fernandes, 2005). Boron is known to be a passive mover in plants (Supanjani, 2006). The amount of B taken up by the roots and transported to the shoots is related to the rate of transpiration (Sotiropoulos et al. 2002; Raven et al. 1980).

Studies have demonstrated that the mobility of B can vary dramatically between species (Brown and Hu, 1988). Boron enters the transpiration stream via the roots and tends to accumulate at the sites of termination in leaves (Brown and Hu, 1998; Nable et al. 1997; Reid et al. 2004; Sotiropoulos et al. 2002; Raven, 1980). In species where B is immobile toxicity symptoms always are exhibited as leaf tip and edge burn (Brown and Hu, 1998).

However, in species where B is mobile toxicity is exhibited as die back in young shoots rather than marginal leaf burn (Brown and Hu, 1998). Boron immobility is evidenced by elevated B concentrations in older leaves. Elevated B concentrations in younger leaves are an indication of B mobility because they have transpired less water than older leaves young leaves (Brown and Hu, 1998).

Boron does not accumulate evenly in leaves and typically concentrates in leaf tips of monocots and leaf margins of dicots. This is where toxicity symptoms typically first appear (Gupta, 2007; Kohl Jr. and Oertili, 1961). In general, B concentrations are lower in plant stems (Gupta, 2007). Soil pH influences the availability of B to plants and becomes less available as pH increases (Gupta, 2007; Hu and Brown, 1997). Furthermore, B toxicity can produce necrotic spots in the leaf blade (Sotiropoulos et al. 2002), marginal and tip chlorosis (Gupta, 2007), leaf burn (Nable et al. 1997), interveinal chlorosis, premature leaf drop, and plant death (Goldberg, 1993).

Molybdenum. Molybdenum (Mo) is an abundant essential micronutrient found in most plant tissues. Gupta and Lipsett (1981) concluded that the allocation of Mo throughout plant organs varies with the plant species, but generally the concentration is highest in the seeds. The concentration level considered toxic differs from plant to plant but dicots are typically more sensitive than monocots (Hamlin, 2007). However, Mo can reach toxic levels in the soil with applications of municipal sewage sludge or in soils near mining and smelting activities (Gupta, 1998).

The availability of Mo is tied to soil pH; therefore, Mo is more available at higher pH and less available at lower pH (Kaiser et al. 2005; Gupta, 1997). Under acidic soil conditions the molybdate anion is strongly adsorbed to the surface of Fe and Al oxides (Smith et al. 1997) and this adsorption is greatest at pH 4.0 (Keddy et al. 1997). Another factor in Mo availability is soil moisture. Poorly drained soils can accumulate high quantities of available MoO_4^{2-} (Gupta, 1998). However, the majority of plants tested are not particularly sensitive to excessive levels of Mo in the soil medium (Hamlin, 2007). Symptoms of Mo toxicity in plants include: burning, chlorosis and yellowing of leaves (Gupta, 1998) and an inhibition of root/shoot growth (Kevresan et al. 2001).

Greenhouse Experimental Methods

A total of 468 plants of three native species, *A. incarnata*, *C. aquatilis*, and *I. virginica*, were grown in approximately 38 cubic inch pots. Plants were organized into 13 groups, which were randomly organized on two greenhouse benches, and 12 of each species were organized randomly within each group. Washed sand was used as the growing medium. Immediately after transplanting was complete a modified Hoagland's solution was applied. The modified Hoagland's solution consisted of 940 ml of distilled water, 10 ml magnesium sulfate ($MgSO_4$) 0.14 M, 10 ml potassium nitrate (KNO_3) 0.17 M, 10 ml potassium hydrous phosphate (KH_2PO_4) 0.12 M, 10 ml iron ethylenediaminetetraacetic acid (Fe EDTA), and 10 ml calcium nitrate ($Ca(NO_3)_2 \cdot 4H_2O$) 0.10 M (Hoagland and Aron, 1950). The typical trace elements were omitted from the Hoagland's solution. The trace element solution was omitted because varying concentrations of boric acid, molybdic acid disodium salt dihydrate were applied as treatments. Aluminum chloride ($AlCl_3$) also was applied to the plants in this experiment but is not part of the Hoagland's solution.

Prior to the start of the experiment plants were treated with 50 ml of modified Hoagland's solution every other day for five weeks, daily if plants looked stressed, to ensure that the plants recovered from transplant shock and to allow time for the plants to begin regular production of new vegetative and root growth.

Plants were sorted into ten groups of 36, 12 plants of each of species. Treatment levels of Al, B, and Mo were applied every other day for 60 days. The concentrations were: Al = 9, 18, 27 mg/L; B = 14, 26, 47, 79 mg/L; Mo = 2.5, 5.0, 7.5 mg/L. There were 108 plants, (36 of each species), set aside as controls. Among the control plants, 36 (12 of each species) received Hoagland's solution and distilled water with pH reduced to 4.8. This was to provide a control group for the Al treatments where natural acidity ranged was approximately 4.8. Concentrations of Al, B, and Mo were gradually elevated to the treatment levels over a 13-day period. Due to apparently random plant loss during the course of the experimental period, final sample sizes ranged from 10-12. In addition, two individuals of *A. incarnata* were deleted from Mo concentration 2 since they were notably more robust before first measurements on day 28.

First growth measurements were taken on day 28 of the experiment. Stem height, number of leaves and branches, and total combined length of all branches were the measurements taken for *A. incarnata*. The number of shoots, number of leaves with a sheath greater than 2 cm, and length of longest leaf were measured for *C. aquatilis*. The number of leaves greater than 2 cm, length of longest leaf, number of dead leaves, and length of shortest leaf were recorded for *I. virginica*. The measurements were again recorded on day 42, and for the final time on day 58. On day 61 all of the plants were removed from their pots and root lengths, length of longest root, and photographs were taken.

After roots were measured and the plants photographed, the plants were dried at 120° F in a heated drying closet for four days and dry weights of roots and shoots, including leaves, were recorded. Data was analyzed with ANOVA for its ability to show if there are significant differences between pairs of groups. However, ANOVA cannot show which pairs are significantly different. Therefore, Tukey's Post Hoc tests were performed on measured variables against concentrations of an individual treatment to determine which groupings, if any, had significant differences. The critical p-value, or alpha, used was 0.05.

Normalization, by using the natural log, of the data was necessary on root weight, stem weight, and total weight for *C. aquatilis* and *I. virginica* with Al and Mo treatments, all three plant species for B, and stem weight only for *A. incarnata* with Mo treatments. As well, root length and length of the longest root for *C. aquatilis* with B treatments and *I. virginica* with B and Mo treatments required normalization.

Columbia Analytical Services in Seattle, WA, performed Inductive Cold Plasma Mass Spectrometry (ICP-MS) on aboveground tissue samples. ICP-MS was used to analyze boron content of 24 plant samples. Three samples were taken from the *A. incarnata* control group and three samples also were taken from each of the four boron treatment levels of *A. incarnata*. Three samples were taken from the *I. virginica* control group as well as from the B treatment levels 2 and 4 of *I. virginica*. Sample sizes of 0.5 - 1.3 grams were required from the plants above ground tissue for each sample. Tissue samples from as many as five plants were bulked within treatment type in order to obtain these sample amounts. Boron was the focus of this test because it was the nutrient whose specimens were exhibiting the majority of and most severe symptoms of toxicity and this test would provide further evidence for whether or not these symptoms could be attributed to the addition of the boron treatments.

Results from Greenhouse Experiment

Qualitative Observations: Qualitative inhibition of root growth was observed in all three plant species under all three nutrients (Figures 26-30; 38-55). The roots of *I. virginica* were particularly thickened and turned brown (Figure 31) at the lowest Al concentration. Leaf tip and edge burn were produced in *A. incarnata* and *I. virginica* (Figures 32 & 33) at the lowest concentration of B. Other symptoms of B treatment included necrotic spots on the leaf blade (Figures 34 & 35) and premature leaf drop (Figures 36 & 37).

Figure 26.—*A. incarnata* roots (Control)

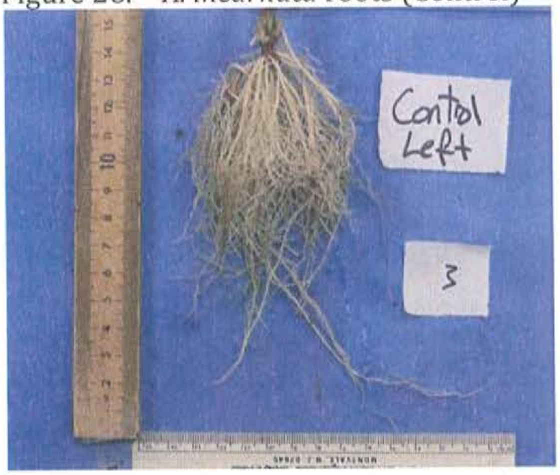


Figure 27. —*A. incarnata* roots (Control pH)

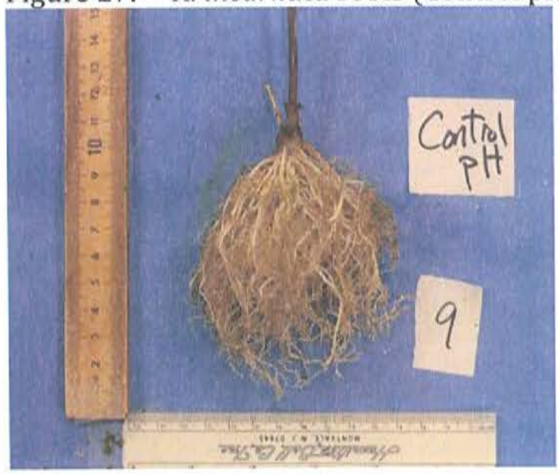


Figure 28. —*A. incarnata* roots (B1)

Figure 29. —*A. incarnata* roots (Mo1)

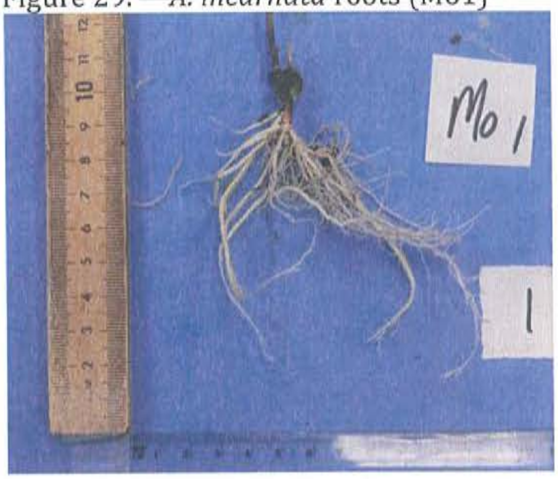


Figure 30. —*A. incarnata* roots (Al1)

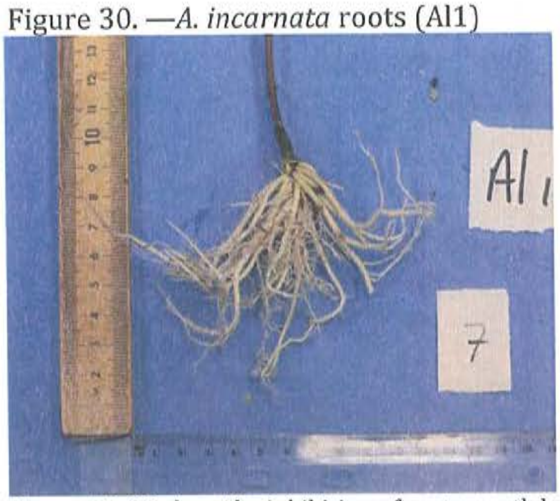
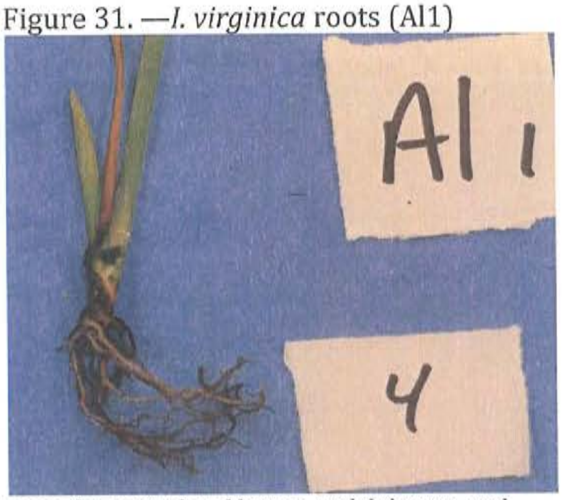


Figure 31. —*I. virginica* roots (Al1)



Figures 26-30 show the inhibition of root growth between the control and boron, molybdenum, and aluminum 1 treatments of *A. incarnata*. Figure 31 shows inhibited root growth and roots that are brittle, thickened, and brown following aluminum 1 treatment.

Figure 32. —*A. incarnata* (B1 Day 42)

Figure 33. —*I. virginica* (B1 Day 56)

Figures 32 & 33 show leaf tip and edge burn from B toxicity in *A. incarnata* and *I. virginica*.

Figure 34. —*A. incarnata* (B3 Day 33)

Figure 35. —*C. aquatilis* (B1 Day 47)

Figures 34 & 35 show boron induced necrotic spots on the leaf blades of *A. incarnata* and *C. aquatilis*.

Figure 36.—*A. incarnata* (Control)

Figure 37. —*A. incarnata* (B1)

Figure 36 shows normal leaf retention; Figure 37 shows premature leaf drop.

Figure 38. —*A. incarnata* (Al Control)

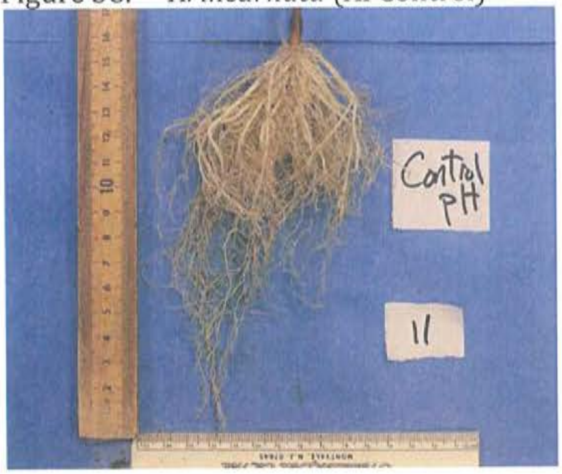


Figure 39. —*A. incarnata* (Al1)

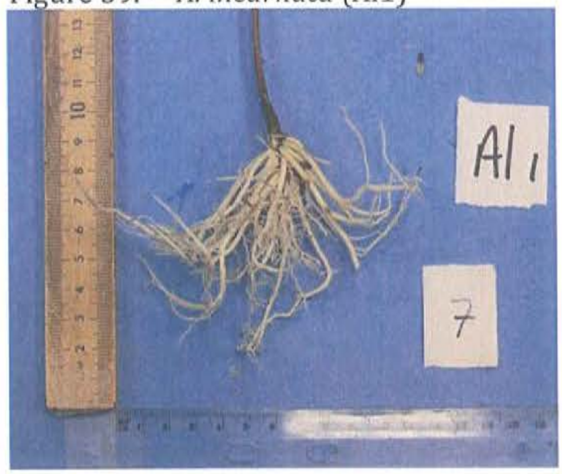


Figure 40. —*C. aquatilis* (Al Control)

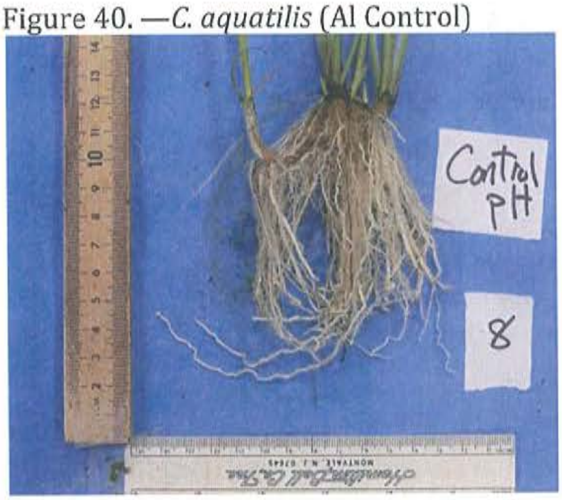


Figure 41. —*C. aquatilis* (Al1)

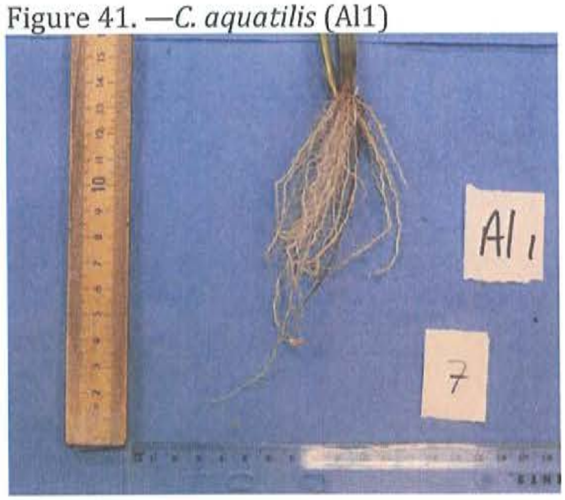


Figure 42. —*I. virginica* (Al Control)

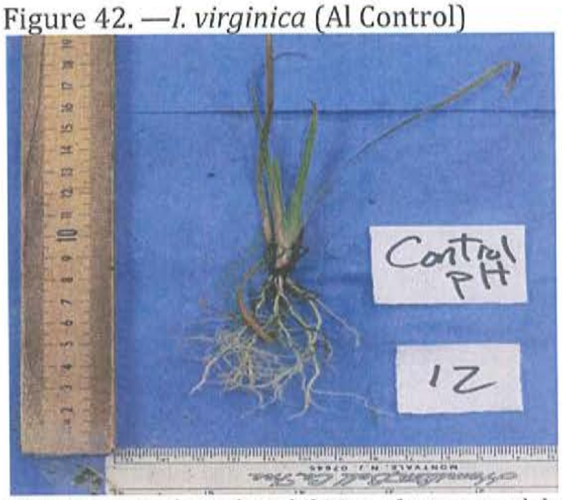
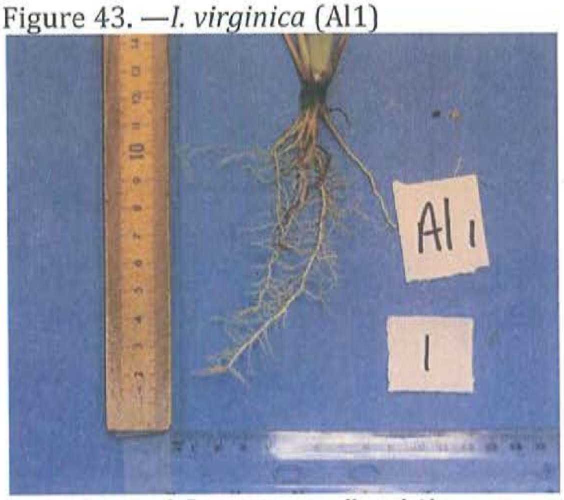


Figure 43. —*I. virginica* (Al1)



Figures 38-43 show the inhibition of root growth between Al control (low pH control) and Al treatments in all 3 plant species.

Figure 44.—*A. incarnata* (Control)

Figure 45.—*A. incarnata* (B1)

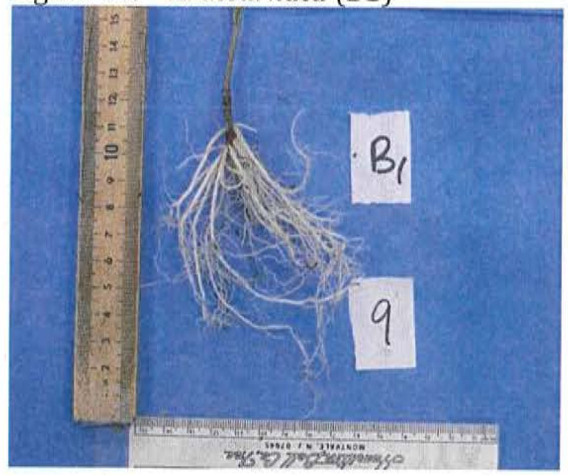


Figure 46.—*C. aquatilis* (Control)

Figure 47.—*C. aquatilis* (B1)

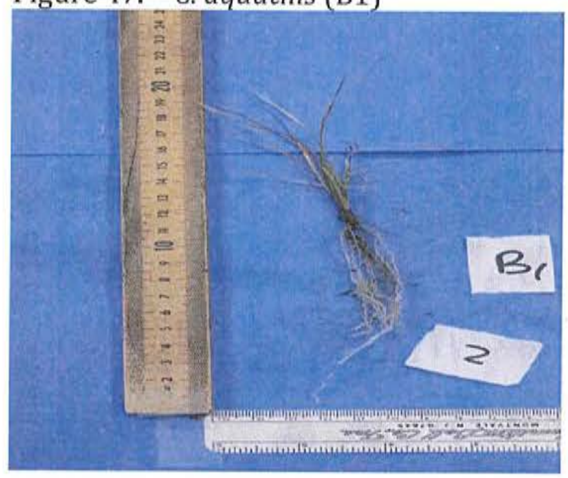


Figure 48.—*I. virginica* (Control)

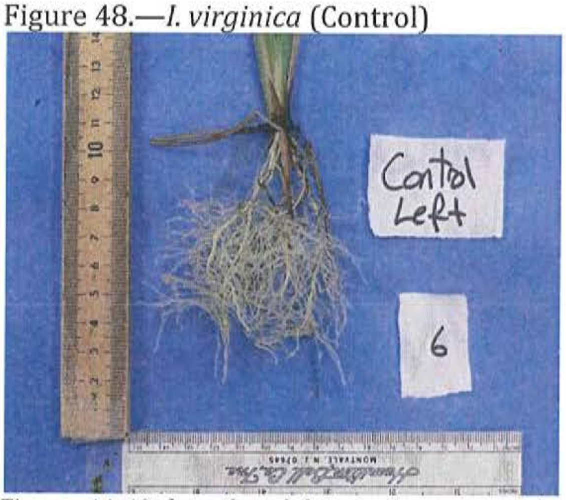
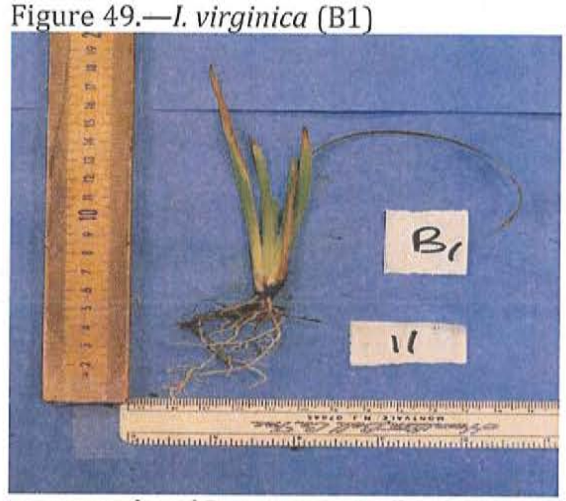


Figure 49.—*I. virginica* (B1)



Figures 44-49 show the inhibition of root growth between controls and B treatments in all 3 plant species.

Figure 50.—*A. incarnata* (Control)

Figure 51.—*A. incarnata* (Mo1)

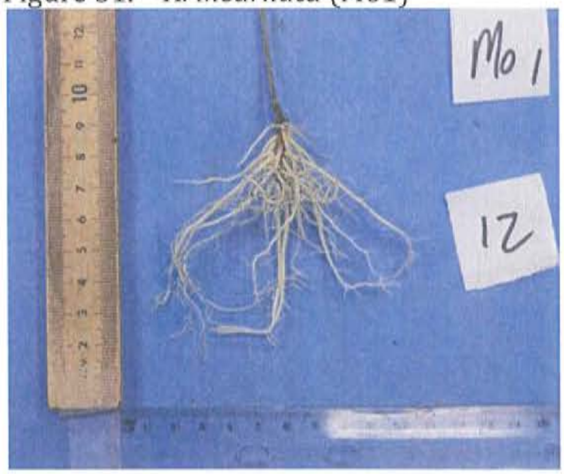


Figure 52.—*C. aquatilis* (Control)

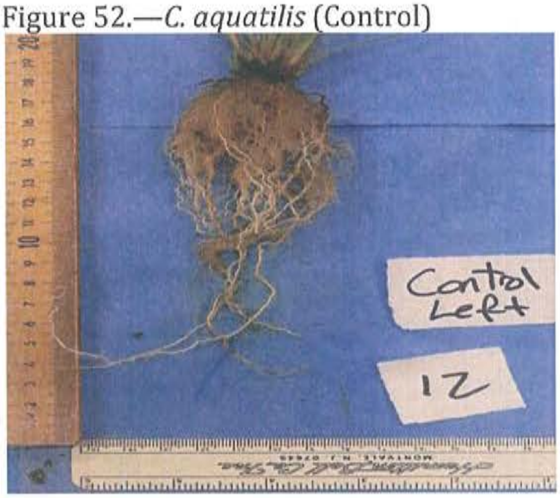
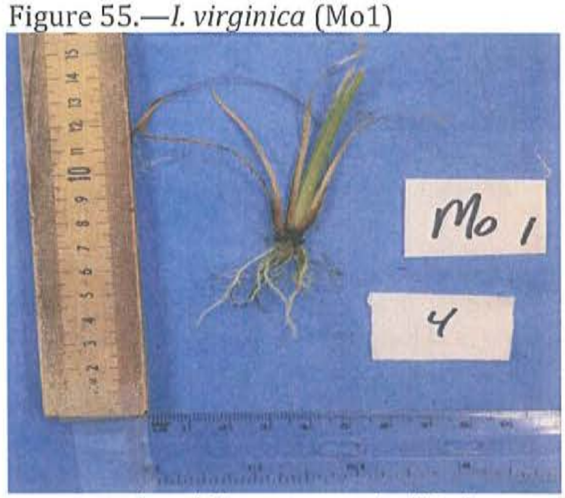


Figure 53.—*C. aquatilis* (Mo1)

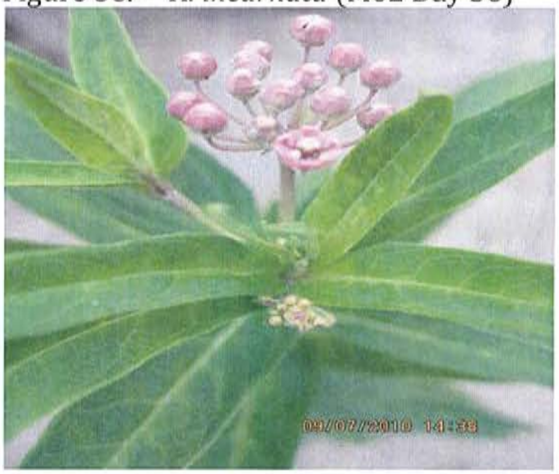
Figure 54.—*I. virginica* (Control)

Figure 55.—*I. virginica* (Mo1)



Figures 50-55 show the inhibition of root growth between controls and Mo treatments in all 3 plant species.

Figure 56. —*A. incarnata* (Mo2 Day 56)



Necrotic spots in the leaf blade and along the margin as well as purpling of the leaf blade were witnessed by day 15 in *A. incarnata* for all nutrient treatment levels of Al, B, and Mo, except for the lowest concentration of boron. The most severe symptoms expressed were at higher concentrations of Al and B. By day 20 these symptoms became apparent in the B treatments in *C. aquatilis*. Necrosis became increasingly severe throughout all three plant species in all three nutrient concentration levels (4 in the case of boron) and by day 56 the majority of plants were expressing moderate to severe toxicity symptoms. *Asclepias incarnata* in molybdenum treatment level 2 attempted to produce an inflorescence. The inflorescence was small, dull colored, dry, and failed to open normally (Figure 53).

ANOVA Analyses. Aluminum had a statistically significant relationship on root, stem and total weight ($p \leq 0.004$), root length ($p = 0.029$), and stem length ($p = 0.040$) of *A. incarnata* and length of the longest root ($p = 0.001$), number of sheaths over 2 cm long ($p = 0.042$), and length of the longest leaf ($p = 0.024$) when applied to *C. aquatilis* (Figures 57-62; Appendix B).

Results of the Post Hoc test showed that when aluminum was applied to *A. incarnata* the root length mean of the control group was significantly less than that of Al treatment 2 (Figure 58). Likewise stem length at the lowest Al concentration was less than the mean of the next higher treatment (Figure 59). On the other hand, the various weight parameters for Al treatment 2 were not significantly different from the control (Figure 57; Appendix B). When Al was applied to *C. aquatilis* several measurements of growth, namely longest root length, number of sheaths over 2 cm, and longest leaf length, may have been enhanced at the lowest concentration (Figures 60-62) but potentially inhibited at higher concentrations.

Boron had a statistically significant relationship when applied to *A. incarnata* on root, stem, and total weight (p = 0.001), length of the longest root (p = 0.001), and the number of leaves (p = 0.002) (Figures 57, 63-65; Appendix C). The Post Hoc test showed that all concentrations of B had a significant difference in root weight, stem weight, and total weight compared with the control (Figure 57). Other indicators of growth such as length of longest root (Figure 63), number of leaves (Figure 64), and root length (Figure 65) were significantly reduced at least at the highest B concentration. While the two monocot species, *C. aquatilis* and *I. virginica*, had obvious qualitative symptoms, the quantitative measures, including total weight (Table 1), were not significantly inhibited over the course of this experiment.

Molybdenum had a statistically significant relationship on stem weight (p = 0.003), stem length (p = 0.005), and number of leaves (p = 0.001) of *A. incarnata* and on length of the longest leaf (p = 0.013) of *C. aquatilis* (Figures 57, 66-70; Appendix D). The Post Hoc test revealed that when Mo was applied to *A. incarnata* there was a significant reduction of

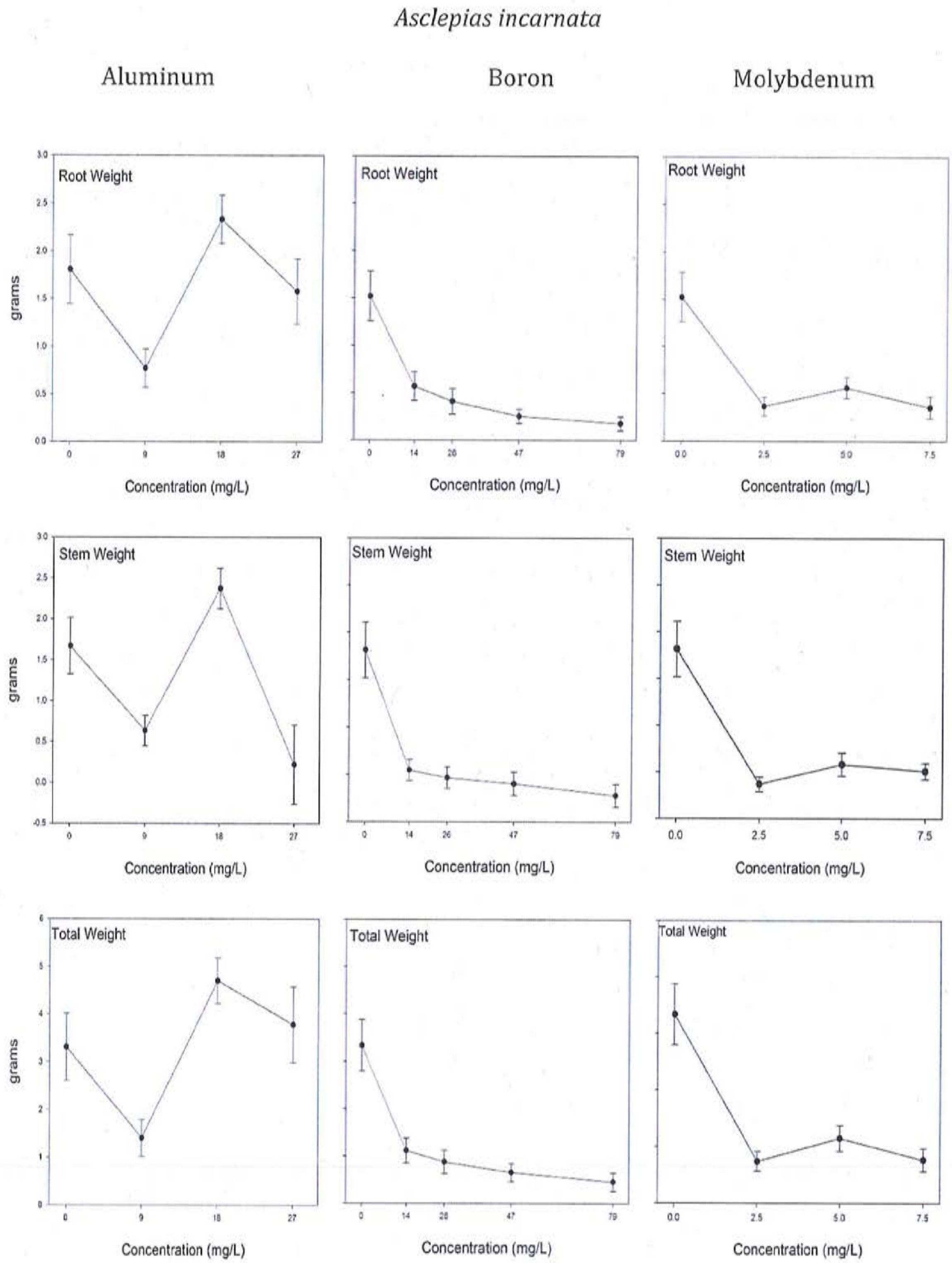


Figure 57. Response of *A. incarnata* to applications of aluminum, boron, and molybdenum. Al, B, and Mo concentrations are in mg/L; root, stem, and total weights are in grams.

Figure 58. Al: Root Length

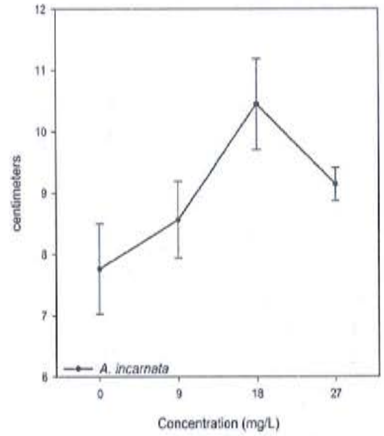


Figure 59. Al: Stem Length

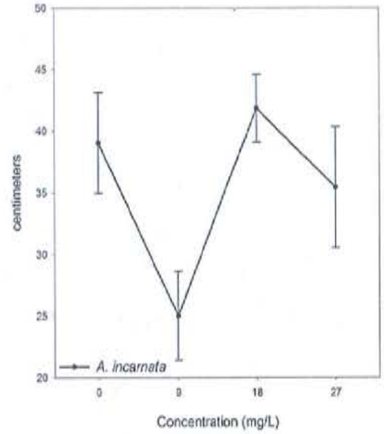


Figure 60. Al: Longest Root

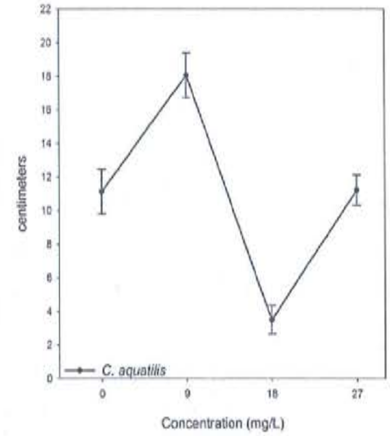


Figure 61. Al: # Sheaths > 2cm

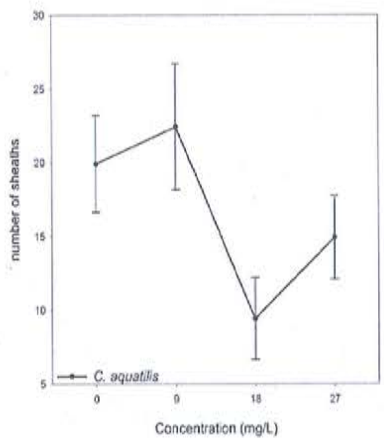


Figure 62. Al: Longest Leaf

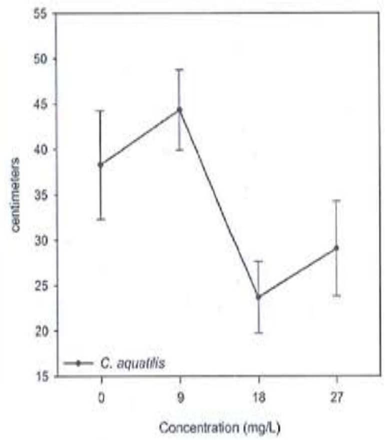


Figure 63. B: Longest Root

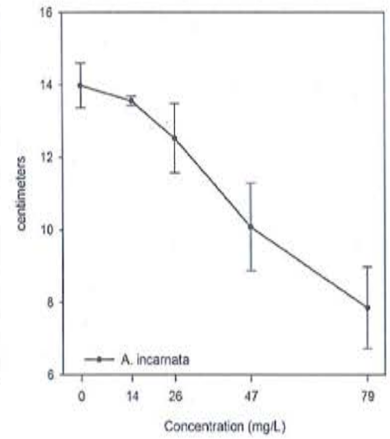


Figure 64. B: Number of Leaves

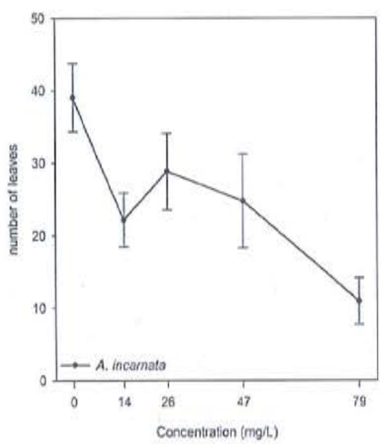


Figure 65. B: Root Length

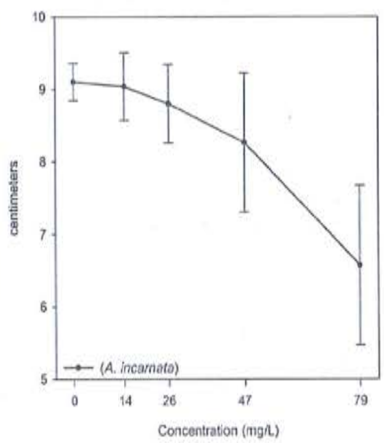


Figure 66. Mo: Number of Leaves

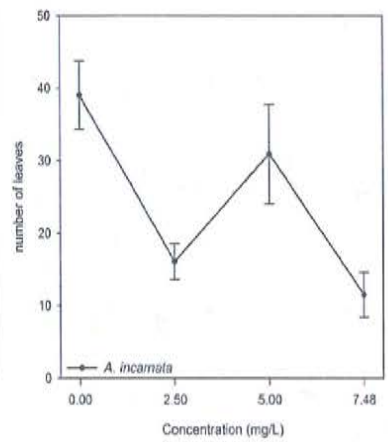


Figure 67. Mo: Stem Length

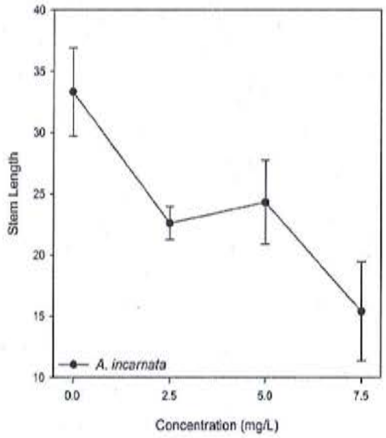


Figure 68: Mo: # Sheaths > 2cm

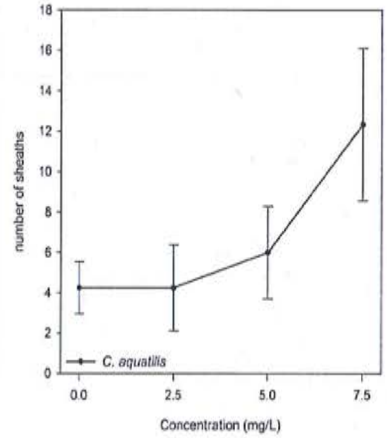


Figure 69. Mo: Longest Leaf

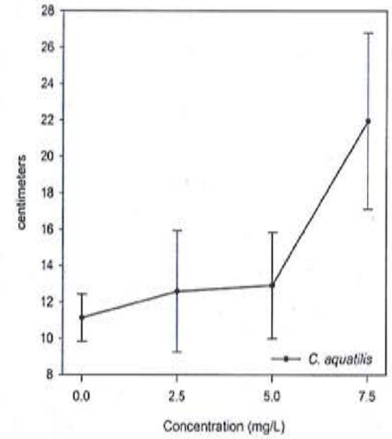
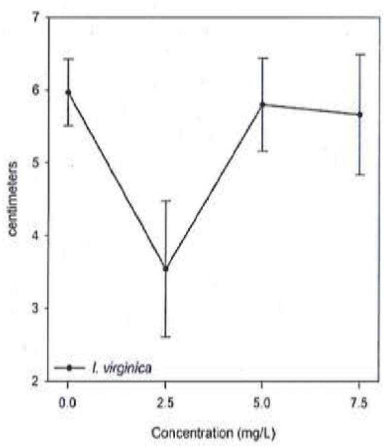


Figure 70. Mo: Root Length



stem weight between the control group and treatment levels 1 and 3, on stem length between the control group and treatment level 3, and number of leaves between the controls and treatment levels 1 and 3. A significant difference could not be demonstrated between the control and Mo treatment 2, a group with a high degree of variability among test plants (Figure 57). Not surprisingly, this same response was exhibited in another growth response, the number of leaves (Figure 66). Across the entire experiment, *A.*

incarnata at the highest Mo concentration suffered the most mortality. As a result, only ten plants had measurable root systems and eight plants with aboveground parts.

When Mo was applied to *C. aquatilis* a significant difference was found in the number of sheaths longer than 2 cm (Figure 68) and in the length of the longest leaf (Figure 69). In both instances these parameters increased with concentration of Mo, reaching a statistically significant threshold at the highest Mo concentration used in the experiment. On the other hand, root length of *I. virginica* was inhibited with low levels of Mo but no significance difference was observed at other Mo concentrations (Figure 70).

Inductive Coupled Plasma Mass Spectrometry. ICP-MS was used for this study to measure B uptake in samples of *A. incarnata* and *I. virginica*. In both *A. incarnata* and *I. virginica*, accumulation of B was evident. *Asclepias incarnata* control had a boron mean uptake of 62 ppm compared to 179 ppm, 446 ppm, 553 ppm, 427 ppm at the progressively higher concentrations of B. *Iris virginica* control treatment had a boron mean uptake of 107 ppm, while B treatment level 2 and 3 were 419 ppm and 797 ppm. The Post Hoc test revealed for *A. incarnata* that the mean of the control samples was less than the means of treatment levels 2, 3, and 4 and for *I. virginica* the mean of the control samples was lower than the mean of treatment level 4 (Appendix E).

Discussion

Visually the three native wetland plant species responded similarly to varying concentrations of Al, B, and Mo. Aluminum and B, at elevated concentrations, produced leaf purpling, necrotic spotting, and tip death in *A. incarnata* by day 15 of the experiment. By day 20 the two lowest B concentrations and the lowest Mo concentration in *A. incarnata* were affected and the necrosis expanded to include *C. aquatilis*. And by day 56 all three plant species, all treatment concentration levels of the three nutrients, had expressed pervasive necrosis and yellowing of leaves and in one specimen of *A. incarnata* incomplete flowering was expressed. Qualitatively root inhibition was apparent in *A. incarnata* in all three nutrients and concentration levels (Figures 26-30, 38-39, 44-45, 50-51). The controls of all three plant species did express some leaf wilting, leaf tip death, and purpling of the leaf margin. However, these symptoms were neither as severe nor widespread as in the plants receiving Al, B, and Mo. And plant mortalities, of which there were 52, during the experiment, appeared to be random, with the possible exception of the highest concentration of Mo, and not the result of treatments.

The symptoms observed in the greenhouse experiment are commonly noted in the literature (e.g., Miyasaka et al. 2007; Gupta, 2007; Sotiropoulos wt al. 2002; Kevresan et al. 2001). However, the prior and current literature was limited to research in vegetables and woody species, primarily. There has been little, if any, research on the responses of elevated levels of Al, B, and Mo, or other constituents of fly ash leachate, to native wetland plant species.

It was particularly instructive that the three species used in this study had some noteworthy differences in their response to elevated levels of Al, B, and Mo. The dicot *A. incarnata* seemed the most sensitive of the three species, especially to increasing concentrations of B. The applications of B to *A. incarnata* had a dramatic effect on root, stem, and total weight (Figure 57) as well as length of the longest root, number of leaves, and root length (Figures 63-65). These results were further reinforced with the ICP-MS tests. The ICP-MS tests revealed that *A. incarnata* and *I. virginica* are accumulator species, which are species that accumulate and concentrate metals in the aboveground tissues.

Although increasing concentrations of B produced progressively greater inhibitions of growth, Al treatments had unexpected variation in response (e.g., Figure 57) in the form of an unexpectedly pronounced inhibition of growth at the lowest Al concentration. Several explanations may be posited including a natural variability in plant response to elevated levels of nutrients and heavy metals in the soil medium. The fact that elemental uptake by wetland plants varies among species and is related to rooting depth and plant life form (Weis and Weis, 2004) could explain why some plants are bigger, more resilient, and appear more tolerant to varying concentration levels. This may suggest that small differences in the condition of the plants at the on-set of the treatment may lead to large differences in their ability to acclimatize over the course of the experiment.

Alternatively, because the inhibition of root growth is one of the most rapid responses to toxic concentrations of a heavy metal (Wong and Bradshaw, 1982), even a low but toxic Al concentration could have broad consequences on plant growth. One might wonder whether more extensive root damage leads to elevation of pH levels within the rhizosphere with subsequent effect on the absorption of Al (Taylor and Foy, 1985). Experimental results suggest that there are various mechanisms involving extracellular and intracellular carboxylate ion production that assist in the sequestering and detoxification of Al in plants (Panda and Matsumoto, 2007). These may act differentially over a range of concentrations.

The resilience of plant growth in response to Al and Mo was evident in several growth responses. In this experiment, toxic effects on root growth of *A. incarnata* only became apparent at and above 18 mg/ml concentration (Figure 58) and in *C. aquatilis* the number of sheaths and length of the longest leaf only decreased at Al concentrations above 9 mg/ml (Figures 61-62). And perhaps the most interesting result was the increase in the number of sheaths greater than 2 cm and leaf length of *C. aquatilis* with increased concentrations of Mo (Figures 68-69).

In summary, the above results suggest that B toxicity is uniformly expressed both in qualitative as well as quantitative measures of plant response across a range of concentrations. In contrast, the responses to Mo and especially Al, while evident and no less severe in foliage symptoms, were less uniform across the range of concentrations and quantitative measures. The latter may indicate some potential for these three plant species to acclimatize to these two fly ash constituents.

This greenhouse experiment has applications that can be translated into the field. The findings for these three common native wetland species aided in the recognition of symptoms in the field sites and corroborate observations from CBWC, especially the SW corner of Cowles Bog. The greenhouse experiment produced symptoms of incomplete flowering, leaf tip and leaf margin burn and necrosis, necrotic spotting, chlorosis of the leaf blade and veins, marginal leaf curl, and purpling of the stem and these symptoms also were observed in Cowles Bog in many species.

The long-term implications of these findings suggest that the vegetative quality of affected areas of Cowles Bog will remain low until the effects of the fly ash leachate are eliminated from the site. High levels of B, which have an especially negative impact on vegetation during the first growing season (Wong and Bradshaw, 1982), make the establishment of new native vegetation difficult. At the same time, Ye et al. (1998)

concluded that the invasive non-native *Typha latifolia* (cattail) is inherently tolerant to elevated levels of heavy metals commonly found in the leachate of fly ash. A virtual cattail monoculture is currently present in some portions of Cowles Bog and, with its sequestered B, presents a continuing risk to the establishment of more conservative, native plant species.

Further study is necessary to determine the specific levels of the constituents of fly ash, including Al, B, and Mo in Cowles Bog. The continuation of groundwater and vegetation monitoring is necessary and the testing of plant samples *in situ* by ICP-MS could be a valuable tool in determining the uptake concentrations of specific, individual fly ash constituents in the vegetation in the CBWC.

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Appendix A.

Latitude/Longitude of sites in study

Site #	Latitude	Longitude	Location
1	41° 38.229'	87° 05.816'	Cowles Bog (CB)
2	41° 38.241'	87° 05.837'	Cowles Bog
3	41° 38.219'	87° 05.858'	Cowles Bog
4	41° 38.243'	87° 05.929'	Cowles Bog
5	41° 38.231'	87° 05.953'	Cowles Bog
6	41° 38.230'	87° 06.011'	Cowles Bog
7	41° 38.236'	87° 06.052'	SW Corner Cowles Bog
8	41° 38.219'	87° 06.072'	SW Corner Cowles Bog
9	41° 38.249'	87° 06.052'	Cowles Bog
10	41° 38.314'	87° 05.990'	Cowles Bog
11	41° 38.321'	87° 06.007'	Cowles Bog
12	41° 38.345'	87° 06.000'	Cowles Bog
13	41° 38.371'	87° 05.986'	Cowles Bog
14	41° 38.390'	87° 06.006'	Cowles Bog
15	41° 38.413'	87° 05.998'	Cowles Bog
16	41° 38.438'	87° 05.964'	Cowles Bog
17	41° 38.454'	87° 05.928'	Cowles Bog
18	41° 38.685'	87° 05.514'	Cowles Bog Boardwalk
19	41° 38.691'	87° 05.340'	North Side Cowles Bog
20	41° 38.506'	87° 05.848'	Sm Wetland North of CB
21	41° 38.556'	87° 05.878'	Lrg Wetland North of CB
22	41° 38.581'	87° 05.719'	Lrg Wetland North of CB
23	41° 38.596'	87° 05.955'	Lrg Wetland North of CB
24	41° 38.405'	87° 06.170'	Sm Wetland West of CB
25	41° 38.346'	87° 06.168'	Lrg Wetland West of CB
26	41° 38.350 '	87° 06.217'	Lrg Wetland West of CB
27	41° 38.348'	87° 06.240'	Lrg Wetland West of CB
28	41° 38.361 '	87° 06.314'	Lrg Wetland West of CB
29	41° 38.380'	87° 06.216'	Lrg Wetland West of CB
30	41° 38.367'	87° 06.113'	Lrg Wetland West of CB
31	41° 38.366'	87° 06.041'	Lrg Wetland West of CB
32	41° 38.359'	87° 06.697'	Blag Slough
33	41° 38.367'	87° 06.862'	Blag Slough
34	41° 38.367'	87° 06.886'	Blag Slough

Appendix B.

ANOVA:

Mean weights in grams, lengths in centimeters, and number of sheaths ± standard error of control and three aluminum treatments (Al applied as $AlCl_3$) and representative p-values for *A. incarnata* and *C. aquatilis*.

Nutrient	Plant Species	Measurement	Control	Treatment 1 Al = 9 mg/L	Treatment 2 18 mg/L	Treatment 3 27 mg/L	P-Value
Aluminum	A. incarnata	Root Weight	1.81 ± 0.36 ab	0.77 ± 0.20 b	2.33 ± 0.25 a	1.58 ± 0.34 ab	0.006
Aluminum	A. incarnata	Stem Weight	1.67 ± 0.34 ab	0.64 ± 0.19 b	2.37 ± 0.25 a	2.20 ± 0.48 a	0.004
Aluminum	A. incarnata	Total Weight	3.31 ± 0.70 ab	1.41 ± 0.38 b	4.70 ± 0.48 a	3.78 ± 0.80 a	0.005
Aluminum	A. incarnata	Root Length	7.76 ± 0.74 b	8.56 ± 0.63 ab	10.45 ± 0.74 a	9.14 ± 0.27 ab	0.029
Aluminum	A. incarnata	Stem Length	32.54 ± 5.53 ab	18.76 ± 4.22 b	38.35 ± 4.30 a	35.44 ± 4.91 ab	0.04
Aluminum	C. aquatilis	Longest Root	11.13 ± 1.33 b	18.05 ± 1.33 a	9.49 ± 0.85 b	11.22 ± 0.91 b	0.001
Aluminum	C. aquatilis	Number of Sheaths	19.92 ± 3.27 ab	22.42 ± 4.27 a	9.42 ± 2.77 b	14.92 ± 2.83 ab	0.042
Aluminum	C. aquatilis	Length of Longest Leaf	38.28 ± 5.97 ab	44.33 ± 4.45 a	23.68 ± 3.94 b	29.04 ± 5.25 ab	0.24

Means that do not share a letter are significantly different.

APPENDIX C.

ANOVA:

Mean weights in grams, lengths in centimeters, and numbers of leaves ± standard error of control and four boron treatments (B applied as $B(OH)_3$) and representative p-values for *A. incarnata*.

Nutrient	Plant Species	Measurement	Control	Treatment 1 B = 14 mg/L	Treatment 2 26 mg/L	Treatment 3 47 mg/L	Treatment 4 79 mg/L	P-Value
Boron	A. incarnata	Root Weight	1.52 ± 0.26 a	0.57 ± 0.15 ab	0.41 ± 0.14 bc	0.25 ± .07 bc	0.18 ± .08 c	0.001
Boron	A. incarnata	Stem Weight	1.82 ± 0.30 a	0.55 ± 0.11 ab	0.47 ± 0.11 bc	0.40 ± 0.12 bc	0.28 ± 0.12 c	0.001
Boron	A. incarnata	Total Weight	3.35 ± 0.54 a	1.11 ± 0.26 ab	0.87 ± 0.25 bc	0.65 ± 0.19 bc	0.45 ± 0.20 c	0.001
Boron	A. incarnata	Root Length	9.10 ± 0.26 a	9.04 ± 0.47 ab	8.80 ± 0.54 ab	8.27 ± 0.96 ab	6.57 ±1.10 b	0.053
Boron	A. incarnata	Longest Root	13.98 ± 0.625 a	13.55 ± 1.32 ab	12.53± 0.96 ab	10.08 ± 1.21 bc	7.85 ± 1.13 c	0.001
Boron	A. incarnata	Number of Leaves	39.04 ± 4.70 a	22.17 ± 3.71 ab	28.83 ± 5.30 ab	24.75 ± 6.48 ab	10.92 ± 3.20 b	0.002

Means that do not share a letter are significantly different.

APPENDIX D.

ANOVA:

Mean weights in grams, length in centimeters, and number of leaves and sheaths ± standard error of control and three molybdenum treatments (Mo applied as molybdic acid disodium salt dihydrate) for *A. incarnata* and *C. aquatilis*.

Nutrient	Plant Species	Measurement	Control	Treatment 1 Mo = 2.5 mg/L	Treatment 2 5 mg/L	Treatment 3 7.5 mg/L	P-Value
Molybdenum	A. incarnata	Root Weight	1.53 ± 0.26 a	0.37 ± .97 bc	0.56 ± 0.11 ab	0.36 ± 0.12 c	0.001
Molybdenum	A. incarnata	Stem Weight	1.82 ± 0.30 a	0.37 ± .08 b	0.58 ± 0.12 ab	0.51 ± .09 b	0.001
Molybdenum	A. incarnata	Total Weight	3.34 ± 0.54 a	0.74 ± 0.17 b	1.15 ± 0.23 ab	0.76 ± 0.20 b	0.001
Molybdenum	A. incarnata	Stem Length	33.33±3.61 a	22.62±1.34 ab	24.32±3.43 ab	15.42±4.07 b	0.005
Molybdenum	A. incarnata	Number of Leaves	39.04 ± 4.70 a	16.08 ± 2.48 b	30.90 ± 6.84 a	11.50 ± 3.12 b	0.001
Molybdenum	C. aquatilis	Number of Sheaths	4.25 ± 1.29 b	4.25 ± 2.13 ab	6.00 ± 2.29 ab	12.33 ± 3.78 a	0.056
Molybdenum	C. aquatilis	Longest Leaf	11.13 ± 1.30 b	12.58 ± 3.34 ab	12.91 ± 2.92 ab	21.95 ± 4.85 a	0.013

Means that do not share a letter are significantly different.

Appendix E.

Mean mg/kg (ppm) of boron uptake for samples of *A. incarnata* and *I. virginica*

Sample	Asc inc Control	Asc inc B1	Asc inc B2	Asc inc B3	Asc inc B4
1	65	211	359	732	444
2	56	98	376	405	418
3	64	229	602	523	420
Mean	61.7^{c}	179.3^{bc}	445.7^{ab}	533.3^{a}	427.3^{ab}

Sample	Iris Control	Iris B2	Iris B4
1	101	430	690
2	119	408	590
3	101	na	1110
Mean	107^{b}	419^{ab}	796.7^{c}

Means that do not share a letter are significantly different.

Attachment D

Remedial Alternatives: EPA Threshold and Balancing Criteria

Area	Corrective Measure Alternative		Alternative Score by Criterion							Total Score	Cost
			Long-term Effectiveness	Toxicity, Mobility, and Volume Reduction	Short-term Effectiveness	Implementability	Green Remediation	Community Acceptance	State Acceptance		
SWMU-15	1	Full Excavation and Off-site Disposal	6	6	3	6	3	6	6	36	$40,700,000
	2	Full Excavation and On-site Consolidation	4	2	1	3.5	1	1	1	13.5	$38,300,000
	3	Full Excavation, 1/2 Off-site Disposal, 1/2 On-site Consolidation	5	4	2	3.5	2	4	4	24.5	$42,500,000
	4	Partial Excavation, Off-site Disposal and Solidification	3	5	5	5	5	5	5	33	$20,500,000
	5	Partial Excavation, On-site Consolidation and Solidification	2	3	4	1.5	4	3	3	20.5	$25,000,000
	6	Encapsulation	1	1	6	1.5	6	2	2	19.5	$28,900,000
	Total Score by Criterion		21	21	21	21	21	21	21	N/A	N/A
Greenbelt & Eastern	1	Full Excavation and Off-site Disposal	Excavation & Off-Site Disposal is required by NPS and is the only alternative evaluated for the Greenbelt & Eastern Wetland area.							N/A	$276,000
Ground water	1	In-Situ Remediation by Permeable Reactive Barrier	1	2	1.5	2	2	1	1	10.5	$890,000

	2	Groundwater Pump & Treat	3	3	1.5	1	1	2	2	13.5	$7,500,000
	3	Monitored Natural Attenuation	2	1	3	3	3	3	3	18	$880,000
	Total Score by Criterion		6	6	6	6	6	6	6	N/A	N/A
Previously Barren Soil Areas	1	Excavation & Off-site Disposal with Soil Replacement	1	3	2	1	1	1	1.5	10.5	$133,000
	2	Soil Flushing / pH Adjustment	2	2	2	2	2	2	1.5	13.5	$104,000
	3	Monitored Natural Attenuation	3	1	2	3	3	3	3	18	$84,000
	Total Score by Criterion		6	6	6	6	6	6	6	N/A	N/A

The scoring of alternatives is based on a ranking performed in descending order, with the highest ranking alternative for each criterion receiving a score of 6 and the lowest ranking alternative receiving a score of 1 for SWMU 15. For “Groundwater Beneath the IDNL” and “Previously Barren Soil Areas”, the highest ranking alternative receives a score of 3, and the lowest ranking alternative receives a score of 1. Scores are relative and apply only within a specified area. Ties are assigned a score based on the average method of determining ties – all alternatives that rank the same for a specific criterion are assigned a score based on the average value of their sorted position between 1 and 3 (or their sorted position between 1 and 6 for SWMU 15 alternatives). For example, Alternatives 1 and 2 for “Groundwater Beneath the IDNL” are determined to be equal and rank the lowest for short-term effectiveness. The assigned score of 1.5 for each is the average of their sorted position within the ranking of that criterion: (2+1)/2 = 1.5.

Remedial Alternatives: Costs

Area	Corrective Measure Alternative	Total Score	Capital Cost	O&M Cost	Project Management, Engineering, & Contingency Cost	Total Cost
SWMU-15	Full Excavation and Off-site Disposal	36	$31,600,000	$100,000	$9,000,000	**$40,700,000**
	Full Excavation and On-site Consolidation	13.5	$26,200,000	$3,100,000	$9,000,000	**$38,300,000**
	Full Excavation, 1/2 Off-site Disposal, 1/2 On-site Consolidation	24.5	$30,800,000	$1,700,000	$10,000,000	**$42,500,000**
	Partial Excavation, Off-site Disposal and Solidification	33	$15,700,000	$100,000	$4,700,000	**$20,500,000**
	Partial Excavation, On-site Consolidation and Solidification	20.5	$17,200,000	$1,700,000	$6,100,000	**$25,000,000**
	Encapsulation	19.5	$15,000,000	$7,100,000	$6,800,000	**$28,900,000**
Greenbelt & Eastern Wetland	Full Excavation and Off-site Disposal	N/A (See Table above)	$166,000	$18,000	$92,000	**$276,000**
Groundwater Beneath IDNL	In-Situ Remediation by Permeable Reactive Barrier	10.5	$430,000	$270,000	$190,000	**$890,000**

	Groundwater Pump & Treat	13.5	$3,000,000	$2,500,000	$2,000,000	**$7,500,000**
	Monitored Natural Attenuation	18	$60,000	$550,000	$270,000	**$880,000**
Previously Barren Soil Areas	Excavation & Off-site Disposal with Soil Replacement	10.5	$84,000	$11,000	$38,000	**$133,000**
	Soil Flushing / pH Adjustment	13.5	$32,000	$44,000	$28,000	**$104,000**
	Monitored Natural Attenuation	18	$61,000	$0	$23,000	**$84,000**

A Citizen's Guide to Solidification and Stabilization

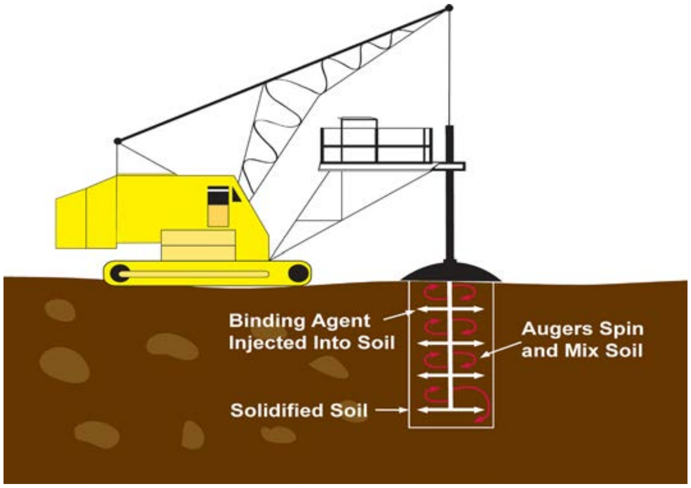
What Are Solidification And Stabilization?

Solidification and stabilization refer to a group of cleanup methods that prevent or slow the release of harmful chemicals from wastes, such as contaminated soil, sediment, and sludge. These methods usually do not destroy the contaminants. Instead, they keep them from "leaching" above safe levels into the surrounding environment. Leaching occurs when water from rain or other sources dissolves contaminants and carries them downward into groundwater or over land into lakes and streams.

Solidification binds the waste in a solid block of material and traps it in place. This block is also less permeable to water than the waste. Stabilization causes a chemical reaction that makes contaminants less likely to be leached into the environment. They are often used together to prevent people and wildlife from being exposed to contaminants, particularly metals and radioactive contaminants. However, certain types of organic contaminants, such as PCBs and pesticides, can also be solidified.

How Does It Work?

Solidification involves mixing a waste with a binding agent, which is a substance that makes loose materials stick together. Common binding agents include cement, asphalt, fly ash, and clay. Water must be added to most mixtures for binding to occur; then the mixture is allowed to dry and harden to form a solid block.



Binding agents can be injected into soil and mixed using augers.

Similar to solidification, stabilization also involves mixing wastes with binding agents. However, the binding agents also cause a chemical reaction with contaminants to make them less likely to be released into the environment. For example, when soil contaminated with metals is mixed with water and lime — a white powder produced from limestone — a reaction changes the metals into a form that will not dissolve in water.

Additives can be mixed into the waste while still in the ground (often referred to as "in situ"). This usually involves drilling holes using cranes with large mixers or augers, which both inject the additives underground and mix them with the waste. The number of holes needed depends on the size of the augers and the contaminated area. Dozens of holes may need to be drilled. When the waste is shallow enough, the contaminated soil or waste is excavated and additives are mixed with it above ground (often referred to as "ex situ"). The waste is either mixed using backhoes and front end loaders or placed in machines called "pug mills." Pug mills can grind and mix materials at the same time.

Solidified or stabilized waste mixed above ground is either used to fill in the excavation or transported to a landfill for disposal. Waste mixed in situ is usually covered with a "cap" to prevent water from contacting treated waste (See *A Citizen's Guide to Capping* [EPA 542-12-004].)

How Long Will It Take?

Solidification and stabilization may take weeks or months to complete. The actual time it takes will depend on several factors. For example, they may take longer where:

- The contaminated area is large or deep.
- The soil is dense or rocky, making it harder to mix with the binding agent.
- Mixing occurs above ground, which requires excavation.
- Extreme cold or rainfall delays treatment.

Are Solidification And Stabilization Safe?

The additives used in solidification and stabilization often are materials used in construction and other activities. When properly handled, these materials do not pose a threat to workers or the community. Water or foam can be sprayed on the ground to make sure that dust and contaminants are not released to the air during mixing. If necessary, the waste can be mixed inside tanks, or the mixing area can be covered to minimize dust and vapors. The final solidified or stabilized product is tested to ensure that contaminants do not leach. The strength and durability of the solidified materials are also tested.

Large augers inject and mix binding agent with contaminated soil.

How Might It Affect Me?

Nearby residents or businesses may notice increased truck traffic as equipment and additives are brought to the site or as treated waste is transported to a landfill. They also may hear earth-moving equipment as waste is excavated or mixed. When cleanup is complete, the land often can be redeveloped.

Why Use Solidification Or Stabilization?

Solidification and stabilization provide a relatively quick and lower-cost way to prevent exposure to contaminants, particularly metals and radioactive contaminants. Solidification and stabilization have been selected or are being used in cleanups at over 250 Superfund sites across the country.

Contaminated soil mixed with cement in a pug mill is spread on the ground as pavement.

Example

Solidification and stabilization were used to clean up contaminated sludge and soil at the South 8th Street Landfill Superfund site in Arkansas. From the 1960s to 1970s, municipal and industrial wastes were disposed at the site, including a 2.5-acre pit of waste-oil sludge. In the 1980s, that area was found to be contaminated with oily wastes, PCBs, pesticides, and lead.

In 1999, cranes with augers were used to inject and mix limestone, fly ash, and Portland cement with 40,000 cubic yards of sludge and soil in the pit. These additives helped solidify the mixture as well as stabilize the lead and other metals. The hardened material was left in place and covered with a soil cap. Evaluations in 2004 and 2009 indicated that the cleanup approach is still protecting human health and the environment. The site has been deleted from the National Priorities List, the list of the nations most serious hazardous waste sites.

For More Information

For more information about this and other technologies in the Citizen's Guide Series, visit:

www.cluin.org/remediation
www.cluin.org/products/citguide

United States Environmental Protection Agency

Office of Solid Waste and Emergency Response (5102G)

EPA 542-F-12-019
September 2012
www.epa.gov/superfund/sites
www.cluin.org

ATTACHMENT B

NIPSCO SWMU 15 Supporting Documentation Memo – December 2, 2020

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Revised Memo

To:	Michelle Kaysen / EPA	**Reviewer:**	John Storm / Wood
From:	Russell Johnson / Wood Daniel Sullivan / NIPSCO, LLC		
cc:	Joe Ferry, Marc Okin / NIPSCO, LLC	**Wood File No.:**	3651200111.2400.****
Date	December 2, 2020		
Re:	Southern Environmental Law Center Response to Comments Statement of Basis for Area C Bailly Generating Station		

On July 6, 2020, the United States Environmental Protection Agency (EPA) opened the comment period for the Statement of Basis for Area C at the Northern Indiana Public Service Company, LLC (NIPSCO, LLC) Bailly Generating Station. The Statement of Basis' proposed remedy under the RCRA Corrective Action Program contemplates excavation of coal combustion residuals (CCR) above the water table (92,000 cubic yards) at Solid Waste Management Unit (SWMU) 15 and disposal at an off-site facility permitted to accept CCR. Remaining CCR below the water table (86,000 cubic yards) will be solidified in place by mixing in amendments designed to reduce the leachability of CCR contaminants by at least two orders of magnitude through a reduction of both hydraulic conductivity and increased chemical fixation (also referred to as in-situ solidification and stabilization, ISS).

In a letter dated October 19, 2020, the Southern Environmental Law Center (SELC) stated that citing safety concerns associated with excavating ash from below the water table does not justify leaving saturated ash onsite. The letter goes on to say that the SELC is "…concerned that EPA's explanation for its approach in the Bailly Statement of Basis could be taken out of context and used to resist needed cleanups in our region and elsewhere in the country." The SELC requests that EPA "…make clear that your concerns about excavation of saturated ash are based on specific facts of the Bailly situation that you are addressing."

NIPSCO, LLC believes that the SELC comments misread the Statement of Basis' remedy recommendation to be exclusively predicated on worker safety concerns. That is, NIPSCO, LLC believes the Statement of Basis reflects a multi-faceted remedy proposal including safety (which is, of course paramount at any NIPSCO, LLC construction site) among several other site-specific factors.

As EPA is aware, performing deep excavations under poor site and subsurface conditions (unstable CCR) and shallow groundwater conditions pose several challenges. Typical construction techniques to allow safe construction would include driving sheet pile or other shoring methods, however overhead power lines preclude or significantly limit these stabilization-of-excavation activities. Furthermore, adjacent sensitive environmental conditions complicate the use of dewatering to allow excavation to the necessary remediation depths for full removal of the saturated CCR. Unlike many large open impoundments subject to closure under the CCR rule, conditions at SWMU 15 pose unique challenges, including:

- Proximity to the Indiana Dunes National Park (IDNP) – In 1971, "NIPSCO built a dike out of sand, which was native to the area, and topped off the dike with some muck, which was also native to the area."[1] The dike was constructed directly on the property line between NIPSCO, LLC and the IDNP as shown in **Figure 1**, which includes the limits of buried CCR. Approximately 250 feet of the dike directly abuts SWMU 15 where CCR was deposited up against the dike. The top of the dike that passes directly adjacent to SWMU 15 is also known as the Cowles Bog Trail, promoted for recreational use by the National Park Service (NPS). In addition, the NPS has communicated their desire that our remedy, including monitoring, be conducted in a manner that does not impact the sensitive dune and bog complexes within the IDNP. The proposed remedial approach minimizes impacts on the IDNP and achieves reductions in site-related contaminants in the aquifer beneath the IDNP in a timeframe consistent with full excavation. As described in detail below the bog complex exists because of well-established hydrologic conditions (water levels, groundwater discharge and geochemistry) and those balances can be disrupted by water management processes needed for a full-excavation scenario.
- Overhead Transmission Lines (135KV) – three sets of transmission lines traverse the landfilled ash at SWMU 15 (see **Figure 1** and photograph); however, the transmission towers are not founded on CCR. One tower set was built on the crest of a dune, whereas two other tower sets were constructed on sand imported prior to the landfilling of CCR. Therefore, it is not necessary to remove the tower sets to excavate CCR, but the presence of overhead lines make the driving of sheet pile extremely dangerous, if not impossible, directly beneath and lateral to those lines for some distance. Moving the transmission towers would also be a challenge as obstacles include a rail line and the Bailly entry road that run parallel to one another along the western border of SWMU 15, with the Arcelor Mittal steel property on the other side of the road (see **Figure 1**). To the east is additional SWMU 15 area, another set of transmission lines, wetlands and the IDNP property. Changing the orientation of the transmission lines may also require reconfiguration of the Dune Acres substation, which occupies approximately 12 acres and immediately abuts SWMU 15 to the south, with associated safety, cost and schedule implications.

[1] Supplemental Statement of Northern Indiana Public Service Company (NIPSCO). Presented May 30, 1977, To the National Park Service Study Team, Pursuant to P.L. 94-549, Section 19, Relative to Study Area II-A. Page 12.

- Proximity to the Cowles Bog Wetland Complex - As described on the National Park Service (NPS) website (NPS, 2020), Indiana Dunes National Park (the Park) is comprised of over 15,000 acres of dunes, oak savannas, swamps, bogs, marshes, prairies, rivers, and forests. The Park preserves an important remnant of a once vast and unique environment, resulting from the retreat of the last great continental glacier some 14,000 years ago. The park landscape represents at least four major successive stages of historic Lake Michigan shorelines, making it one of the most extensive geologic records of one of the world's largest, freshwater bodies. Over 1,100 flowering plant species and ferns make their homes here. From predacious bog plants to native prairie grasses and from towering white pines to rare algal species, the plant diversity is rich. The Park is also renowned for the its bird life; more than 350 species have been observed here. The NPS has called the IDNP "a treasure of diverse natural resources located within an urban setting."[2]

  The Cowles Bog, located within the Park, features so much plant diversity that it was designated as a National Natural Landmark in 1965, a year before Indiana Dunes National Lakeshore was even established (NPS, 2020). The Cowles Bog is off limits to the public because it is a very sensitive feature within the Park. It is a fen, which is supported by a constant flow of lime-rich water from springs beneath a floating mat of peat moss.[3] The center of the Cowles Bog National Natural Landmark is located approximately 3000 feet from SWMU 15 and is surrounded by a large mat of floating vegetation known as the Cowles Bog Wetland Complex. The westernmost end of the Cowles Bog Wetland Complex abuts the dike separating the NIPSCO, LLC property from the IDNP (see **Figure 1**).

  In contrast to the ephemeral nature of the interdunal wetlands that are common in the INDP, Cowles Bog is a much larger feature and has a thick deposit of peat. Based on lithologic borings and water level relationships, it has been concluded that the peat has developed as a result of a groundwater leakage from the underlying sub-till aquifer through a breach in the otherwise laterally contiguous till unit.[4] Upwelling in Cowles Bog is well-known phenomenon, as portrayed by **Figures 2, 3 and 4**. The Cowles Bog and wetland complex are also the headwaters of Dunes Creek, which drains the area off to the east and, perhaps as a consequence of the hydraulic conditions described above, has a uniquely stable water level compared to the more ephemeral interdunal wetlands.

  Today the Cowles Bog wetland complex occupies a small portion of a much larger marsh system that once stretched between Gary and Michigan City, Indiana. In the 1960's, dunes were removed and several interdunal wetlands were filled in for industrial construction, which changed the hydrology of the area, facilitating the rapid spread of the non-native narrow leaf cattail (*Typha angustifolia*) and hybrid cattail (*Typha. x glauca*). Other invasive species such as common reed (*Phragmites australis*) also increased. The alteration to the natural hydrology has led to the loss of native wetland plant species. Indiana Dunes National Park is actively working to remove invasive species and promote and restore native plants.

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[2] NPS (National Park Service). 2020. Indiana Dunes National Park website. Available at: https://www.nps.gov/indu/learn/nature/great-marsh-restoration.htm. Accessed Nov. 17.

[3] https://www.audubon.org/important-bird-areas/cowles-bog-indiana-dunes-national-lakeshore

[4] Final Area C Corrective Measures Study, NIPSCO Bailly Generating Station, RCRA Corrective Action Program, EPA ID# 000 718 114, Chesterton, Indiana. July 9, 2019

- Dune Sand Base – CCR was placed immediately in contact with fine-grained dune sand. Wood has performed geotechnical studies of the CCR and underlying sand to assess excavation floor and wall stability. Both the CCR and sand were determined to have negligible to no cohesive force with internal friction angles indicating a very loose material. Considering the low friction angles, relatively non-existent cohesive strength, and the saturated condition of the sand that underlies CCR, the excavation floor may not be stable, especially if the pit is dewatered from above (i.e., the underlying sand would remain saturated). Excessive upward groundwater pressures at the floor of the excavation may result in exit gradients that are enough to move the sand particles and create boils or heaving sands.[5] To prevent heaving, the regional water table would have to be lowered below the CCR/sand contact.
- Dewatering Implications - to achieve the required drawdown to completely dewater the CCR and some amount of underlying sand over several acres, pumping would be substantial for two reasons: (1) the sand has a relatively high hydraulic conductivity ranging from $6.1*10^{-4}$ to $9.8*10^{-3}$ cm/sec,[3] and (2) groundwater that would otherwise discharge to the IDNP wetlands and some induced infiltration from the wetlands would be diverted to the pumping wells. Sheet pile could be installed to minimize induced infiltration from the wetlands but may not be possible as noted above.

  At EPA's request, NIPSCO, LLC has prepared an internal draft Corrective Measures Implementation (CMI) Plan for a pilot study of the proposed remedy at SWMU 15. This plan will not be finalized until such time that the remedy has been selected; however, one aspect of the CMI Plan was to evaluate the partial dewatering of CCR within the footprint of SWMU 15, with re-infiltration to the subsurface elsewhere within the footprint of SWMU 15. Although dewatering may not be necessary for the ISS of saturated CCR at full-scale, to achieve all objectives of the proposed pilot-scale work in the allotted timeframe, dewatering will be necessary to access the thickest CCR deposits safely and quickly in the selected pilot-study footprint to perform ISS. To improve CCR stability, the goal was to draw down water levels approximately 5 feet below the current water levels in the saturated CCR. The extraction/re-infiltration scenario was evaluated quantitatively using the MODFLOW model developed in support of the Corrective Measures Study (CMS) Report[3], assuming sheet pile would not be employed. To achieve the target water levels, it was necessary to simulate a combined flow of 55 gallons per minute (gpm) from the well-point system to achieve partial drawdown for only a portion of SWMU 15.

  To implement the full excavation option substantially more groundwater extraction would be required to lower water levels a few feet below the saturated CCR in the absence of sheet pile. **Figures 5 and 6** present two cross-section (see **Figure 2** for cross-section lines) that provide conceptualized depictions of drawdown after an extended period of pumping, perhaps requiring a combined extraction rate of 200 gpm or more from a multi-well extraction system. **Figure 5** shows a simplified well-point system in a portion of SWMU 15 where the saturated thickness of CCR is approximately 5 feet. For this portion of SWMU 15, potentially less pumping would be needed, with less drawdown to achieve the desired goal of lowering the water table into the underlying dune sand. For this depiction, well IDNL GW-13 is partially dewatering with some induced infiltration from the

[5] Memo to Michelle Kaysen/USEPA from Peter Guerra and Russ Johnson, SWMU 15 Geotechnical Investigation Summary, Corrective Measures Study for Area C, NIPSCO Bailly Generating Station. January 23, 2017.

wetland complex. **Figure 6** depicts an area where the saturated thickness of CCR is >10 feet. To completely dewater the CCR would require more pumping. Pumping at such high rates might completely dewater nearby wells (see IDNL-GW13 as an example), with more induced infiltration from the wetland complex.

Once treated, the extracted water could be discharged outside the Cowles Bog Wetland Complex (e.g., directly to Lake Michigan), but doing so would disrupt the Cowles Bog water balance. Alternatively, treated water could be returned to the bog wetland complex via surface water, but that would deviate from the normal Cowles Bog hydrology and may have implications from discharging treated water that has a very different chemistry than the natural groundwater.

Historical water quality data from Cowles Bogs was obtained from an article published in by Arihod in 1974:[6]

> A water-table well at the north edge of Cowles Bog had water containing significantly higher total phosphorus, total organic carbon, ammonia nitrogen, organic nitrogen, and color values than from other National Lakeshore wells. Surface water quality data from Cowles Bogs (north inlet) indicate that pH ranges from 5.8 to 6.7, dissolved oxygen from 1.5 to 4.7 mg/L, and low conductance of 70-120 micromhos. The iron concentration was very high (7.6 mg/1), which, for that type of water, usually is due to iron contained in the organic acids that color the water a dark brown or black.

While it may be possible to replicate some of these parameters by manipulating the treated discharge water, other important water quality characteristics would be difficult to reproduce. For example, high concentrations of organic acids associated with iron[6] could not be replicated in treated discharge water. The organic acids and other dissolved organic particles in the water column supply nutrients and help to maintain a natural water chemistry that support plankton and benthic invertebrate communities upon which other wildlife depend for food. Plankton and benthic communities also drive nutrient cycling which in turn affects plant communities. Even temporary alterations to hydrology could result in lasting adverse effects that are in conflict the Park's mission. Moreover, the return of treated water could promote the spread of non-native and invasive species which the NPS is trying to remove and place further stress on sensitive native plants which the NPS is trying to restore.

- Groundwater Treatment – the primary contaminant of concern at Bailly is boron. To remove boron effectively, the CMS evaluated two technologies: reverse osmosis and ion exchange. Both produce a waste material that has concentrated minerals, called a "reject" or "brine". This material would have to be routinely trucked off-site for disposal at a permitted deep well injection facility, which is not considered a "green" technology. Moreover, it is this mineral-depleted water that would have to be discharged back to the Cowles Bog wetland complex to maintain the water balance. The potential implications of altering the Cowles Bog surface water hydrology and chemistry are not known.

[6] Arihood, L.D. 1974. Water-Quality Assessment Report of the Indiana Dunes National Lakeshore, 1973-1974. United States Geological Survey Water-Resources Investigation 14-75.

The work at Bailly is being conducted pursuant to the RCRA AOC, not the CCR Rule. Even so, IDEM has adopted in full the CCR Rule into their Solid Waste Regulations and ISS of CCR is an allowable technology for the Closure in Place option.

Finally, NIPSCO, LLC has conducted testing of solidified CCR from SWMU 15, including EPA's Leaching Environmental Assessment Framework (LEAF), hydraulic conductivity testing, and durability testing (i.e., unconsolidated compressive strength, freeze/thaw and wet/dry) following ASTM methodologies. NIPSCO, LLC and EPA have concluded that ISS is an effective technology for CCR below the water table, and that this proposed remedy is the responsible approach given the many drawbacks and potential unintended consequences enumerated above.

SWMU 15

Northern Indiana Public
Service Company

Bailly Generating Station
Chesterton, Indiana

Legend

- SWMU 15
- Bailly Generating Station Property Boundary
- Dike
- Transmission Towers (3 Each)
- Transmission Tower (Single)
- Path of Overhead Transmission Line

Location of Site

Notes and Sources

FIGURE 1

Basemap Source: 2018 Indiana Orthophotography obtained from the Indiana University Indiana Spatial Data Portal.

N

0 250 Feet

wood.
Wood Environment & Infrastructure Solutions, Inc.
271 Mill Road
Chelmsford, MA 01824
(978) 692-9090

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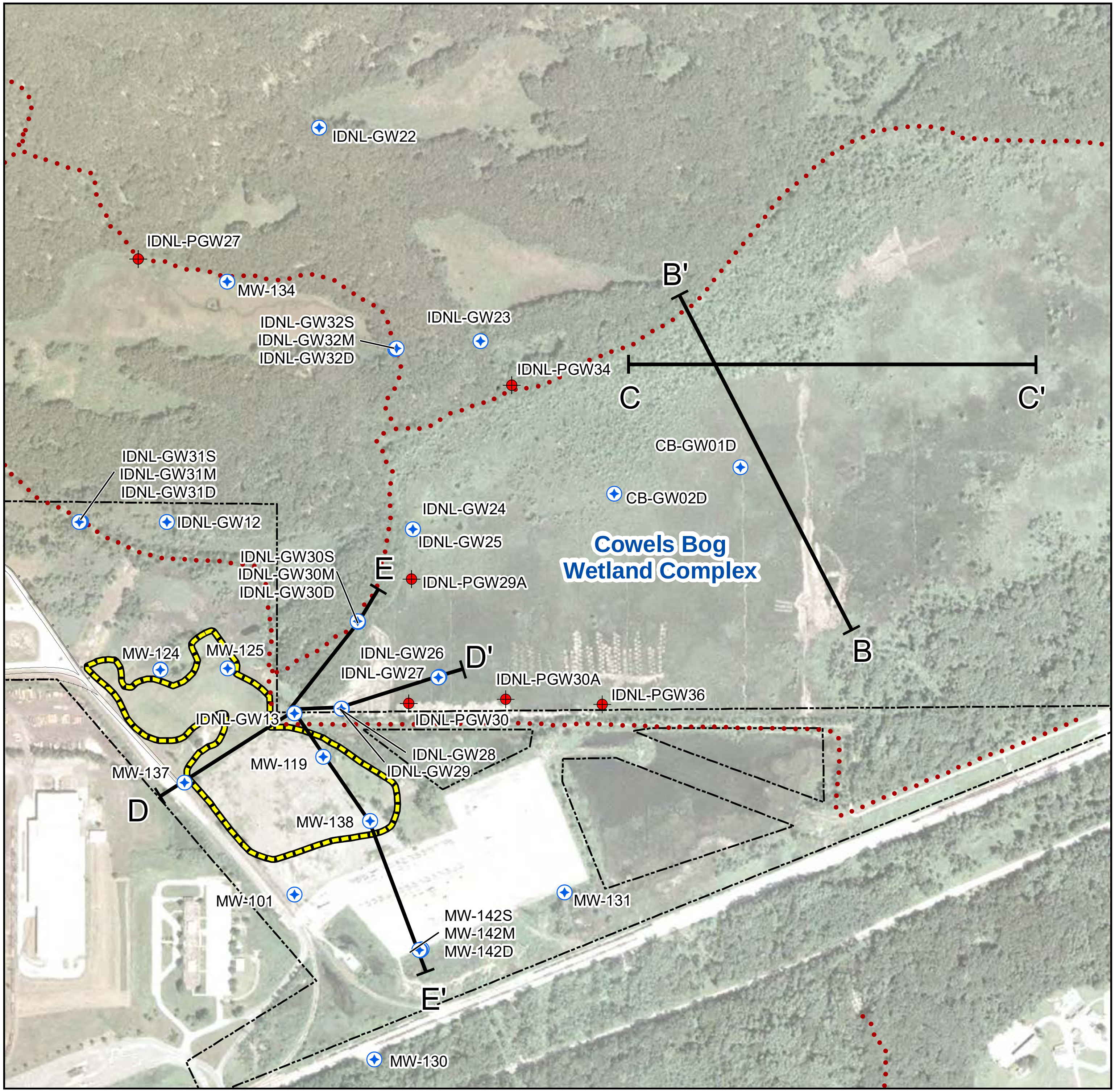

Cross Section Lines

Northern Indiana Public Service Company

Bailly Generating Station
Chesterton, Indiana

Legend

- Groundwater Monitoring Well
- Direct Push Groundwater Sample Location
- Trail
- Coal Combustion Residual Fill Area
- Bailly Generating Station Property Line
- E — E' Cross-Section Line

Location of Site

Notes & Sources

FIGURE 2

0 700 Feet

N

Wood Environment & Infrastructure Solutions, Inc.
271 Mill Road
Chelmsford, MA 01824
(978) 692-9090

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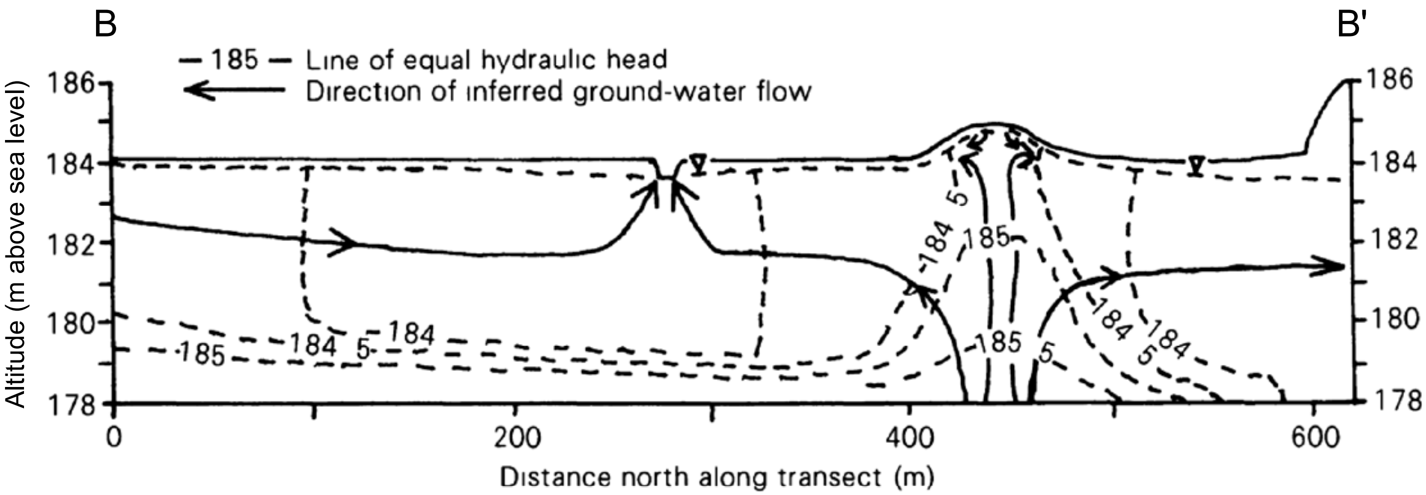

UPWELLING BELOW COWLES BOG

Northern Indiana Public Service Company

Bailly Generating Station
Chesterton, Indiana

Location of Site

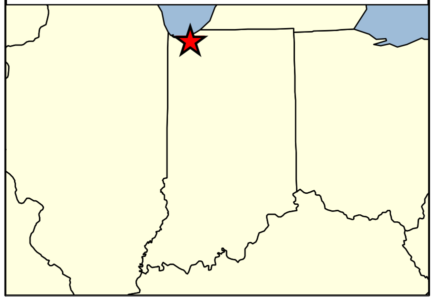

FIGURE 3

Note: See Figure 4-7 for Section B-B' line.

Source: D.A. Wilcox, R. J. Shedlock, and W.H. Henderson. Hydrology, Water Chemistry and Ecological Relations in the Raised Mound of Cowles Bog. Journal of Ecology (1986), 74, 1103-1117.

wood.

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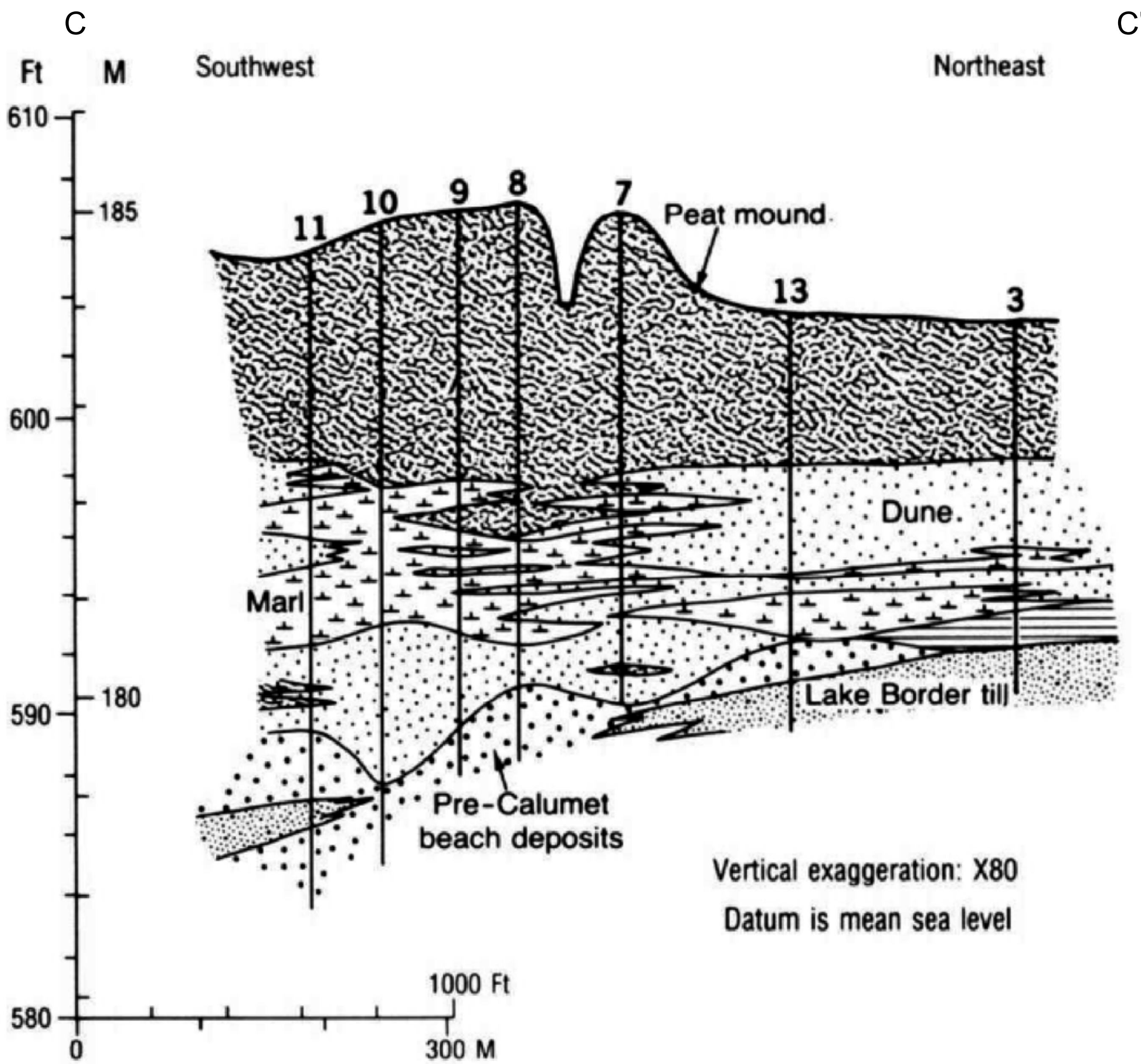
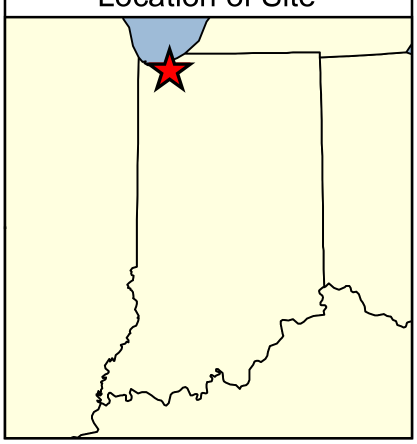
271 Mill Road
Chelmsford, MA 01824
(978) 692-9090



Location of Site



BREACH IN LAKE BORDER TILL BELOW COWLES BOG

Northern Indiana Public Service Company

Bailly Generating Station
Chesterton, Indiana

FIGURE 4

Note: See Figure 4-7 for Section C-C' line.

Source: Figures 5 and 7 from Thompson, T.A. 1990. Dune and beach complex and back-barrier sediments along the southeastern shore of Lake Michigan; Cowles Bog Area of the Indian Dunes National Lakeshore. Geological Society of America. Special Paper 251.

wood.
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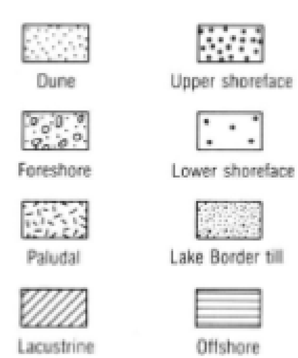
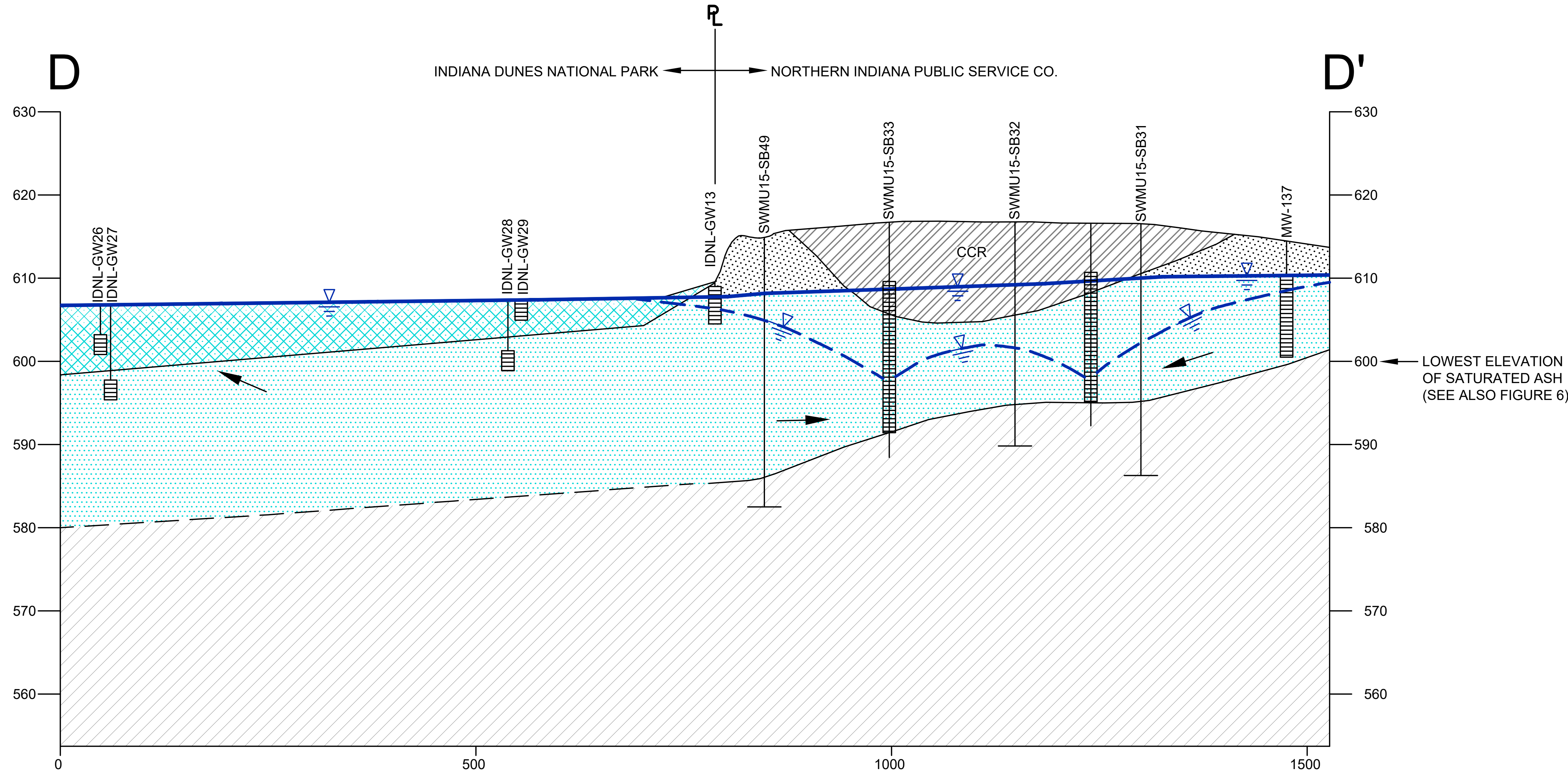
271 Mill Road
Chelmsford, MA 01824
(978) 692-9090

Legend





LEGEND:

- DUNE-BEACH AND LACUSTRINE SAND
- SILT AND CLAY
- GROUNDWATER FLOW DIRECTION
- WATER TABLE MARCH 2015
- ESTIMATED WATER TABLE WITH PUMPING
- COAL COMBUSTION RESIDUAL
- PEAT
- MONITORING WELL/EXTRACTION WELL
- SOIL BORING

NOTES:

1. WATER LEVELS MEASURED BY AMEC FOSTER WHEELER ON MARCH 10 AND 11, 2015.
2. 10 X VERTICAL EXAGGERATION.

HORIZONTAL SCALE: 1" = 150'

0 150 300

0 15' 30'

VERTICAL SCALE: 1" = 15'

CLIENT LOGO

CLIENT:
NORTHERN INDIANA PUBLIC SERVICE COMPANY

PROJECT
NORTHERN INDIANA PUBLIC SERVICE COMPANY
BAILLY GENERATING STATION
CHESTERTON, INDIANA

DRAWN BY: D. DEMPSEY
CHECKED BY: R. JOHNSON
DATUM: NONE
PROJECTION: NONE
SCALE: AS SHOWN

wood.

271 MILL ROAD
3RD FLOOR
CHELMSFORD, MA 01824

TITLE
CROSS SECTION D-D'

DATE: 11/19/2020
PROJECT NO: 3651200111
REV. NO.: A
FIGURE No. 5

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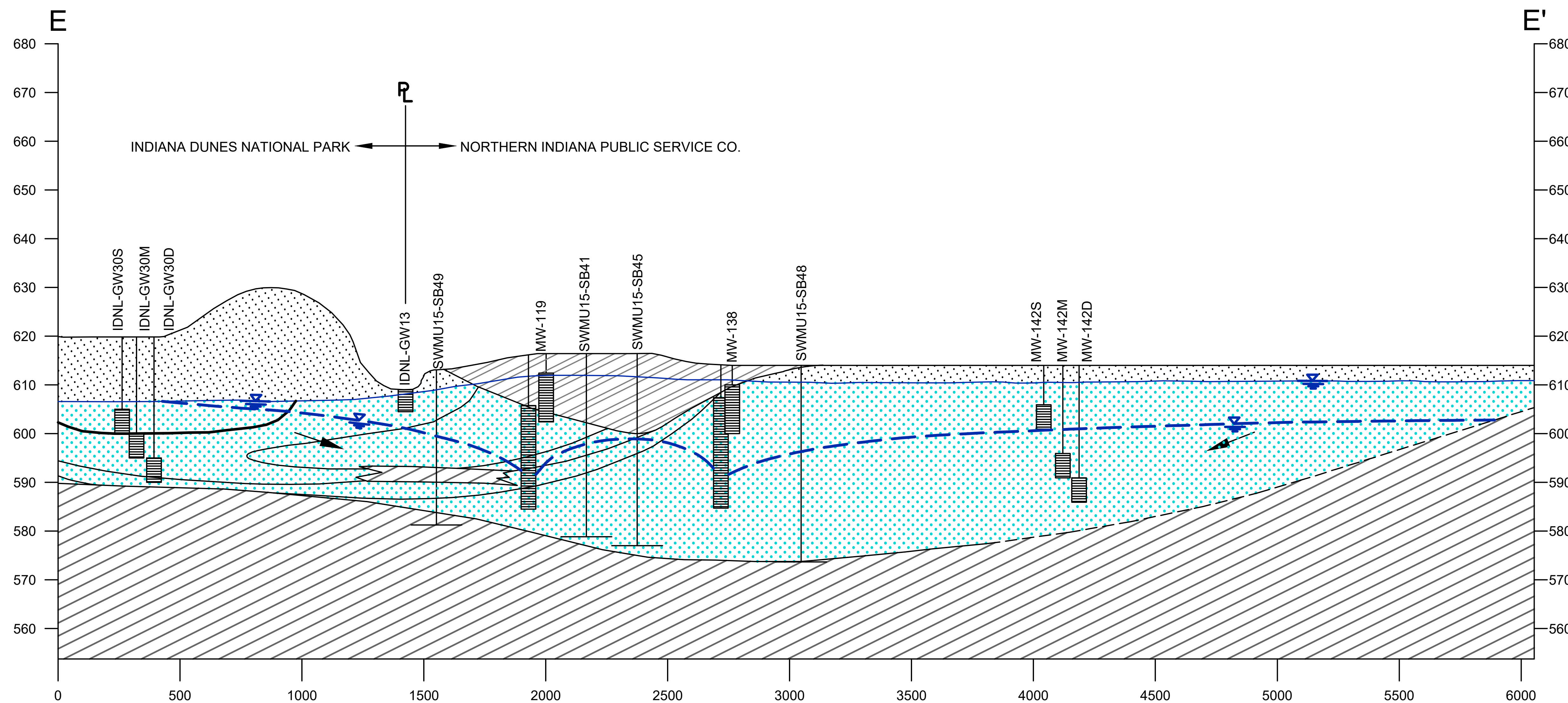

NOTES:

1. WATER LEVELS MEASURED BY AMEC FOSTER WHEELER ON MARCH 10 AND 11, 2015.
2. 20 X VERTICAL EXAGGERATION.

LEGEND:

- DUNE-BEACH AND LACUSTRINE SAND
- SILT AND CLAY
- GROUNDWATER FLOW DIRECTION
- WATER TABLE MARCH 2015
- ESTIMATED WATER TABLE WITH PUMPING
- COAL COMBUSTION RESIDUAL
- PEAT
- MONITORING WELL/EXTRACTION WELL
- SOIL BORING

HORIZONTAL SCALE: 1" = 500' (0, 500', 1000') / VERTICAL SCALE: 1" = 25' (0, 25', 50')	CLIENT LOGO	CLIENT: NORTHERN INDIANA PUBLIC SERVICE COMPANY	DRAWN BY: D. DEMPSEY; CHECKED BY: R. JOHNSON; DATUM: NONE	wood. 271 MILL ROAD, 3RD FLOOR, CHELMSFORD, MA 01824
		PROJECT: NORTHERN INDIANA PUBLIC SERVICE COMPANY BAILLY GENERATING STATION CHESTERTON, INDIANA	PROJECTION: NONE; SCALE: AS SHOWN	TITLE: CROSS SECTION E-E'

DATE: 11/19/2020
PROJECT NO: 3651200111
REV. NO.: A
FIGURE No. 6

C:\Users\dana.dempsey\Documents_Projects\Work from Home Starting 2020-03-18\NiSource\BaillyGeneratingStation\2020-11-19\Figure 6.dwg – Figure 6 – Dec. 01, 2020 4:09pm – dana.dempsey

ATTACHMENT C

EPA SWMU 14 Uncertainties Analysis – January 21, 2021

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 5
77 WEST JACKSON BOULEVARD
CHICAGO, IL 60604-3590

January 21, 2021

VIA ELECTRONIC MAIL

Mr. Dan Sullivan
NiSource Environmental Remediation
801 E. 86th Ave.
Merrillville, Indiana 46410

RE: NIPSCO Bailly Generating Station
Area C Statement of Basis
SWMU 14 Proposed Remedy

Mr. Sullivan:

EPA received a significant number of comments on the Bailly Area C Statement of Basis regarding the proposed path forward for SWMU 14. The RCRA Corrective Action program is mandated to solicit meaningful stakeholder engagement and to take concerns under consideration during remedy selection. Stakeholder comments can result in a re-examination of a proposed remedy and subsequent change to that remedy. The location of the Bailly site is unique in its proximity and contaminant impacts to an ecologically sensitive National Park. Stakeholder input for the Bailly site represents the interests of a National Park and National Natural Landmark and, therefore, has been weighted proportionally as a remedy selection balancing criterion.

Comments were received from the National Parks Conservation Association in collaboration with Save the Dunes, including a technical evaluation by CEA Engineers. Additional comments were also received from Earthjustice in collaboration with Hoosier Environmental Council, Izaak Walton League, Just Transition NWI, NAACP LaPorte County, and NWI Green Drinks, including a technical evaluation by Geo-Hydro, Inc.

EPA has reviewed and considered these stakeholder perspectives and also reviewed SWMU 14's highly unique site-specific conditions. EPA believes there is profound uncertainty associated with multiple lines of evidence relied upon to select the proposed path forward. These lines of evidence are site-specific conditions related to the proximity of the CCR to the National Park and Cowles Bog. EPA will summarize those lines of evidence which we find substantive enough to recommend a presumptive remedy of excavation and off-site disposal in the Final Decision/Response to Comments:

Natural groundwater elevation fluctuations/increasing precipitation:

The current position of coal ash above the water table may not serve to prevent releases of hazardous contaminants over the long term due to fluctuations in the hydrologic environment at this particular location. Increased precipitation regionally and locally serves as a potential infiltration threat as well as a threat to rising groundwater. An unlined and uncapped disposal area in highly conductive sand, over a water table that is naturally subject to wide, somewhat unpredictable swings in elevation, is neither an appropriate nor safe permanent waste disposal site adjacent to a National Park. Given the low risk tolerance of the National Park's ecosystems, hydrologic changes represent a threat even under transient conditions that allow discontinuous releases from SWMU 14. Based on existing groundwater plumes identified downgradient from SWMU 14, it is not necessary for the CCR to be fully or permanently submerged for contaminant migration. This combination of site-specific factors presents significant uncertainty.

Wide swings in hydrologic conditions were noted in the 2014 Revised Risk Assessment for SWMU 14, "Annual precipitation was above average from 2006 through 2009, and as a result the water table in the vicinity of SWMU 14 increased from approximately 604 feet amsl in 2006 to 610 feet amsl in 2009." A groundwater elevation change of six feet over three years demonstrates the uncertainty associated with leaving CCR in place and uncontained next to a hydraulically connected National Park with sensitive wetland ecosystems. These conditions are not consistent with EPA groundwater policy. As stated in the EPA's 2004 *Handbook of Groundwater Protection and Cleanup Policies for RCRA Corrective Action*, "This policy on final cleanup goals for contaminated groundwater is important to protect human health and the environment by ensuring the short- and long-term availability of our Nation's groundwater resources and by preserving and protecting hydraulically connected surface waters and their ecosystems."

Future water table elevation uncertainty appears high based on the Great Lakes Dashboard Project[1], a multi-agency effort to gather and present long-term, basin-scale hydrological and climatological data for the Great Lakes. As presented on the dashboard, the Lake Michigan/Huron basin monthly and annual water level averages are increasing. Both monthly and annual average water levels have been above the lake-wide period of record average (1918-present) and steadily increasing. Though the lake level fluctuations of recent past appear consistent with historic fluctuations, there is concern regarding the increasing magnitude and variability of fluctuations in the future. As stated above, even temporary or discontinuous releases from SWMU 14 into the National Park are problematic.

Increasing precipitation appears to have a more robust and statistically significant trend, according to a NOAA Great Lakes hydrologist EPA consulted. In collaboration with NOAA, the University of Michigan has indicated that, "since 1951, total annual precipitation has increased by 14% in the U.S. Great Lakes region.[2]" Given the hydrologic connection to Lake Michigan and the system's sensitivity to precipitation the fate and transport component of the BERA's uncertainty evaluation is of concern (additional discussion below).

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[1] https://www.glerl.noaa.gov/data/dashboard/portal.html

[2] http://glisa.umich.edu/

Site-specific uncertainty also increases given the rate of groundwater contamination at CCR units across the country, including units where waste is reported to be "more than 5 feet above groundwater." The addition of hydrologic uncertainty in a sandy aquifer that is connected to Lake Michigan raises concerns not just of the waste becoming *fully* saturated in groundwater but also being situated or located at a decreased distance from the water table. As presented in Geo-Hydro's comments:

"The proposed remedy is to leave waste in place, in an unlined and uncapped sand pit on the edge of IDNP with no remediation. This remedy is not protective of the environment. For example, industry claims that about 31% of CCR surface impoundments have bases that are more than 5 feet above groundwater. Yet industry data indicates that 92% of all impoundments have contaminated underlying groundwater above federal standards. This means that most of those impoundments are contaminating groundwater, even those where CCR is more than 5 feet above the water table. Also, groundwater monitoring data publicly posted by utilities in 2018 indicates 76% of CCR landfills are contaminating groundwater."

Regional/local groundwater pumping and Conceptual Site Model:

Regarding hydrologic uncertainty, EPA received public comments associated with local groundwater pumping and its impact on the water table. "*NIPSCO's CCR Assessment of Corrective Measures Study on the Settling Ponds, dated May 1, 2019, indicates that ArcelorMittal withdraws more than 1,000 gallons per minute from multiple wells located south of the CCR units to depress groundwater levels and reduce infiltration into pits and basements in that facility*."

The EPA NIPSCO project manager has consulted with the EPA ArcelorMittal project manager. The pumping scenario that NIPSCO presented in the CCR submittal appears to be incorrect. According to ArcelorMittal, of the 35 dewatering wells that were installed many years ago only one is still in use. The current groundwater pumping that is taking place on that site is not located near the NIPSCO CCR impoundments or SWMU 14. The only dewatering well that is currently in use is pumping groundwater at 15 gallons per minute.

Nonetheless, the concern associated with regional or local groundwater pumping and artificial lowering of the water table is directly connected to the uncertainty analysis. If past practices at ArcelorMittal lowered the water table in the area of SWMU 14, that average historic groundwater level has influenced the conceptual site model and the assumptions used to evaluate fate and transport. If NIPSCO has been basing its CSM assumptions on the presumption that 1000GPM was withdrawn, as suggested in your own CCR submittal, there may be an overall lack of understanding of the groundwater conditions in this area contributing to overall uncertainty.

Absence of groundwater modeling or other quantitative evaluation:

The commenters note the lack of any groundwater modeling to demonstrate potential impacts on waste location relative to groundwater under changing conditions and subsequent impacts to the

National Park. There is also a lack of any modeling associated with increasing precipitation and its impact on the leachability of the CCR. It is reasonable to believe, based upon the SWMU 15 evaluation, that should the CCR come in contact with the water table, have diminished distance to the water table, and/or be subject to increasing precipitation trends, there will be unacceptable risk to the Park. NIPSCO has not demonstrated otherwise.

To that point, the commenters take exception to the use of the SPLP leachate test as a line of evidence to suggest the CCR does not pose a risk to groundwater and downgradient receptors:

"*The Risk Assessment states that SPLP results were used to conclude that SWMU 14 is not a leaching threat to IDNP. It has been widely acknowledged for several years that SPLP "may be inappropriate, or at least not optimal for evaluating the leaching potential of CCRs as they are actually managed." That knowledge is what caused EPA to fund development of alternative test methods such as the Leaching Environmental Assessment Framework (Methods 1313, 1314, 1315, 1316).*

Research has shown that where SPLP is used, a dilution factor should not be applied. The plume evaluation described in the SWMU 14 risk assessment concludes by stating "When an appropriate dilution factor is applied to the SPLP leachate concentrations, the resulting groundwater concentrations are predicted to be less than the site-specific background for all metals." SPLP test results, some of which have had a dilution factor of up to 20x applied, should not be considered as evidence of a lack of ecological risk."

The Agency acknowledges that NIPSCO did not utilize the LEAF methodology until later in the project while evaluating SWMU 15. LEAF methods, although in development for a long time, were not validated and finalized by EPA until 2017. The methods were available in a 2010 EPA document, Background Information for the Leaching Assessment Framework (LEAF) and some private laboratories started supporting those methods around 2012. However, the methods were not finalized by EPA until later and therefore not used at the time of the SWMU 14 investigation.

It is nonetheless noted as an additional line of uncertainty associated with our overall confidence in the future leachability of CCR at SWMU 14. This is especially the case given the extensive use of CCR in the development of the inorganic method for LEAF.

Site-Specific Uncertainty and the Baseline Ecological Risk Assessment

EPA finds the above lines of evidence relevant to the uncertainty section of the Baseline Ecological Risk Assessment. The proximity of this contaminant source to a National Park, for the reasons discussed above, presents a significant uncertainty for the risk assessment. EPA's ecological risk assessor, Jennifer Dodds, has provided the following observations regarding the BERA's uncertainty section:

> An extensive and comprehensive ecological risk assessment (ERA) was completed as part of the overall risk evaluations at the NIPSCO Facility over the course of many years. In particular, the baseline ecological risk assessment (BERA) used site specific information, including plant toxicity studies and amphibian surveys, along with

appropriate assumptions and input parameters to evaluate the potential risks to ecological receptors at the facility and in the neighboring Indiana Dunes National Lakeshore (IDNL). Assessing risks to ecological receptors at any site always involves a certain degree of uncertainty due to the lack of absolute scientific knowledge and cannot be eliminated from the evaluations conducted in this BERA or any risk assessment. Some of the areas of greatest uncertainty within the BERA as it relates to SWMU 14 surround the fate and transport processes of the contaminants of concern (COCs) in the various environmental media and the relevant exposure pathways for those COCs from SWMU 14 to each potential receptor and habitat area.

SWMU 14 was believed to operate from 1962 to 1986 and does not contain a cap or liner. Infiltration of precipitation through soil and the coal combustion residuals (CCR) allows some metals to dissolve into soil pore water, which eventually migrates downward to the water table and ultimately towards IDNL. During times of high groundwater elevation, groundwater-to-surface water discharge likely occurs within low-lying interdunal areas. Boron and other COCs were detected in groundwater downgradient of SWMU 14 and SWMU 15 although the concentrations in groundwater downgradient of SWMU 14 were much lower than observed in groundwater downgradient of SWMU 15. The ERA estimated hazard quotients (HQs) slightly above 1 for arsenic, boron and manganese in both soil and groundwater. EPA has determined that chemicals with a HQ above 1 present a potential for adverse effects. For those COCs, additional site-specific information was considered in the risk management decision and an evaluation of all the lines of evidence at that time supported the risk determination that SWMU 14 does not pose unacceptable risk to the survival, growth, reproductive success or population sustainability of ecological populations in the IDNL. More specifically, after extensive study of the area, the location of the CCR above the water table, the SPLP data, and the groundwater monitoring, results indicated that SWMU 14 was not a significant leaching threat to either the IDNL or Lake Michigan.

The conclusions of the BERA were used by the project manager in concert with other data gathered throughout the facility investigations to propose risk management cleanup decisions for SWMU 14. The specific balancing criteria considered in the decision making process that most directly relate to the ongoing uncertainty seen at SWMU14 are the long-term reliability, effectiveness and implementability (including community and state acceptance) of the remedy along with the amount of reduction in toxicity, mobility and volume of COCs provided by a given remedy. The public comments received indicate that the level of community acceptance of the proposed remedy for SWMU 14 is low, due in part to the uncertainties already described. The ongoing uncertainties surrounding the fate and transport of the COCs coupled with the detections of those COCs in the groundwater, and in light of low community acceptance, should compel a reevaluation of the remedy decision. Community acceptance is of critical importance here due to the current and potential future impacts to a National Park and a congressionally designated National Natural Landmark.

Corrective Action Principles, Policy and Guidance

A basic operating principle of the Corrective Action program is risk-based decisions, as articulated in the May 1, 1996 Advance Notice of Proposed Rulemaking (ANPR):

> "Risk-based decision making is especially important in the corrective action program, where it should be used to ensure that corrective action activities are fully protective given reasonable exposure assumptions and consistent with the degree of threat to human health and the environment at the given facility."

The inherent uncertainties of evaluating risk, in combination with site-specific variables, are recognized within the uncertainty analysis of a risk assessment. As described in EPA's 1992 *Framework for Ecological Assessment*, "uncertainty analyses provide the risk manager with an insight into the strengths and weaknesses of an assessment" and "can serve as a basis for making rational decisions regarding alternative actions…"

The guidance also discusses several major sources of uncertainty including the conceptual model formulation and natural variability. "If incorrect assumptions are made during conceptual model development regarding the potential effects of a stressor, the environments impacted, or the species residing within those systems, then the final risk assessment will be flawed." As indicated by the stakeholders, the potential future impacts of increased precipitation and water table fluctuations on the leaching of contaminants from CCR into the National Park represents a significant CSM uncertainty. As acknowledged in the 1992 *Ecological Assessment* guidance, natural variability includes "weather patterns" and is an area of uncertainty that can be "described but not reduced." The uncertainty section of a risk assessment is, therefore, equally important as exposure or toxicity in scenarios where the threshold of acceptable risk is so low. EPA finds the combination of uncertainties discussed here as a compelling reason to proceed with source control.

Another basic operating principle of the Corrective Action program is the evaluation of remedial alternatives against the established threshold and balancing criteria. The stakeholders have presented a position based upon the abundance of uncertainty that the threshold criteria would not be met at SWMU 14 if the "no remedy" alternative had been evaluated. The overwhelming weight of uncertainty makes it difficult to assess the protection of human health and the environment into the future. Sustained achievement of the media cleanup objectives is unknown given potential future leaching events. Final remedies must consider protection of resources both now and into the future. The National Park conservation and recreational uses are the reasonable future land use in perpetuity and must be afforded the greatest level of protection.

EPA's groundwater handbook clearly emphasizes the importance of these threshold criteria in protecting the "Nation's groundwater resources and by preserving and protecting hydraulically connected surface waters and their ecosystems." The attainment of media cleanup objectives is further described in the handbook, "Protecting the environment means, among other things, considering the ecological setting at and around a facility in evaluating and selecting final remedies. This is especially important for groundwater remedies where contaminated groundwater discharges into surface water."

The level of uncertainty associated with long-term protectiveness and remedial attainment compliance directly impacts SWMU 14's potential risk to the Park. In light of the low community acceptance informed by multiple lines of evidence, the EPA finds the lack of source control to be unacceptable. As stated in the groundwater handbook, "EPA expects facilities to control or eliminate surface and subsurface sources of groundwater contamination as necessary to protect human health and environment. In controlling sources, EPA prefers approaches that lead to permanent reductions in toxicity, mobility, or volume. Additionally, EPA expects that treatment will be used to address source materials considered to be "principal threats" …" It is reasonable to conclude the contaminants in SWMU 14 are "principal threats" based upon similar waste material in SWMU 15 and given additional leaching to groundwater will present comparable risks to the National Park in time.

The Corrective Action program is charged with incorporating meaningful stakeholder engagement at every site, as expressed in the ANPR and re-iterated throughout much of the program's guidance. At this site, stakeholder engagement represents a national interest. The Indiana Dunes National Park contains globally rare ecosystems preserved as a remnant of a once vast environment. With over 1,100 flowing plant species, the biological diversity of this newly designated National Park is fourth among all of our national parks. The balance of preservation requires a vigilance toward future degradation, which we believe is possible if CCR is left in SWMU 14.

As suggested at the beginning of this letter, EPA is willing to proceed with excavation and off-site disposal of the CCR in SWMU 14 as a presumptive remedy. The consistency of such a remedy with the unsaturated component of SWMU 15, along with the finality excavation offers, provides EPA with the opportunity to proceed without an alternatives analysis. We believe the time and resources spared by doing so is considerable. Please don't hesitate to contact me with questions or concerns.

Thank you,

Michelle Kaysen

Michelle Kaysen
Corrective Action, Remediation Branch
Land, Chemicals and Redevelopment Division

e-cc: Mary Fulghum, EPA ORC
Jose Cisneros, EPA LCRD
Dan Deeb, Schiff Hardin
Russ Johnson, Wood
Charles Morris, National Park Service
Dan Plath, National Park Service

ATTACHMENT D

Comments on the Statement of Basis for Area C

Submitted by:

Southern Environmental Law Center

National Parks Conservation Association in collaboration with Save the Dunes, including a technical evaluation by CEA Engineers

Earthjustice in collaboration with Hoosier Environmental Council, Izaak Walton League, Just Transition NWI, NAACP LaPorte County, and NWI Green Drinks, including a technical evaluation by Geo-Hydro, Inc.

October 19, 2020

By Email

Kirstin Safakas
EPA Community Involvement Coordinator
U.S. Environmental Protection Agency, Region 5
77 West Jackson Boulevard
Mail Code: EC-19J
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Safakas.kirstin@epa.gov

Re: Comments on the Statement of Basis for Area C of the Northern Indiana Public Service Company Bailly Generating Station, Chesterton, Indiana

Dear Ms. Safakas:

The following groups, Hoosier Environmental Council, Izaak Walton League, Just Transition NWI, NAACP LaPorte County Branch, Earthjustice and NWI Green Drinks, write to comment on the U.S. Environmental Protection Agency's (EPA) "Statement of Basis for Area C of the Northern Indiana Public Service Company Bailly Generating Station."[1] This submission includes the technical comments of Mark Hutson, P.G., attached hereto as Appendix 1. We also express our concurrence with the comments submitted by the National Parks Conservation Association (NPCA) and Southern Environmental Law Center (SELC).

First, we want to express our appreciation of the efforts of EPA Region 5 to make this a transparent and inclusive process, to establish clear and effective lines of communication between agency staff and the public, and to solicit public participation in an open and meaningful manner. Second, we appreciate the diligent efforts by EPA over the course of many years to investigate and evaluate this site and its impact on Indiana Dunes National Park.

The corrective action at issue concerns the dumping of coal combustion waste (coal ash) by the NIPSCO Bailly Generating Station in unlined pits, near or into groundwater, in an ecologically sensitive area along the shore of Lake Michigan bordering Indiana Dunes National Park. In 2005, EPA and NIPSCO entered into an Administrative Order on Consent requiring NIPSCO to investigate and clean up coal ash contamination released at its property and causing harm to the adjacent park. EPA issued the order under the authority of Section 3008(h) of the Resource Conservation and Recovery Act (RCRA). EPA's RCRA Corrective Action program, administered at this site by EPA Region 5, oversees the cleanup of the facility. According to EPA, the Corrective Action program "is responsible for ensuring that facilities investigate and clean up releases of hazardous waste and hazardous constituents at their properties and any

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[1] US EPA, Region 5, Statement of Basis for Area C, Northern Indiana Public Service Company (NIPSCO), Bailly Generating, Chesterton, Indiana, EPA ID No. 000 718 114 (2020).

releases that have spread beyond the property boundaries, which may pose a risk to human health or the environment."[2]

After more than a decade of data collection and evaluation, EPA has proposed in the Statement of Basis an approach to remediate the coal ash, contaminated soil and contaminated groundwater at Area C of the Bailly Generating Station. In summary, Area C includes two former NIPSCO coal ash landfills, the North and South Landfills, called Solid Waste Management Units (SWMU) 14 and 15, respectively. According to NIPSCO's Baseline Ecological Risk Assessment, NIPSCO initiated dumping coal ash in the landfills in 1962 and continued to 1986 in SWMU 14 and to 1979 in SWMU 15.[3] At the South Landfill known as SWMU 15, coal ash remains in contact with groundwater and has generated a toxic plume that has harmed globally significant and ecologically sensitive areas of Indiana Dunes National Park.

We have measured the adequacy of the proposed corrective action in the Bailly Statement of Basis against EPA's three remedial "Threshold Criteria" for RCRA corrective action, which are set forth in EPA guidance.[4] EPA's Threshold Criteria require that all corrective actions:

1. Protect human health and the environment based on reasonably anticipated land use(s), both now and in the future;
2. Achieve media cleanup objectives appropriate to the assumptions regarding current and reasonably anticipated land use(s), and current and potential beneficial uses of water resources; and
3. Control the sources of releases to achieve elimination or reduction of any further releases of hazardous wastes or hazardous constituents that may threaten human health and the environment.

As explained in detail in the attached expert comment, and as supported by the comments of NPCA and SELC, we find that EPA's Statement of Basis falls short of meeting all the criteria. Specifically, the Bailly Statement of Basis:

1. Does not protect human health and the environment from the contaminants released and to be released from coal ash disposed in the former North Landfill (SWMU 14);
2. Cannot achieve now or in the future the Great Lakes Initiative standards for groundwater quality due to uncertainty concerning the leaching of hazardous contaminants from the former North Landfill (SWMU 14); and
3. Does not control the source of releases from disposed coal ash in the former North Landfill (SWMU 14), and consequently the coal ash may continue to threaten the ecologically sensitive dune ecosystem with hazardous releases.

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[2] *Id.* at 1.
[3] AMEC, 2011, Baseline Ecological Risk Assessment for Area C, NIPSCO Bailly Generating Station, RCRA Corrective Action Program, EPA ID # 000 718 114, Chesterton, Indiana, April 29, 2011 at 3-2.
[4] U.S. EPA, Solid Waste and Emergency Response, Handbook of Groundwater Protection and Cleanup Policies for RCRA Corrective Action, EPA530-R-04-030, April 2004 at 4.1 *See also*, U.S. EPA, Final Remedy Selection for Results-Based RCRA Corrective Action, Fact Sheet #3, March 2000 at 2.

We arrive at this conclusion based on the following findings, which are explained in detail in our technical comments:

1. **Failure to Determine the Impact of Groundwater Pumping:** Aggressive groundwater pumping at multiple wells at the adjacent ArcelorMittal steel plant located south of Area C is currently impacting groundwater flow from SWMU 14. Additional evaluation of the direction of groundwater flow is needed to understand how this pumping is currently impacting the transport of coal ash contaminants. Evaluation is also needed to determine the impact of the cessation of such pumping. Cessation may cause an increase in the groundwater level at SWMU 14, resulting in coal ash coming in contact with groundwater, and may impact flow direction, thereby increasing risk to Indiana Dunes National Park.

2. **Failure to Remediate Coal Ash at the former North Landfill (SWMU 14):** For the following reasons, the failure to remediate SWMU 14 may result in additional hazardous releases and creates an ongoing threat to Indiana Dunes National Park:

   - *Uncertainty regarding the future level of the groundwater table:* The current position of coal ash above the water table will not serve to prevent releases of hazardous contaminants over the long term due to fluctuations in the water table as a result of precipitation and potential changes in pumping of groundwater at the ArcelorMittal plant. An unlined and uncapped hole in the sand, over a water table that is artificially depressed by nearby pumping and naturally subject to wide swings in elevation, is neither an appropriate nor safe permanent waste disposal site.

   - *Use of an inappropriate leach test for coal ash:* EPA has acknowledged for more than a decade that the Synthetic Precipitation Leaching Procedure (SPLP) is not reliable for evaluating the leaching potential of coal ash and tends to underestimate the leaching of certain hazardous contaminants. The Statement of Basis, however, relies on SPLP test results as evidence of a lack of ecological risk from SWMU 14. Such conclusions are unreliable.

   - *The magnitude and extent of contaminant plumes from wastes disposed at SWMU 14 were not evaluated.* Gaps in groundwater monitoring data indicate that contaminant plumes, including boron and selenium, have not been adequately investigated in violation of 40 C.F.R. § 264.100(d). Leaving SWMU 14 with no applied remedy is simply letting disposed coal ash continue to leach as water infiltrates into and through the waste, and groundwater is contaminated. The absence of a groundwater monitoring program compounds this deficiency. Ash contaminants will continue to migrate into Indiana Dunes National Park, either attenuating to soils and wetland sediments, or discharging into surface water.

3. **Excavation and off-site disposal of the coal ash from SWMU 14 must be considered.** Rather than leaving the coal ash in place to continue leaching contaminants into

groundwater, excavation and off-site disposal of the ash would be the most protective remedial alternative.

4. **The proposed remedy for SWMU 15 is likely to be effective.** Excavation and off-site disposal of coal ash located above the water table and solidification and stabilization of coal ash located below the water table is likely to be effective in reducing migration of contaminants from the site. The effectiveness of the proposed remedy must, nevertheless, be ascertained by long-term monitoring.

5. **Dewatering and removal of coal ash disposed in groundwater is effective and can be done safely.** We understand EPA's reluctance, in this specific setting, to dewater SWMU 15 sufficiently to safely excavate coal ash located below the water table due to its ecologically-sensitive location. EPA should clarify, however, that this is a site-specific restriction on the remedy that would not likely apply to any other coal ash sites. Coal ash has been and continues to be removed from groundwater at sites across the nation, resulting in effective, long-term cleanups.

6. **The procedures employed to remove coal ash from the Greenbelt and Eastern Wetland areas must ensure complete excavation.** The proposed remedy for the Greenbelt and Eastern Wetland area appears likely to be appropriate and protective of the environment. The protectiveness of this remedy will, however, depend on the procedures used to distinguish between coal ash and unimpacted native materials.

7. **MNA can only be employed in conjunction with effective source control measures.** MNA is not an appropriate option at sites with uncontrolled contaminant sources. In the case of SWMU 14, the source is proposed to remain uncontrolled, even though the previous investigations directly attributed at least two contaminant plumes (boron and selenium) to coal ash located in SWMU 14. Therefore MNA cannot be proposed as a remedy for SWMU 14.

8. **Public comment on remedy implementation and the long-term stewardship plan is essential.** Commenters request that EPA continue its effective outreach to concerned groups and citizens for evaluation of undetermined aspects of the remedy and the Long-Term Stewardship Plan.

Thank you for this opportunity to comment on the Bailly Statement of Basis. We appreciate the efforts of Region 5 to make this a transparent and inclusive process. If you have any questions regarding this submission, please contact Indra Frank, Hoosier Environmental Council, IFrank@hecweb.org, 317-981-3207.

Respectfully submitted:

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APPENDIX 1

October 19, 2020

Review of Statement of Basis for Area C

Northern Indiana Public Service Company (NIPSCO)
Bailly Generating Station

At the request of Earthjustice, Mr. Mark Hutson, P.G. of Geo-Hydro, Inc. (GHI) has reviewed the Statement of Basis report and associated documents on the Bailly Generating Station (BGS), located in Chesterton, IN. The Statement of Basis was prepared by the United States Environmental Protection Agency (EPA) to document the proposed approach to remediation of impacts from storage and disposal of coal combustion residuals (CCR) at BGS as well as impacts to environmental resources at Indiana Dunes National Park (IDNP).

Area C of the BGS includes several individual components including solid waste management unit (SWMU) 14, SWMU 15, a greenbelt buffer that separates BGS from IDNP, and affected areas on the IDNP. The Baseline Ecological Risk Assessment for Area C describes CCR being placed in the North and South Landfills located on the eastern portion of the BGS property.[1] The waste disposal units once identified as North and South Landfills are now identified as SWMU 14 and SWMU 15, respectively. It appears that the practice of placing CCR in the North and South Landfills was followed from 1962 when the plant started operating until 1979 at SWMU 15, and 1986 at SWMU 14.[2]

Groundwater is generally described as flowing through the shallow sand aquifer to the north, toward discharge areas in Lake Michigan. Water table maps from 2012[3] and 2018[4] are provided in Attachment 1. Review of these maps show that while there is indeed an apparent northwest flow of groundwater across parts of SWMU 14, there appears to be an undefined lowering of the water table along the south side of the property, likely associated with groundwater withdrawals on the adjacent ArcelorMittal steel plant. NIPSCO's CCR Assessment of Corrective Measures Study on the Settling Ponds, dated May 1, 2019, indicates that ArcelorMittal withdraws more than 1,000 gallons per minute from multiple wells located south of the CCR units to depress groundwater levels and reduce infiltration into pits and basements in that facility.[5] This information helps explain the irregular groundwater contours and indications of southerly groundwater flow shown on the 2012 and 2018 water table maps. More complete and representative determination of the direction of groundwater

[1] AMEC (2011), p. 1-2
[2] AMEC (2011), p. 3-2
[3] AMEC (2014), Figure 2-1
[4] Golder (2019), Figure 6
[5] Golder (2019), p. 5

flow across the entire facility and adjoining properties is needed to understand how groundwater flow transports CCR contaminants now and will continue to do so in the future.

EPA and NIPSCO have spent many years investigating the magnitude and extent of environmental impacts from NIPSCO waste handling practices. This document discusses the remedial actions, or lack thereof, proposed to address NIPSCO's environmental impacts. The proposed remedial actions for each component of Area C are discussed below.

SWMU 14

SWMU 14 (previously called the North Landfill) is an unlined and uncapped area, approximately 3.4 acres in size, used to dispose of fly ash and bottom ash. The 2010 Final RCRA Facility Investigation (RFI) for Area B attributes aluminum, cadmium, and manganese plumes to undefined areas in Area C, and specifically attributes boron and selenium plumes to SWMU 14 in Area C.[6] Maps from the RFI showing the extent of the boron and selenium groundwater plumes attributed to soluble metals leaching from wastes disposed in SWMU 14 are provided in Attachment 2.

The Statement of Basis for Area C includes no remedy for SWMU 14. The document states:

> *CCR also was disposed in SWMU 14, but unlike SWMU 15, the CCR was not placed below the water table. Because the CCR in SWMU 14 does not contact groundwater, it does not substantially impact the groundwater. EPA evaluated the potential risk to both human health and ecological receptors associated with SWMU 14 and determined SWMU 14 did not pose an unacceptable risk to any receptor. Consequently, this proposed remedy does not include SWMU 14. The entire Facility, including SWMU 14 of Area C, will be managed with institutional controls to control use of land and groundwater. The Facility will also require long-term stewardship.*

The statement that SWMU does not substantially impact groundwater conflicts with the findings of the RFI. In order to understand how EPA could reach such a decision, I reviewed the 2014 Revised Risk Assessment for SWMU 14. That document indicates:

> *The position of the coal combustion residuals (CCR) above the water table, the Synthetic Precipitation Leaching Procedure (SPLP) data and the groundwater monitoring results indicate that SWMU 14 is not a leaching threat to the IDNL.*[7]

Each of the above points is considered below.

<u>CCR Position Relative to the Water Table</u> – It is known that the water table elevation in the vicinity of SWMU-14 increased by six feet between 2006 and 2009 in response to increased precipitation.[8] This shows that the elevation of the water table beneath SWMU 14 is very responsive to precipitation variability. Given the currently observable and predicted future changes to the climate,

[6] AMEC (2010 a), pp. 6-9 to 6-10
[7] AMEC (2014), p. ES-1
[8] AMEC (2014), p. 1-3

the assumption that groundwater will remain below the bottom of the wastes disposed in SWMU 14 is overly optimistic. This questionable optimism is compounded by the fact that the elevation of the water table beneath SWMU 14 appears currently to be depressed by withdrawals of groundwater on the adjacent ArcelorMittal plant. There is no guarantee that groundwater withdrawals of over 1,000 gallons per minute will continue indefinitely into the future.

There is no indication that modeling of BGS groundwater has been conducted to evaluate the elevation of the water table in the future should pumping on the adjacent property cease and precipitation again increase. An unlined and uncapped hole in the sand, over a water table that is artificially depressed by nearby pumping and naturally subject to wide swings in elevation, is neither an appropriate nor safe permanent waste disposal site.

<u>SPLP Results</u> – The Risk Assessment states that SPLP results were used to conclude that SWMU 14 is not a leaching threat to IDNP. It has been widely acknowledged for several years that SPLP "may be inappropriate, or at least not optimal for evaluating the leaching potential of CCRs as they are actually managed."[9] That knowledge is what caused EPA to fund development of alternative test methods such as the Leaching Environmental Assessment Framework (Methods 1313, 1314, 1315, 1316).

Research has shown that where SPLP is used, a dilution factor should not be applied.[10] The plume evaluation described in the SWMU 14 risk assessment concludes by stating "When an appropriate dilution factor is applied to the SPLP leachate concentrations, the resulting groundwater concentrations are predicted to be less than the site-specific background for all metals."[11] SPLP test results, some of which have had a dilution factor of up to 20x applied, should not be considered as evidence of a lack of ecological risk.

<u>Groundwater Monitoring Results</u> - The groundwater monitoring results should be viewed as at best inconclusive. There is only one assumed downgradient monitoring well on the site that is not partially screened in ash. The evaluation of the impacts on groundwater quality at SWMU 14 did not acknowledge that contaminant plumes originating in SWMU 14 were identified in the RFI for Area B. The magnitude and extent of contaminant plumes from wastes disposed at SWMU 14 are not evaluated. One downgradient well on the boundary of the waste unit is clearly insufficient to delineate the previously identified contaminant plumes and to identify the range of contaminant concentrations migrating from the site.

The proposed remedy is to leave waste in place, in an unlined and uncapped sand pit on the edge of IDNP with no remediation. This remedy is not protective of the environment. For example, industry claims that about 31% of CCR surface impoundments have bases that are more than 5 feet

[9] Kossen, et al (2009), p. 18. *See also*, U.S. Environmental Protection Agency, Hazardous and Solid Waste Management System; Disposal of Coal Combustion Residuals from Electric Utilities; Final Rule, 80 Fed. Reg. 21,302 (April 17, 2015) at 21,321.
[10] Townsend, Dubey, and Tolaymat (2006)
[11] AMEC (2014), p. 2-10

above groundwater.[12] Yet industry data indicates that 92% of all impoundments have contaminated underlying groundwater above federal standards. This means that most of those impoundments are contaminating groundwater, even those where CCR is more than 5 feet above the water table. Also, groundwater monitoring data publicly posted by utilities in 2018 indicates 76% of CCR landfills are contaminating groundwater.[13] While the percentage of landfills with bottoms above groundwater is not known, it is certainly higher than CCR impoundments. So the same conclusion applies. Widespread evidence indicates that separation from groundwater does not mean groundwater will not be contaminated. Leaving SWMU 14 with no applied remedy is simply letting disposed coal ash continue to leach as water infiltrates into and through the waste and groundwater is contaminated.

Ash contaminants will continue to migrate into the IDNP, either attenuating to soils and wetland sediments, or discharging into surface water. Attenuation of metals on subsurface soils and wetland sediments, possibly to quite high concentrations, will occur over time as long as soluble metals are allowed to be leached from disposed coal ash. While it is often, but not always, difficult to detect contamination in surface water caused by discharging CCR contaminants, detailed sampling of the sediment and/or porewater at the bottom of a surface water body or wetland can detect metals that have precipitated from solution or attached to sediments as groundwater flows into sediment. Metals contained in released CCR leachate can accumulate to elevated concentrations in bottom sediments while contamination of surface water remains undetectable due to high dilution.

A report on sampling conducted at the Dominion Chesapeake Energy Center by AMEC[14] is provided in Attachment 3. The AMEC report concludes with the following statement: "Arsenic sequestration on iron-bearing geomedia is attenuating dissolved arsenic concentrations outside the landfill and peninsula boundaries." In fact, arsenic transported from the site in groundwater was detected in porewater and sediments at the bottom of the river at concentrations up to 452.2 ug/l and 8.2 mg/kg, respectively. While arsenic is not apparently an issue at this site, the principle still applies.

Identification of specific mechanisms that attenuate contaminants and locations where attenuation occurs should be conducted for plumes migrating from SWMU 14 and SWMU 15. These investigations are needed in order to determine if CCR contaminants accumulating in sediments will pose a threat to the ecology of IDNP.

Under current conditions, with groundwater maintained below the CCR, placing a cap over the disposed ash would reduce release of contaminants. Under future conditions, if increasing precipitation and/or a reduction or termination of pumping on the adjacent property results in increased groundwater elevation beneath SWMU 14, a cap-in-place scenario should not be expected to be protective of downgradient water quality. Excavation and off-site disposal of the coal ash from

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[12] Environmental Integrity Project & Earthjustice, 2019, p. 5

[13] *Id.*

[14] AMEC(2010 b) (Attachment 3).

SWMU 14 rather than leaving the waste in place to continue leaching contaminants into groundwater would be the most protective remedial alternative.

SWMU 15

SWMU 15 (previously called the South Landfill) is an unlined and uncapped area used to dispose of fly ash and bottom ash. The largest of the CCR disposal areas, SWMU 15 is thought to contain approximately 178,000 cubic yards of CCR. Approximately 92,000 cubic yards are located above the water table and the remaining 86,000 cubic yards are located below the water table.[15] EPA concluded that SWMU 15 posed unacceptable ecological risks to various ecological receptors and specified that an acceptable decision would include source control, limited off-site remediation, and long-term monitoring.[16]

The proposed final remedy for SWMU 15 consists of a combination of excavating and transporting unsaturated CCR for off-site disposal, and in-situ solidification of saturated CCR by mixing Portland cement into the waste and allowing the mixture to cure in place. Solidification of the waste with Portland cement should reduce the hydraulic conductivity and leachability of the resulting solid material.[17] Reductions in the hydraulic conductivity and leachability of the mass should prove effective in reducing, but not eliminating release of contaminants to the environment.

The proposed remedy of excavation and off-site disposal of wastes located above the water table and solidification and stabilization of wastes located below the water table is likely to be effective in reducing migration of contaminants from the site. However the discussion of the rationale for selecting this remedy seems to imply[18] that concerns over worker safety, along with the high volume of groundwater that would need to be removed in order to facilitate safe excavation were critical factors in this decision. EPA should make clear that excavation of coal ash from below the water table is being safely completed at many facilities where adequate dewatering of CCR is conducted.[19] In this setting the reluctance to dewater the system sufficiently to safely excavate CCR located below the water table is understood. It should be made clear however, that this is a site-specific restriction on the remedy that would not likely apply to any other CCR sites.

Considering that this remedy will leave wastes in place below the groundwater, and dependent on the stability of the solidified mass to contain contaminants, an extended period of performance monitoring should be required. Long term monitoring of groundwater needs to be robust to verify that the solidification works initially and its ability to sequester CCR contaminants continues into the future as the solidified waste ages and weathers in place. The performance of the remedy should be

[15] USEPA (2020), p. 19
[16] USEPA (2020), p. 14
[17] USEPA (2020, p. 19
[18] USEPA (2020), p. 19
[19] Previously saturated coal ash disposed in impoundments below the water table has been or is in the process of being excavated from most of the CCR impoundments in multiple states including all of the coal-fired generation facilities in North Carolina and South Carolina.

monitored for a minimum of 30 years and until such time as CCR-related contaminants are no longer detectable in the groundwater downgradient of the waste.

Greenbelt and Eastern Wetland

During the investigation of Area C, an area containing approximately 705 cubic yards of CCR that had been accidentally deposited on the Greenbelt outside of SWMU 15 was discovered. The proposed remedy for this area is excavation and off-site disposal of CCR to an anticipated depth of approximately 3.5 feet. The excavated area will then be reclaimed with imported native dune sand and topsoil from an approved borrow pit. Following CCR removal and reclamation of the area, EPA is recommending that the area be monitored for 10 events over a period of 5 years, as part of the long-term stewardship plan.

The proposed remedy for the Greenbelt and Eastern Wetland area appears likely to be appropriate and protective of the environment. The protectiveness of this alternative will however depend on the procedures used to distinguish between CCR and unimpacted native materials. The public should be provided the opportunity to review and comment on detailed plans for implementing all proposed remedies.

IDNP Groundwater

Contamination of IDNP groundwater considered in the Statement of Basis for Area C consists solely of elevated boron concentrations downgradient of SWMU 15. Although it is clear that SWMU 14 is also adding some amount of leached metals to IDNP groundwater[20] and SWMU 15 is adding contaminants other than boron, boron is the only groundwater constituent considered. The proposed remedy for IDNP groundwater is monitored natural attenuation (MNA) with source control. In the case of SWMU 15, the selected source control appears to be technically appropriate. In the case of SWMU 14, however, the source is proposed to remain uncontrolled, even though the RFI report directly attributed at least two contaminant plumes (boron and selenium) to wastes located in SWMU 14. It is unclear why contaminant plumes identified in the Area B investigation sourced at SWMU 14 are not addressed. MNA is not an appropriate choice at sites with uncontrolled contaminant sources.

If left unaddressed, CCR-related contaminants will continue to migrate onto IDNP (if flow directions are correctly understood) from SWMU 14. Ash contaminants will continue to migrate into the IDNP, either attenuating to soils and wetland sediments, or discharging into surface water. Attenuation of metals on subsurface soils and wetland sediments, possibly to quite high concentrations, will likely occur over time as long as soluble metals are allowed to be leached from disposed coal ash. While it is often, but not always, difficult to detect contamination in surface water caused by discharging CCR contaminants, detailed sampling of the sediment and/or porewater at the bottom of a surface water body or wetland can detect metals that have precipitated from solution or attached to sediments as groundwater flows into sediment. Metals contained in released

[20] See plume maps in Attachment 2.

CCR leachate can accumulate to elevated concentrations in bottom sediments while contamination of surface water remains undetectable due to high dilution. An example of a site where accumulation of high concentrations of CCR-related arsenic in river bottom sediments is described is provided as Attachment 3.

The application of MNA on boron is problematic in any environment. Numeric models used to estimate transport of boron with groundwater flow routinely model boron with little attenuation on native materials. It is likely that the only MNA mechanisms that will attenuate boron in the sandy substrate of IDNP are dispersion and dilution. Relying on dispersion and dilution of contaminants of concern does not achieve EPA's stated preference for remedies that remove or destroy contaminant mass.[21]

Implementation Plans

Detailed implementation plans will presumably be produced at some point in the future prior to actions being taken in the field. EPA should provide an opportunity for the public to review and comment on detailed implementation plans that will describe in detail plans and procedures to be followed during remedy implementation. Items of particular interest and concern that must be included in the planning documents include:

- Detailed descriptions of how remedies will be implemented.
- Details of testing or processes used to distinguish CCR from native materials and verify that the extent of waste is known and removed, as required.
- Details of fugitive dust control measures and air monitoring that will be required to protect the public from fugitive dust generated during site remediation, including making air monitoring results readily available for public review.

Long Term Stewardship

The discussion of Long Term Stewardship indicates that NIPSCO must ensure that all controls and long-term remedies are maintained and operate as intended. The discussion indicates that the Long Term Stewardship Plan will include:

- Institutional Control Implementation and Assurance Plan;
- Five-year remedy review procedures, operation, maintenance, and monitoring details;
- Annual certification that all controls, including institutional controls, are in place and remain effective; and
- Long term review and inspection of remedies on a five-year basis.

What is not described is the duration of the required Long Term Stewardship program. Solid waste facilities are generally committed to providing long term operation and maintenance of facilities for

[21] USEPA (2015), p. 7

a minimum of 30-years after closure. There is no indication of the minimum length of time that the Long Term Stewardship program will continue. It should also be made clear that ongoing Long Term Stewardship information such as environmental monitoring data will be made readily available for public review and comment.

Summary of Findings

1. The adjacent ArcelorMittal steel plant withdraws more than 1,000 gallons per minute from multiple wells located south of the CCR units to depress groundwater levels and reduce infiltration into pits and basements in that facility. This explains the irregular groundwater contours and indications of southerly groundwater flow shown on the 2012 and 2018 water table maps shown in Attachment 1. More complete and representative determination of the direction of groundwater flow across the entire facility and adjoining properties is needed to understand how groundwater flow transports CCR contaminants now and will continue to do so in the future.

2. EPA identifies three reasons for proposing that CCR at SWMU 14 be left in place without remediation. Problems with each of EPA's rationales are identified as follow:

   The position of CCR above the water table
   It is known that the water table elevation in the vicinity of SWMU-14 increased by six feet between 2006 and 2009 in response to increased precipitation.[22] This shows that the elevation of the water table beneath SWMU 14 is very responsive to precipitation variability. The water table beneath SWMU 14 appears to currently be being depressed by withdrawals of groundwater on the adjacent ArcelorMittal plant. There is no guarantee that groundwater withdrawals of more than 1,000 gallons per minute will continue indefinitely into the future. An unlined and uncapped hole in the sand, over a water table that is artificially depressed by nearby pumping and naturally subject to wide swings in elevation, is neither an appropriate nor safe permanent waste disposal site.

   Synthetic Precipitation Leaching Procedure data
   It has been widely acknowledged for more than a decade that SPLP is not appropriate, or at least not optimal, for evaluating the leaching potential of CCRs as they are actually managed. SPLP test results, some of which have had a dilution factor applied, should not be considered as evidence of a lack of ecological risk.

   Groundwater monitoring results indicate that SWMU 14 is not a leaching threat
   There is only one assumed downgradient monitoring well on the site that is not partially screened in ash. The magnitude and extent of contaminant plumes from wastes disposed at SWMU 14 are not evaluated. Leaving SWMU 14 with no applied remedy is simply letting disposed coal ash continue to leach as water infiltrates into and through the waste and groundwater is contaminated. Ash contaminants will

[22] AMEC (2014), p. 1-3

continue to migrate into the IDNP, either attenuating to soils and wetland sediments, or discharging into surface water.

3. Excavation and off-site disposal of the coal ash from SWMU 14 rather than leaving the waste in place to continue leaching contaminants into groundwater would be the most protective remedial alternative.
4. The proposed remedy for SWMU 15 of excavation and off-site disposal of wastes located above the water table and solidification and stabilization of wastes located below the water table is likely to be effective in reducing migration of contaminants from the site.
5. In this setting the reluctance to dewater the system sufficiently to safely excavate CCR located below the water table is understood. It should be made clear, however, that this is a site-specific restriction on the remedy that would not likely apply to any other CCR sites.
6. The proposed remedy for the Greenbelt and Eastern Wetland area appears likely to be appropriate and protective of the environment. The protectiveness of this alternative will, however, depend on the procedures used to distinguish between CCR and unimpacted native materials.
7. The proposed remedy for IDNP groundwater is monitored natural attenuation (MNA) with source control. In the case of SWMU 15, MNA with adequate source control appears to be a technically appropriate selection. In the case of SWMU 14, however, the source is proposed to remain uncontrolled, even though the RFI report directly attributed at least two contaminant plumes (boron and selenium) to wastes located in SWMU 14. It is unclear why contaminant plumes identified in the Area B investigation sourced at SWMU 14 are not addressed. MNA is not an appropriate choice at sites with uncontrolled contaminant sources.

Qualifications

I express the opinions in this document based on my formal education in geology and over 40 years of experience on a wide range of environmental characterization and remediation sites. My education includes Bachelor of Science and Masters of Science degrees in geology from Northern Illinois University and the University of Illinois at Chicago, respectively. I am a registered Professional Geologist (PG) in Georgia, Kansas, Nebraska, Illinois, Indiana, Wisconsin, and North Carolina, a Certified Professional Geologist by the American Institute of Professional Geologists, and am a Past President of the Colorado Ground Water Association.

My entire professional career has been focused on regulatory, site characterization, and remediation issues related to waste handling and disposal practices and facilities, for regulatory agencies and in private practice. I have worked on contaminated sites in over 35 states and the Caribbean. My site characterization and remediation experience includes activities at sites located in a full range of geologic conditions, including soil and groundwater contamination in both consolidated and unconsolidated geologic media, and a wide range of contaminants. I have served in various technical and managerial roles in conducting all aspects of site characterization and remediation including definition of the nature and extent of contamination (including developing and implementing monitoring plans to accurately characterize groundwater contamination), directing human health and ecological risk assessments, conducting feasibility studies for selection of appropriate remedies to meet remediation goals, and implementing remedial strategies. Much of my consulting activity over the last 15 years has been related to groundwater contamination and permitting issues at coal ash storage and disposal sites in numerous states, including Alabama, Arizona, Colorado, Georgia, North Carolina, Illinois, Indiana, Kansas, Maryland, Minnesota, Mississippi, Montana, New Mexico, Nevada, North Carolina, Pennsylvania, South Carolina, Virginia, and Wisconsin.

I would be happy to discuss my thoughts on this site with you and/or USEPA at any time. Please let me know if you have questions or comments.

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October 19, 2020

By email

Kirstin Safakas, Community Involvement Coordinator
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77 W Jackson Blvd.
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RE: Comments on Statement of Basis for Area C – NIPSCO Bailly Generating Station

Dear Ms. Safakas,

The National Parks Conservation Association (NPCA) appreciates the opportunity to provide comments on U.S. Environmental Protection Agency's Statement of Basis for Area C – NIPSCO Bailly Generating Station. NPCA is joined by Save the Dunes (SDCF) in submitting these comments.

Since 1919, NPCA has been the leading voice of the American people in protecting and enhancing our National Park System. NPCA and our 1.4 million members and supporters advocate for America's national parks and work to protect and preserve the nation's most iconic and inspirational places for present and future generations. Save the Dunes is dedicated to preserving, protecting, and restoring the Indiana dunes and all natural resources in Northwest Indiana's Lake Michigan Watershed for an enhanced quality of life.

Indiana Dunes National Park, which is located within the EPA study area, features a variety of natural and cultural features, some of which are globally rare. The purpose of Indiana Dunes National Park (INDU) is to "to preserve for the educational, inspirational, and recreational use of the public certain portions of the Indiana dunes and other areas of scenic, scientific, and historic interest and recreational value."[1]

Since 1966, the park has been managed by the National Park Service (NPS), whose mission as the managers of national parks is "to conserve the scenery and the natural and historic objects and the

[1] See 16 U.S.C. 460u.

wildlife therein and to provide for the enjoyment of the same in such manner and by such means as will leave them unimpaired for the enjoyment of future generations."[2]

NPCA ***generally supports*** the proposed Statement of Basis but has specific concerns as detailed below. We are submitting these comments to ensure that the proposed remedies are consistent with the 1916 Organic Act, 2016 NPS Management Policies, and the park's enabling legislation, specifically the legislation's goal of bringing into park ownership lands within its authorized boundary. Indeed, NPCA is broadly supportive of remediation efforts at the Bailly facility precisely because such efforts are an environmental and legal prerequisite to NPS ultimately acquiring portions of the Bailly facility for full integration into INDU as legislatively intended.

In addition, NPCA submits the technical memorandum by CEA Engineers, hereinafter referenced as "Appendix A."

Solid Waste Management Unit 14

NPCA ***is strongly concerned*** about the potential for contamination of the groundwater at INDU stemming from groundwater migration from SWMU 14 and ***requests*** that EPA require NIPSCO to implement now, and include in its Long Term Stewardship Plan (LTSP), procedures for monitoring contamination levels in the groundwater downgradient of SWMU 14 at INDU, as is consistent with federal regulation.[3]NPCA shares the concerns expressed by Earthjustice and other environmental organizations that the lack of groundwater data and monitoring as part of the Statement of Basis is inconsistent with the Corrective Action program and that changes to groundwater flow could negatively affect water quality within INDU, altering the risk profile at SWMU 14.

Although the levels of boron and molybdenum in the groundwater downgradient of SWMU 14 are currently below the Great Lakes Initiative (GLI) screening levels,[4] we are concerned that contamination could be present and accumulate further over time, restricting groundwater use in INDU.[5] EPA's policy on groundwater remediation calls for groundwater to be protected at levels that allow its "maximum beneficial use."[6] In the case of INDU's groundwater, this policy requires restoration to drinking water standards so as not to limit future uses.[7] Current and long-term monitoring is necessary to ensure that rainwater does not infiltrate the landfill and, over the long-term, carry substantial amounts of contamination into INDU's groundwater such that it poses a risk to human health or the environment.[8]

NPCA ***requests*** that institutional controls for SWMU 14 be included in NIPSCO's Institutional Control Implementation and Assurance Plan (ICIAP). NPCA's technical evaluation (Appendix A)

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[2] 16 U.S.C. 1.
[3] 40 CFR 264.100(d).
[4] EPA, NIPSCO *Bailly Generating Station: Frequently Asked Questions*, page 10, found at https://www.epa.gov/sites/production/files/2020-07/documents/nipsco-faq-update-20200727.pdf.
[5] CEAPC Technical Memorandum, page 8.
[6] EPA, *Handbook of Groundwater Protection and Cleanup Policies for RCRA Corrective Action Sites* (2004), page 1.1., found at https://www.epa.gov/sites/production/files/2017-02/documents/gwhb041404.pdf.
[7] EPA, Statement of Basis, page 13.
[8] "EPA recommends that groundwater cleanup levels be based on the maximum beneficial use to ensure that groundwater is cleaned up to levels that protect human health and the environment both now and in the future." EPA, *Handbook of Groundwater Protection and Cleanup Policies for RCRA Corrective Action Sites* (2004), page 5.1., found at https://www.epa.gov/sites/production/files/2017-02/documents/gwhb041404.pdf.

indicates that the perpetual application of institutional controls specifically designed to limit land use are necessary to prevent human and ecological receptors' exposure to residual coal ash in SWMU 14.[9] The Statement of Basis already includes the need for institutional controls through its plan to implement an environmental restrictive covenant on the NIPSCO property,[10] which includes SWMU 14. However, there is insufficient discussion in the Statement of Basis regarding the details of such controls, details that will determine the efficacy and acceptability of relying on institutional controls here.

Separate from the instant corrective action plan, NPCA ***strongly urges*** NIPSCO to enroll SWMU 14 in the Indiana Department of Environmental Management (IDEM) Voluntary Remediation Program (VRP). The VRP permits landowners to work with the department to create a remediation plan in line with IDEM standards.[11] After completing the remediation, the Governor's Office issues the landowner a Covenant Not to Sue, protecting the landowner and future landowners from liability for later issues related to the cleanup. This program could be beneficial for SWMU 14, since otherwise there is no remedial action proposed for this area and, therefore, potential liability for future cleanup requirements is an uncertain though legitimate risk. If NIPSCO enrolled in the VRP, it would provide certainty with respect to potential liability for NIPSCO in the short-term and NPS in the event of a future acquisition.

Solid Waste Management Unit 15 and Indiana Dunes National Park Groundwater

NPCA ***supports*** the proposed remediation plan for SWMU 15 but ***requests*** that the proposed institutional controls for the site provide for the use of SWMU 15 as a necessary buffer zone between INDU and adjacent industrial use. In addition, NPCA ***strongly urges*** NIPSCO to work with NPS to operate this site as undeveloped open space.

Considering the proximity and shared groundwater of SWMU 15 with INDU and its Cowles Bog National Natural Landmark (NNL), NPCA agrees with EPA that full excavation and dewatering would present too great a risk to the natural wetlands and hydrology of INDU and the NNL.[12] Likewise, to address the levels of boron in INDU groundwater, NPCA ***supports*** the usage of Alternative 3 – Monitored Natural Attenuation with Source Control. Alternative 3 is the remedy that is most protective of the delicate ecosystem of INDU because, as noted in Attachment A, it "eliminates potential adverse impacts to wetlands at Indiana Dunes, and specifically Cowles Bog, resulting from dewatering and disruption of natural groundwater flows."[13]

If pursued, the alternative remedies could risk harming wildlife and the ecosystem in INDU and Cowles Bog, which would be inconsistent with NPS law and policy and could threaten the area's NNL status. Indeed, EPA identified this ecological risk in the Statement of Basis, ruling out the first two proposed remedies because they "involve physical disruption to the National Park, Cowles Bog and nearby wetland habitat."[14] The NNL designation is based upon two primary criteria: how illustrative an NNL is of the unique character of its area and the degree to which the NNL has not been disturbed by human contact compared to other similar areas.[15] The rejected alternative

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[9] CEAPC Technical Memorandum, page 8.
[10] EPA, Statement of Basis, page 3.
[11] IDEM, *Voluntary Remediation Program: Resources*, https://www.in.gov/idem/cleanups/2366.htm.
[12] EPA, Statement of Basis, page 20.
[13] CEAPC Technical Memorandum, page 7.
[14] EPA, Statement of Basis, page 21.
[15] See 36 CFR 62.5.

remedies could threaten Cowles Bog's ability to meet both of these criteria as the remediation would cause the area to be subject to significant human contact and could reduce wildlife in the area, diminishing the illustrative character of the area. Best protecting INDU natural resources and the Cowles Bog NNL status is further reason that NPCA's overall support of Alternative 3.

Furthermore, NPCA ***strongly urges*** that institutional controls for the site provide for use of SWMU 15 as an undeveloped buffer zone. While SWMU 15 is not part of the jointly managed Greenbelt, it lies between two portions of the Greenbelt and is immediately adjacent to INDU property. Given its location, it is reasonable to anticipate future use of this site as such a buffer. A blanket prohibition on future development of any kind would be appropriate given that the remedy selected for SWMU 15 will leave coal ash waste *in situ*. Institutional controls that continue SWMU 15's use as undeveloped open space is a reasonable step to ensure that waste left in place is not disturbed and released during future construction, as that would jeopardize the sensitive Cowles Bog and INDU.

Either the institutional controls need to ban development on SWMU 15, effectively preserving as open space or as a buffer, or the remediation plan would need to be changed to remove contamination enough to permit development. Since the more extensive remedy would impair national park resources, NPCA ***strongly urges*** implementation of stronger institutional controls.

Greenbelt and Eastern Wetlands

NPCA ***supports*** the proposed remediation plan for the Greenbelt and Eastern Wetlands area, including complete excavation and off-site disposal of CCR. The usage of residential equivalent standards[16] is critical because it will facilitate the ultimate NPS acquisition of the Greenbelt area and eventual incorporation of the area into INDU. The usage of residential or equivalent standards will ensure that this area can be properly incorporated into the park and that it can safely be used by visitors.

NPCA is aware of legislation preventing NPS from acquiring the Greenbelt area[17] without the level of remediation proposed in this Statement of Basis. Again, NPCA is ***broadly supportive*** of remediation efforts at the Bailly facility precisely because such efforts are a prerequisite to NPS ultimately acquiring portions of the Bailly facility for full integration into the park, as the statute presumes that NIPSCO will ultimately convey the Greenbelt to INDU.

Proposed Institutional Controls

NPCA requires more information regarding the proposed restrictive covenants and ***strongly urges*** EPA and NIPSCO to carefully draft restrictive covenants to be tailored to the unique setting of the Bailly facility, in addition to the concerns above regarding SWMU 14 and SWMU 15.

In support of NPCA's long-term goal of seeing the Greenbelt area incorporated into INDU, NPCA seeks further clarification from EPA as to the land to be covered by the proposed restrictive covenants. Specifically, it is unclear in the Statement of Basis whether EPA intends those covenants to apply to any portion of the Greenbelt area. Further, even if the covenants do not extend to any part of the Greenbelt area, NPCA ***urges*** EPA to take special caution when drafting

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[16] EPA, Statement of Basis, page 14.
[17] See 16 U.S.C. § 460u–18(b).

the restrictive covenants, ensuring they pose no barrier to future acquisition of the Greenbelt area by NPS.

To fully support EPA's proposed remedy, NPCA needs clarification as to the geographic scope of the restrictive covenants proposed by EPA. In the Statement of Basis, EPA refers to one of the institutional controls to be implemented as part of the proposed remediation as "an environmental restrictive covenant…to restrict the land use of the NIPSCO property to industrial or commercial use now and in the future."[18] However, this is under a heading titled "*Facility-Wide*: Land Use Institutional Control" (emphasis added), implying that the covenant would only apply to the Bailly facility and not the Greenbelt area. Further, the document later explicitly states "off-site INDU property will have no use restrictions."[19]

As EPA is aware, the Greenbelt area is split into three distinct parts: one portion owned by NPS, and two parts still owned by NIPSCO, but subject to either a conservation easement or a revocable license, with SMWU 15 in between. Due to the references to the restrictive covenants applying to the "Facility" and the NPS approved residential level cleanup standard being used for the Greenbelt area, the Statement of Basis seems to imply that the restrictive covenants will not be in effect on any of the Greenbelt property. However, given that portions of the Greenbelt property are in fact "NIPSCO property," NPCA's support of the proposed cleanup is contingent upon an explicit statement by EPA that the restrictive covenants will cover no portion of the Greenbelt area with any restriction that could preclude addition to the INDU.

Even if, as it appears in the Statement of Basis, the restrictive covenants do not cover the Greenbelt area, NPCA urges EPA and NIPSCO to carefully draft the covenants to ensure they do not in any way impact the ability of the Greenbelt area to be incorporated into INDU. NPCA will not be able to fully support EPA's planned restrictive covenants without further clarification of their scope and adoption of the institutional control design recommendations to assure the institutional controls facilitate – and do not frustrate – the long-term goal of incorporating the Greenbelt area into INDU and ensure that SWMU 15 remains as a necessary buffer zone.

Consistent with our comments on SWMU 15, NPCA ***requests*** that institutional controls implemented for the facility be carefully crafted to exclude any Greenbelt area and to prohibit only certain future uses, rather than limit the land to a strict set of future uses. This step would ensure that EPA follows its own guidance on developing institutional controls, which state that controls "should be carefully evaluated, selected, and narrowly tailored to meet the cleanup objectives for the site in a manner that does not unnecessarily restrict the reasonably anticipated future land use or resources."[20]Park usage is distinct from industrial, commercial, or even residential, and without careful drafting and consideration, could be unintentionally lost.

Financial Assurance

NPCA ***requests*** that NIPSCO's financial assurance cover any unplanned, but reasonably foreseeable eventualities. It is possible that certain contamination issues will take longer to resolve than what the Statement of Basis currently predicts, which would require additional funds

[18] EPA, Statement of Basis, page 3.
[19] EPA, Statement of Basis, page 14.
[20] EPA, A *Guide to Planning, Implementing, Maintaining, and Enforcing Institutional Controls at Contaminated Sites*, page 2, found at https://www.epa.gov/sites/production/files/documents/final_pime_guidance_december_2012.pdf.

for continued monitoring. For example, the Technical Memorandum states that Monitored Natural Attenuation (MNA) will potentially take a longer amount of time to resolve the groundwater contamination at INDU than what EPA expects, given that results from field implementation of *in situ* solidification and stabilization (ISS) can vary from laboratory results, extending the amount of time needed to achieve sufficient remediation.[21] It is possible that certain contamination issues will persist despite the corrective action plan.

The Statement of Basis itself affirms that a contingency plan may be needed to remedy the INDU groundwater, should source control and MNA be insufficient[22] and it is possible that new contamination issues will arise in the future. As previously noted, NPCA is particularly worried about contamination stemming from SWMU 14, which could be aggravated by changing precipitation patterns stemming from climate change that change rates of infiltration and affect groundwater movement.[23] NIPSCO should therefore account for the potential cost of prolonged cleaning or re-cleaning of parts of the Bailly facility or offsite properties when developing its cost-estimate.[24]

In addition, NPCA ***requests*** that EPA require NIPSCO provide the required financial assurance for this corrective action through a trust fund or insurance. Applicable regulations under the Resource Conservation and Recovery Act (RCRA) allow five types of mechanisms to provide assurance of the financial means to complete corrective action. EPA should require NIPSCO to use one of the more secure forms of assurance, such as insurance or a trust fund, which involve a third-party entity providing additional assurances of funding security. Doing so is more consistent with the "intent of the RCRA financial responsibility requirement" of ensuring that facilities are not "insolvent or abandoned by their owners and operators, leaving the costs of corrective action to be borne by the public."[25] Should EPA allow the financial assurance to be met through self-insurance, then such corporate guarantee should be made by NiSource, not NIPSCO; since NiSource appears to be the corporate identity functionally responsible for the Bailly Facility cleanup,[26] the financial assurance should not be allowed to rest on a subsidiary. In addition, EPA should not allow NIPSCO to reduce the amount of financial assurance at least until the company conducts its first five-year review.

Finally, EPA must be mindful how it makes future decisions about cleanup completion and the level of financial assurance as remedial work shifts to focus on long-term monitoring. The financial assurance will remain in place at least until there is a "Corrective Action Complete without Controls" determination.[27] Therefore EPA should not make such a determination while NIPSCO's LTSP is still in place.

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[21] CEAPC Technical Memorandum, page 11.
[22] See EPA, Statement of Basis, page 3.
[23] "[A] warming climate is expected to increase precipitation in many areas." EPA, *Climate Change Indicators: U.S. and Global Precipitation*, https://www.epa.gov/climate-indicators/climate-change-indicators-us-and-global-precipitation.
[24] 40 CFR 264.144 (cost estimate for post-closure care of a hazardous waste treatment, storage, or disposal facility).
[25] EPA, *Interim Guidance on Financial Responsibility for Facilities Subject to RCRA Corrective Action*, page 3, found at https://www.epa.gov/sites/production/files/documents/interim-fin-assur-cor-act.pdf.
[26] See EPA, NIPSCO *Bailly Generating Station: Frequently Asked Questions*, page 10, page 14, found at https://www.epa.gov/sites/production/files/2020-07/documents/nipsco-faq-update-20200727.pdf. The NIPSCO Project Manager is an employee of NiSource.
[27] See 68 FR 8757.

When considering either future reductions to the amount of financial assurance or issuing a "Corrective Action Complete" designation of any kind, EPA should particularly scrutinize compliance and potential for future harms, based on updated data, because of the Bailly facility's proximity to INDU, as protection of the park's environmental well-being cannot be allowed to suffer or be threatened as work at the Bailly facility moves into longer-term stewardship and monitoring.

Long Term Stewardship Plan

NPCA ***strongly urges*** EPA to alter the scope of the LTSP in several ways. First, NPCA ***requests that*** EPA not preemptively limit the timeframe for the LTSP to 30 years, as this timeframe has the potential to be insufficient for monitoring. Instead, EPA should require that the LTSP extend as long as possible to meet the objectives of the corrective action. NPCA ***strongly urges*** that the LTSP remain in place in perpetuity unless NIPSCO chooses to perform remedial action at SWMU 14 that would fully and finally remove contamination at the site. As is noted in Attachment A, monitoring for SWMU 14 should be extended into INDU to ensure that the concentrations of hazardous material in groundwater downgradient of SWMU 14 "do not exceed the Area C Cleanup groundwater corrective action objectives and restrict groundwater use in Indiana Dunes."[28]

NPCA ***strongly urges*** EPA to implement all recommendations for the LTSP, Five-year Remedy Review, and post-excavation sampling put forward in NPCA's technical memorandum (Appendix A) to ensure the preservation of INDU resources and the safety of park visitors, including:

- Quarterly groundwater, surface water, and sediment sampling consistent with groundwater and hydrogeological investigations previously performed and performed in all locations where hazardous material concentrations exceeded risk assessment screening levels, including Area C-specific background concentrations;
- Soil sampling in the Previously Barren Soil Areas (PBSA) to monitor soil pH and metals concentrations;
- Surveys of native species establishment in the excavated and backfilled areas of the Greenbelt and Eastern Wetlands at least twice a year during the growing season for a period of at least five years;
- Surveys of the native plant communities that have been observed to be naturally reestablishing themselves in the PBSA twice a year during the growing season for a period of at least five years to determine the effectiveness of the proposed monitored natural attenuation; and,
- Plant toxicity studies to determine the extent hazardous materials are continuing to impact plants in INDU.

In addition, NPCA ***requests*** that the LTSP, and related Corrective Measures Implementation Work Plan developed by EPA and NIPSCO, be made available for public comment, as the specifics of the Plan are critical to the success of the Area C cleanup. This takes on added importance as public lands and waters are directly impacted by the success of the LTSP and by extension the Area C cleanup.

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[28] CEAPC Technical Memorandum, page 8.

Indiana Dunes National Park is one of America's most treasured places, underscored by its stewardship by the National Park Service and the 2 million people who visit every year. The Statement of Basis as proposed is a step towards a healthier national park, but must go further to ensure its resources and visitors are well protected long into the future . Thank you for the opportunity to comment.

Sincerely,

Colin Deverell
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Technical Memorandum

Date: October 19, 2020

To: Colin Deverell, Midwest Program Manager; Lynn McClure, Midwest Senior Regional Director

From: Kevin Draganchuk, P.E.

Re: NIPSCO Bailly Generating Station Area C Cleanup Analysis

CEA Engineers, P.C. Job No.: J20-14

At the request of National Parks Conservation Association, (NPCA), CEA Engineers, P.C. (CEAPC) evaluated the United States Environmental Protection Agency's (EPA) proposed approach to remediate, manage, and monitor contaminated soil, groundwater, surface water, and sediments in Area C (Area C Cleanup) of the Northern Indiana Public Service Company (NIPSCO) Bailly Generating Station (Facility), as detailed in the EPA Statement of Basis for Area C NIPSCO Bailly Generating Station Chesterton, Indiana EPA ID NO 000 718 114 (Statement of Basis) and its publicly available supporting documentation. The Facility borders the National Park Service (NPS) Indiana Dunes National Lakeshore (Indiana Dunes). Contamination related to historic coal ash disposal at the Facility has impacted Indiana Dunes. Indiana Dunes contains numerous sensitive environmental resources, including the Cowles Bog Wetland Community Complex (Cowles Bog), and attracts recreational visitors that are potentially impacted by the presence of existing contamination and will be potentially impacted by residual contamination in Area C upon completion of the Area C Cleanup.[1]

CEAPC evaluated the adequacy of the Area C Cleanup to be protective of human health and the sensitive ecological resources in Indiana Dunes. CEAPC's evaluation consisted of:

- Review of the existing contamination on Area C and the associated adverse environmental impacts.
- Review of the technical aspects of the Area C Cleanup, including the post-cleanup monitoring program.
- Evaluation of the efficacy of the technical aspects of the Area C Cleanup to remediate the existing contamination, eliminate risks to human and ecological receptors, and the Long-Term Stewardship Plan (LTSP) required to be developed by NIPSCO and

[1] EPA, Statement of Basis for Area C Northern Indiana Public Service Company (NIPSCO) Bailly Generating Station Chesterton, Indiana EPA ID NO 000 718 114. (Hereafter, "Statement of Basis")

approved by EPA to monitor the effectiveness of the Area C Cleanup at meeting its corrective action objectives .

- Evaluation of the potential risks to Indiana Dunes visitors, wildlife, vegetation and ecological resources from the existing contamination in Area C and the potential risks that will exist due to residual contamination in Area C upon completion of the Area C Cleanup.
- Identification of shortcomings in the information provided by EPA on the Area C Cleanup and LTSP.
- Provision of technical recommendations for modifications to the proposed Area C Cleanup and elements of the LTSP to increase their efficacy at eliminating and/or mitigating the adverse environmental impacts or potential risks to Indiana Dunes visitors, wildlife, vegetation, and ecological resources.
- Provision of technical recommendations regarding elements to include in the LTSP to ensure the efficacy of monitoring at determining progress towards achieving the remedial objectives of the Area C Cleanup and reducing potential risks to Indiana Dunes visitors, wildlife, vegetation, and ecological resources

Executive Summary

CEA Engineers, P.C. (CEAPC) evaluated EPA's proposed approach to remediate, manage, and monitor contaminated soil, groundwater, surface water, and sediments in Area C (Area C Cleanup) of the Northern Indiana Public Service Company (NIPSCO) Bailly Generating Station (Facility) as detailed in the EPA Statement of Basis for Area C NIPSCO Bailly Generating Station Chesterton, Indiana EPA ID NO 000 718 114 (Statement of Basis) and its publicly available supporting documentation. The Facility borders the National Park Service (NPS) Indiana Dunes National Lakeshore (Indiana Dunes). Contamination related to historic coal ash disposal in groundwater and soils at the Facility has impacted Indiana Dunes, including Cowles Bog Wetland Community Complex, and has been determined to present risks to ecological receptors, including sensitive vegetative species, terrestrial species, amphibians, and benthic organisms. The Area C Cleanup includes excavation and off-site disposal of historic coal ash and impacted soils at the Facility and adjacent areas, in-situ stabilization of coal ash below the groundwater table in Solid Waste Management Unit 15 at the Facility, natural attenuation of groundwater, surface waters, soils, and sediments on Indiana Dunes, and monitoring of the effectiveness of the Area C Cleanup. The Area C Cleanup is based on established remediation approaches and is reasonable from an engineering and technical perspective, however, essential elements of the Area C Cleanup related to long-term monitoring and the criteria for determining effectiveness of natural attenuation of contamination in Indiana Dunes have not been provided by EPA and cannot be evaluated by the public. EPA must provide this information to the public to allow for adequate public participation in determining the effectiveness of the Area C Cleanup. Additional concerns related to the Area C Cleanup include requirements for post-excavation confirmation soil sampling at the Facility and adjacent areas and a failure to include

details on monitoring the impacts of residual contamination on Solid Waste Management Unit 14 at the Facility on groundwater in Indiana Dunes.

Area C Cleanup – Background Information

Facility History

The Facility began operation in 1962 and generated electricity via coal combustion. Coal combustion at the Facility resulted in residual material commonly referred to as "coal ash" that contains numerous metals present in coal used during combustion, including aluminum, arsenic, boron, cadmium, chromium, molybdenum, and selenium. From the inception of Facility operations in 1962 until 1979, coal ash was disposed of in two solid waste management units (SWMU), SWMU 14 and SWMU 15. After 1979, the Facility disposed of coal ash in a regulated landfill or provided it for beneficial reuse. Facility operations ceased in 2018.[2,3]

Area C Components and Location Description

Area C includes the portion of the Facility containing SWMU 14 and SWMU 15, a portion of Indiana Dunes inclusive of numerous wetlands, ponds, and a portion of Cowles Bog, and a section of land between the Facility and Indiana Dunes that serves as a buffer zone, the Greenbelt Buffer Area (GBA). The GBA is owned by NIPSCO, however, the area is managed by NPS consistent with land management practices in Indiana Dunes and portions of the GBA have been donated and transferred to NPS by NIPSCO.[4] Attachment A to this Technical Memorandum shows the extent and components of Area C.[5]

Existing Contamination

The coal ash in SWMU 15 has a consistent chemical composition containing primarily iron, calcium, magnesium, aluminum, and carbon. Lesser components include arsenic, barium, boron, chromium, molybdenum, potassium, selenium and silica. Laboratory analysis determined that the coal ash leaches aluminum, arsenic, boron, manganese, molybdenum, and selenium, and cleanup standards for leaching from unsaturated soils were established for arsenic, boron, cadmium, chromium, copper, lead, manganese, molybdenum, and selenium (hereafter collectively, "COCs").[6,7,8] The COCs leach into the groundwater on SWMU 15 and are transported to groundwater in Indiana Dunes through the natural groundwater hydrology in Area C. As a result, a contaminated groundwater plume extends from SWMU 15 into Indiana Dunes

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2 Statement of Basis, page 5.
3 EPA, Statement of Basis Released: Public Comment Period Open, NIPSCO Bailly Generating Facility, Chesterton, Indiana, July 2020.
4 EPA, Week of 7/27/20 UPDATE, Frequently Asked Questions NIPSCO Bailly Generating Station Chesterton, IN Area C Statement of Basis, page 4. (Hereafter, "FAQ").
5 Statement of Basis, Figure 3, Sitewide Overview and Site Features.
6 Statement of Basis, page 16.
7 FAQ, page 6.
8 Wood Environment & Infrastructure Solutions, Inc., Memo from Russ Johnson and Tim Glover to Michelle Kaysen, USEPA, Subject: SWMU Treatability Study NIPSCO Bailly Generating Station, November 16, 2018.

and specifically into Cowles Bog.[9] Contaminated groundwater from SWMU 15 reaches surface waters in wetlands at Indiana Dunes, resulting in surface water, sediment, and soil contamination in the locations where groundwater surfaces. Boron contaminated groundwater is the plume with the largest extent and highest concentrations relative to the other COCs at Indiana Dunes.[10] EPA has determined that the coal ash contamination in SWMU 15 and the resulting contaminated groundwater plume it creates poses an unacceptable risk to ecological receptors.[11]

In addition to the coal ash in SWMU 15, coal ash contaminated soils were found during investigations in portion of the GBA and associated Eastern Wetland (EW) in Indiana Dunes and is known to exist in SWMU 14 due to its history as a coal ash disposal site.[12,13] The coal ash in the GBA and EW is believed to have been accidently placed there during historic coal ash disposal in SWMU 15.[14]

An area of the GBA and Indiana Dunes located north of the Facility known as Area B (Attachment A) and referred to as the Previously Barren Soil Area (PBSA) contains soils with altered pH that has been observed to be reestablishing native plant communities over time. Groundwater migration from unlined coal ash and wastewater settling ponds in Area B altered the pH of the soil in the PBSA, resulting in plant communities dying off.[15] The presence of barren soil indicates acidic conditions that can increase the toxicity of metals.[16] Elevated metals concentrations have been identified in the PBSA, including concentrations of cadmium approximately four times greater than reference soils and molybdenum concentrations as much as 50 times greater than reference soils.[17]

Symptoms in sensitive vegetative species in Cowles Bog consistent with heavy metal contamination related to aluminum, boron, and molybdenum exposure in groundwater were observed during field investigations, with the most common symptom being persistent leaf blade

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9 Statement of Basis, Figure 2.
10 Wood Environment & Infrastructure Solutions, Inc., Memo from Russ Johnson and Tim Glover to Michelle Kaysen, USEPA, Subject: SWMU Treatability Study NIPSCO Bailly Generating Station, November 16, 2018.
11 Statement of Basis, pages 4 and 14.
12 FAQ, pages 4 and 8.
13 Statement of Basis, page 20.
14 *Ibid.*
15 Statement of Basis, page 3.
16 EPA, Letter from Michelle Kaysen, EPA, to Dan Sullivan, Northern Indiana Public Service Company, RE: NIPSCO Bailly Generating Station EPA Area C BERA Comments, EPA IDL IND 000718114 March 15, 2013, page 2.
17 EPA, Letter from Michelle Kaysen, EPA, to Dan Sullivan, Northern Indiana Public Service Company, RE: NIPSCO Bailly Generating Station EPA Area C BERA Comments, EPA IDL IND 000718114 March 15, 2013, page 15.

necrosis.[18] Leaf necrosis resulting from heavy metal exposure includes browning and dieback of leaf edges.[19]

Attachment B to this Technical Memorandum identifies the locations of existing contamination in Area C.[20]

EPA's Risk-Based Approach to Area C Cleanup

The proposed Area C Cleanup is being performed under the Resource Conservation Recovery Act (RCRA) Corrective Action program. RCRA cleanups are designed and implemented to protect human health and the environment and rely upon risk-based assessments to evaluate whether existing contamination poses an unacceptable risk to human health and/or ecological resources that must be eliminated. EPA required NIPSCO to conduct a human health risk assessment (HHRA) and a baseline ecological risk assessment (BERA) for Area C. EPA evaluated the adequacy of NIPSCO's risk assessments in the HHRA and BERA. Based on its own risk assessments, EPA determined if it agreed with the NIPSCO's risk assessment conclusions.

EPA used a variety of different screening levels for the various media investigated in Area C as part of its risk assessments.[21]

- Groundwater: Great Lakes Initiative values (GLI); plant screening values (Oak Ridge National Laboratory values); piping plover (endangered bird species) values developed by EPA for site-specific evaluation; Area C-specific background levels.
- Surface Water: GLI; Area C-specific background levels.
- Soil (ecological): EPA Ecological Soil Screening Levels (avian, mammalian, plant, invertebrates); EPA Region 5 Ecological Screening Levels; and Oak Ridge National Laboratory values.
- Soil (human health): Indiana Department of Environmental Management (IDEM) Risk Integrated System of Closure (RISC) Industrial default closure levels; EPA Regional Screening Levels (industrial); Area C-specific background levels.
- Sediment: EPA Region 5 Ecological Screening Levels; NOAA Screening Quick Reference Tables; Area C-specific background levels.

The HHRA concluded that there are no unacceptable risks to humans in Area C, including park workers and visitors.[22] EPA's policy under RCRA regarding groundwater protection and cleanup requires restoration of aquifers to their maximal beneficial use. EPA's policy requires that human health receptors are protected in a manner that will not limit future uses, (e.g.

18 Rothrock, Paul E., and Manning, George C., Report: Potential Impact of Fly-ash Groundwater Contamination on Vegetation of Cowles Bog, Indiana Dunes National Lakeshore, August 2011.
19 Washington State University, WSU Extension Hortsense, Common Cultural: Marginal leaf necrosis, April 30, 2013.
20 Statement of Basis, Figure 2, Sitewide Overview and Site Features.
21 Statement of Basis, page 11.
22 Statement of Basis, page 13.

unrestricted use) and, as a result, groundwater at Indiana Dunes requires remediation to drinking water standards.[23]

The BERA assessed potential risks to ecological receptors including mammals, birds (including the endangered piping plover), amphibians, soil invertebrates, benthic invertebrates, and terrestrial plants due to COC exposure in soils, surface waters, sediments, and/or groundwater. Contaminated groundwater from the Facility migrating into Indiana Dunes was found to exceed applicable criteria and is also found in surface waters on Indiana Dunes due to the interconnectedness of groundwater and surface waters in the wetland areas. Stressed vegetation was observed during investigations and plants were determined to be the most chronically exposed ecological receptor.[24]

EPA evaluated the BERA submitted by NIPSCO and determined that the possibility of unacceptable risk could not be eliminated from the existing conditions, especially considering the sensitive nature of the environment resources in Indiana Dunes.

EPA concluded that COC contamination in Area C, most especially boron contamination, posed the following risks:[25]

- Unacceptable risks to plants
- Unacceptable risks to certain terrestrial wildlife in some areas of Indiana Dunes
- Potential risks to amphibians, benthic organisms, terrestrial invertebrates, and birds that feed on terrestrial invertebrates

Boron is the COC that presents the highest risks to ecological receptors, especially vegetation. At elevated concentrations boron can be toxic to plants. EPA determined that the presence of sensitive, threatened, or endangered plant species at Indiana Dunes resulted in an unacceptable risk of boron exposure and required remediation.[26,27,28]

Area C Cleanup – Proposed Remedy

SWMU 15

The Area C Cleanup includes excavation of approximately 92,000 cubic yards (cy) of coal ash in SWMU 15 located above the groundwater table. Coal ash excavation below the groundwater table (wet coal ash) would require dewatering activities (e.g. groundwater pumping) that have the potential to adversely impact the natural hydrology of the wetlands on Indiana Dunes, including Cowles Bog.[29,30] Approximately 86,000 cy of wet coal ash is located below the

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23 Statement of Basis, page 13.
24 *Ibid.*
25 Statement of Basis, pages 13 – 14.
26 FAQ, page 7.
27 NIPSCO Bailly Generating Facility Proposed Statement of Basis Question and Answer Session, NIPSCO Bailly Public Meeting, August 3, 2020, 27:2 – 29:11.
28 Statement of Basis, page 5.
29 FAQ, page 3.
30 Statement of Basis, pages 18 - 19.

groundwater table in SWMU 15. EPA proposes to solidify the wet coal ash in place through in-situ solidification and stabilization (ISS), using a Portland cement mixture.[31,32] ISS is intended to bind the COCs in the solidified wet coal ash, reduce the ability of COCs to leach into groundwater, and reduce the ability of groundwater to move through the subsurface at SWMU 15 and migrate to Indiana Dunes.[33,34,35] Laboratory analysis of the proposed ISS formulation planned for use on SWMU 15 showed a boron leaching rate (0.36 mg/l) approximately six times lower than the leaching rate of boron in the existing the wet coal ash in SWMU 15 (2.3 mg/l). Laboratory analysis demonstrated the ability of the proposed ISS formulation to reduce groundwater hydraulic conductivity below a defined performance standard.[36,37]

SWMU 15 is fully owned and managed by NIPSCO and will be remediated to meet industrial/commercial standards. Institution controls will be instituted that limit future use of SWMU 15 to commercial or industrial uses.[38]

CEAPC Comment – SWMU 15

EPA's proposed remedy for SWMU 15 is based on established remediation approaches, such as ISS and excavation with off-site disposal of coal ash to the depth of the groundwater table. EPA's approach of leaving coal ash below the groundwater table in place and using ISS to solidify it in order to reduce diffusion and transport of COCs in groundwater is reasonable from an engineering and technical perspective and eliminates potential adverse impacts to wetlands at Indiana Dunes resulting from dewatering and disruption of natural groundwater flows. Excavation and placement of clean backfill in the excavation area will eliminate risks presented by direct exposure to coal ash and coal ash contaminated soils in SWMU 15.

SWMU 14

EPA proposes no remedial activities in SWMU 14 as part of the Area C Cleanup. SWMU 14 was investigated and coal ash was not located below the groundwater table. NIPSCO's and EPA's risk assessments determined that the presence of coal ash in the SWMU 14 and the

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31 *Ibid.*

32 Wood Environment & Infrastructure Solutions, Inc., Memo from Russ Johnson and Tim Glover to Michelle Kaysen, USEPA, Subject: SWMU Treatability Study NIPSCO Bailly Generating Station, November 16, 2018., page 8.

33 FAQ, page 6

34 NIPSCO Bailly Generating Facility Proposed Statement of Basis Question and Answer Session, NIPSCO Bailly Public Meeting, August 3, 2020, 43:6 – 44:9.

35 Statement of Basis, page 2.

36 Wood Environment & Infrastructure Solutions, Inc., Memo from Russ Johnson and Tim Glover to Michelle Kaysen, USEPA, Subject: SWMU Treatability Study NIPSCO Bailly Generating Station, November 16, 2018, pages 5 - 6.

37 The hydraulic conductivity performance standard was 1x10^7 centimeters/second. The Portland Cement mixture proposed for ISS in SWMU consisting of 6% Portland Cement had the lowest hydraulic conductivity observed during NIPSCO's ISS treatability study (See Wood Environment & Infrastructure Solutions, Inc., Memo from Russ Johnson and Tim Glover to Michelle Kaysen, USEPA, Subject: SWMU Treatability Study NIPSCO Bailly Generating Station, November 16, 2018, page 5).

38 Statement of Basis, page 23.

resulting groundwater contamination downgradient of SWMU 14 did not pose an unacceptable risk to ecological receptors or human health at Indiana Dunes.[39,40]

SWMU 14 is fully owned and managed by NIPSCO and will be governed by institutional controls to regulate the future use of the land and groundwater.[41,42]

CEAPC Comment

Based on the results of the cited investigations in the Statement of Basis and subsequent risk assessments determining no unacceptable risks to human health or ecological receptors resulting from COCs in SWMU 14, CEAPC understands EPA's decision to propose no remedial actions at SWMU 14 as part of the Area C Cleanup is consistent with the requirements of the RCRA Corrective Action Program. However, potential exposure pathways for human and ecological receptors to the residual contamination on SWMU 14 through direct contact and groundwater will persist. The potential for increased risks over time to human health and ecological receptors from COC contaminated groundwater from SWMU 14 exist due to potential changes in groundwater elevations, precipitation depths and intensity resulting from climate changes and groundwater migration patterns. Institutional controls limiting land use and restricting groundwater use have the potential to reduce the exposure risk for human receptors, as long as they remain in place and are properly adhered to, but alone institutional controls are insufficient to be fully protective of human health and ecological receptors.

Groundwater Down Gradient of SWMU 14

Since coal ash in SWMU 14 is not in direct contact with groundwater, EPA determined that it does not substantially impact groundwater, however, rainwater infiltration through the coal ash in SWMU 14 can transport COCs into the groundwater underlying SWMU 14. Subsequent groundwater migration from SWMU 14 can result in COCs entering the groundwater at Indiana Dunes. Groundwater monitoring downgradient of SWMU 14 identified boron and molybdenum concentrations above background levels, however, they were below the GLI screening levels.[43] Though groundwater levels of boron and molybdenum were above background levels, EPA's decision was consistent with the risk based approach utilized under RCRA.

Long-term groundwater monitoring downgradient of SWMU 14 is required to ensure that groundwater COC concentrations downgradient of SWMU 14 do not exceed the Area C Cleanup

39 AMEC Environment & Infrastructure, Inc, Memo to Michelle Kaysen, EPA from Russ Johnson and Dan Cooke, Amec, Subject: NIPSCO Bailly Generating Station – SWMU 14 Groundwater Plume Evaluation and Exposure Parameters – Baseline Ecological Risk Assessment, April 3, 2014.

40 AMEC Environment & Infrastructure, Inc, , Revised Risk Assessment for SWMU 14 NIPSCO Bailly Generating Station, RCRA Corrective Action Program, EPA ID #000 718 114 Chesterton Indiana, December 4, 2014.

41 FAQ, page 8.

42 Statement of Basis, pages 4 – 5.

43 "Background levels" refers to the concentration of a chemical typically found in a specific media, in this instance groundwater, when no external source beyond what naturally occurs in the environment to the media exists.

groundwater corrective action objectives and restrict groundwater use in Indiana Dunes. If COC concentrations increase over time or exceed screening levels, including background levels, the risk levels from groundwater exposure pathways need to be reevaluated to ensure that unacceptable risk levels to human or ecological receptors have not been reached. The failure to include a long term monitoring program for groundwater impacted by SWMU 14 does not meet the requirements of the RCRA Corrective Action Program and must be included in the Statement of Basis to ensure that long term risks from residual coal ash on SWMU 14 are quantified and evaluated. The adequacy of the monitoring program for groundwater impacted by SWMU 14 is an essential element for determining the overall adequacy of the Area C Cleanup and EPA's decision to propose no remedial actions at SWMU 14.

Greenbelt Buffer Area and Eastern Wetlands

No coal ash was intentionally placed in the GBA or EW by NIPSCO, however, during investigations in Area C, coal ash was discovered in the GBA and EW.[44] Due to the location and limited quantity of coal ash discovered, it appears a quantity of coal ash was accidently dropped or spilled into the GBA and EW during placement on SWMU 15. As a result, the Area C Cleanup includes excavation of approximately 705 CY of coal ash impacted soil in the GBA and EW. Excavation will occur immediately northeast of SWMU 15 to a depth of about 3.5 feet below ground surface. The excavation will be backfilled with native dune sand and imported topsoil. The excavated area will be revegetated with native species and monitored for ten events over five years as part of the LTSP.[45,46]

CEAPC Comment – Greenbelt Buffer Area and Eastern Wetlands

Excavation of contaminated soils and coal ash in the GBA and EW was considered the presumptive remedy by EPA (i.e. no other remedial option was considered), since the presence of coal ash in the EW is "unacceptable."[47] Excavation and off-site disposal of contaminated soils and coal ash is reasonable from an engineering and technical standpoint, is limited to a small surface area and shallow depth, and the is the best option to meet the corrective action objective of eliminating the presence of coal ash and related COCs in the GBA and EW in order to prevent the risk of direct exposure and achieve residential use standards (unrestricted use).[48]

Previously Barren Soil Areas

The coal ash and wastewater settling ponds in Area B of the Facility were lined in 1980, thus eliminating the contaminant source to groundwater that caused pH alteration in the PBSA. Observed trends show that the PBSA is returning to the state it existed in prior to adverse impacts from the settling ponds. Desirable native plant communities have been observed reestablishing themselves in the PBSA. EPA proposes Monitoring Natural Attenuation (MNA)

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44 Statement of Basis, Figure 9 – Greenbelt and Eastern Wetlands.
45 FAQ, page 4.
46 Statement of Basis, page 20.
47 Statement of Basis, page 2.
48 Statement of Basis, page 15.

in the PBSA, since the source of contamination to the PBSA, the settling ponds, has been eliminated. Monitoring will be included as part of the LTSP.[49] Installation of piping to provide potable water to the PBSA in Indiana Dunes is included in the Area C Cleanup, if the need arises, in order to meet unrestricted use standards.[50]

CEAPC Comment – Previously Barren Soil Areas

EPA's proposed remedy of MNA in the PBSA is reasonable from an engineering and technical perspective, since the source of continuing contamination to the PBSA was eliminated in 1980 by lining the settling the ponds and natural plant communities are recovering and reestablishing themselves. Alternative remedial actions, such as intrusive activities to remove residual contamination, such as groundwater dewatering and treatment or excavation, would be disruptive to and adversely impact the terrestrial environment and hydrogeology in Indiana Dunes.

Groundwater Contamination at Indiana Dunes

Groundwater at Indiana Dunes will not be directly treated to remove the boron and other COCs as part of the Area C Cleanup, rather, EPA proposes an approach of MNA combined with source control through ISS. EPA plans to reduce groundwater diffusion and transport of COCs from the coal ash located below the groundwater table at SWMU 15 through ISS and allow natural processes to reduce the concentrations of boron and other COCs in groundwater over time.

MNA studies conducted in Indiana Dunes for boron showed that soil materials in the area of the groundwater plume naturally possess attenuation mechanisms including temporary sorption and permanent fixation of boron. These attenuation mechanisms allow for the removal of boron dissolved in groundwater over time.[51] Modeling predicted that it would take approximately five years for groundwater to achieve EPA's corrective action objectives, though the use of natural processes to remediate groundwater over time makes model predictions less precise.[52] EPA's expectation is that groundwater corrective action objectives will be achieved within 15 years.[53]

The Area C Cleanup includes a groundwater monitoring program at Indiana Dunes within the contaminated groundwater plume as part of the LTSP.[54] Installation of piping to provide potable water to the PBSA in Indiana Dunes is included in the Area C Cleanup, if the need arises, in order to meet unrestricted use standards.[55]

CEAPC Comments – Groundwater Contamination at Indiana Dunes

EPA's proposed remedy of ISS in SWMU 15 to serve as source control and reduce the diffusion and transport of the COCs in groundwater and attenuation through natural processes is reasonable from an engineering and technical perspective and has the should minimize the

49 Statement of Basis, pages 3 and 23.
50 Statement of Basis, page 17.
51 Statement of Basis, page 11.
52 Statement of Basis, page 19.
53 Statement of Basis, page 3.
54 FAQ, page 10.
55 Statement of Basis, page 17.

potential for adverse impacts to the sensitive ecological communities in Indiana Dunes and Cowles Bog over time, however, the progress towards meeting the groundwater corrective action objectives needs to be closely monitored under the LTSP to ensure the proposed groundwater remedy is effective. As a result, the elements of the groundwater monitoring program in the LTSP, including monitoring frequency and locations, are essential to the success of the Area C Cleanup (further detailed in the Long Term Stewardship Plan section of this Technical Memorandum).

Potential for a Long Timeframe to Meet Corrective Action Objectives

EPA estimates that the groundwater corrective action objectives will be achieved through MNA within 15 years, however, as evidenced by the length of time between source control, which occurred 40 years ago, and eliminating the adverse impacts to the PBSA, source control and natural attenuation to achieve groundwater corrective action objectives has the potential to take longer than 15 years. Using natural processes for COC removal from groundwater makes predicting the timeframe for meeting groundwater corrective action objectives difficult and modeling exercises less precise.[56] Unlike the lining of the settling ponds as source control for the PBSA, ISS in SWMU 15 will not completely eliminate diffusion and transport of COCs in groundwater, rather, it will substantially reduce groundwater hydraulic conductivity and the leaching rate of COCs into groundwater (e.g. laboratory results for boron leaching after ISS implementation showed a leaching rate six times lower than in the existing wet coal ash).[57] As a result, the wet coal ash at SWMU 15 will be a continuing source of boron and the other COCs into the groundwater plume, albeit at a much lower rate than currently occurs, and will impact the rate of natural attenuation and the timeframe in which the groundwater corrective action objectives will be achieved. Results from field implementation of ISS on the leaching rates of COCs have the potential to deviate from laboratory results performed during the treatability analysis, and, if greater than laboratory results, have the potential to extend the timeframe for achievement of the groundwater corrective action objectives at Indiana Dunes.

NIPSCO is required by EPA to institute a LTSP consisting of at least 30 years of monitoring, which has the potential to be an insufficient time period for the groundwater corrective action objectives to be met.[58] EPA needs to require that the LTSP extend as long as needed to meet the groundwater corrective action objectives of the Area C Cleanup and not limit its timeframe.

Aluminum in Groundwater

An essential element of the groundwater monitoring program in the LTSP will be monitoring groundwater aluminum concentrations on Indiana Dunes. Aluminum was one of the COCs found to be leaching into groundwater and was determined by EPA to be a potential COC in

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56 Statement of Basis, page 19.

57 Wood Environment & Infrastructure Solutions, Inc., Memo from Russ Johnson and Tim Glover to Michelle Kaysen, USEPA, Subject: SWMU Treatability Study NIPSCO Bailly Generating Station, November 16, 2018.

58 FAQ, page 10.

groundwater within SWMU 15 and within Indiana Dunes, including in the EW, Central Blag Slough, Northwest Bag Slough, and Little Lake (see Attachment B).[59] EPA did not establish a cleanup standard for aluminum in groundwater in Area C.[60] During remedial investigations, it was determined that exceedances of background aluminum concentrations resulted from natural fluctuations in groundwater pH that impact the solubility of aluminum.[61] Aluminum is not highly soluble in water between pH levels of 6.5 and 7.5.[62] Groundwater directly downgradient of SWMU 15 was below background aluminum concentrations, however, areas of groundwater that exceeded aluminum background concentrations were discovered in the EW, PBSA, Central Blag Slough, and adjacent areas, including levels exceeding 1,000 µg/l.[63] A number of aluminum groundwater plumes with concentrations above background levels were identified during remedial investigations that are located northeast of SWMU 14 within Indiana Dunes and are in the approximate locations of field investigations that identified vegetative symptoms of heavy metal exposure, including aluminum.[64,65]

EPA's policy regarding groundwater protection and cleanup under RCRA requires restoration of aquifers to their maximal beneficial use. EPA's policy requires that human health receptors are protected in a manner that will not limit future uses (e.g. unrestricted use), and, as a result, groundwater at Indiana Dunes requires remediation to drinking water standards.[66] There are no EPA primary drinking water standards for aluminum, however, secondary drinking water standards, which are non-enforceable guidelines that EPA recommends, do exist. EPA's secondary maximum contaminant level for aluminum is between 50 µg/l and 200 µg/l.[67] The State of Indiana does not have an aluminum drinking water standard.[68]

The LTSP needs to include specific requirements for monitoring groundwater aluminum concentrations and pH downgradient of SWMU 15 and SWMU 14 and in the portions of Indiana Dunes with aluminum concentrations above background levels that have been identified during remedial investigations. In the event that EPA establishes a primary drinking water standard for aluminum or the State of Indiana develops a drinking water standard for aluminum, the cleanup

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59 Statement of Basis, page 10.
60 Statement of Basis, page 16.
61 Amec Foster Wheeler, Memo from Russell Johnson to Michelle Kaysen, EPA, Subject Response to EPA Comments on Corrective Measures Study for Area C Proposed Media Cleanup Standards, June 15, 2015, page 4.
62 Amec Foster Wheeler, Memo from Russell Johnson to Michelle Kaysen, EPA, Subject Response to EPA Comments on Corrective Measures Study for Area C Proposed Media Cleanup Standards, June 15, 2015, page 4 and Figure 6-42, NIPSCO Bailly Generation Station pH vs Aluminum in Area C Groundwater.
63 Amec Foster Wheeler, Memo from Russell Johnson to Michelle Kaysen, EPA, Subject Response to EPA Comments on Corrective Measures Study for Area C Proposed Media Cleanup Standards, June 15, 2015, Figure 6-5, Area C Aluminum Groundwater Results.
64 *Ibid.*
65 Rothrock, Paul E., and Manning, George C., Report: Potential Impact of Fly-ash Groundwater Contamination on Vegetation of Cowles Bog, Indiana Dunes National Lakeshore, August 2011.
66 Statement of Basis, page 13.
67 EPA, National Primary Drinking Water Regulations.
68 327 Indiana Administrative Code, 8-2-4, September 23, 2020.

standards and groundwater corrective action objectives for the Area C Cleanup need to be modified to include groundwater aluminum cleanup standards to be consistent with EPA's groundwater remediation policy under RCRA.

<u>Long Term Stewardship Program</u>

NIPSCO is required by EPA to institute a LTSP consisting of at least 30 years of monitoring. The LTSP includes an Institutional Control Implementation and Assurance Plan, five-year remedy review procedures, and monitoring details, including frequency of data collection and reporting requirements. The five-year remedy review will include inspections to ensure the remedy is functioning as intended, that assumptions underlying the remedy, including cleanup standards, are still valid, and ensuring the protectiveness of the remedy to human health and the environment.[69,70]

<u>CEAPC Comments – Groundwater Contamination at Indiana Dunes</u>

The LTSP is a critical element of the Area C Cleanup and is required for public review to allow for evaluation of the effectiveness of the Area C Cleanup in achieving its corrective action objectives and protecting human health and the environment, especially considering the extent to which MNA is a component of the Area C Cleanup. The LTSP required of NIPSCO has not been provided by EPA as part of the public review and comment of the Area C Cleanup. The LTSP is not anticipated to be produced for at least a year.[71] Due to its importance as a component of the Area C Cleanup, the LTSP needs to be provided to the public for review and comment in order to fully determine the adequacy not only of the LTSP, but the Area C Cleanup as a whole.

<u>LTSP Components</u>

Consistent with previous investigations in Area C, including remedial investigations performed by NIPSCO and the plant toxicity study performed in August 2011 (Cowles Bog Report), elements of the monitoring program for the LTSP need to include:[72,73]

- Quarterly groundwater, surface water, and sediment sampling consistent with groundwater and hydrogeological investigations previously performed and performed in all locations COC concentrations exceeded risk assessment screening levels, including Area C-specific background concentrations.
- Soil sampling in the PBSA to monitor soil pH and metals concentrations.
- Surveys of native species establishment in the excavated and backfilled areas of the GBA and EW twice a year during the growing season for a period of at least five years.

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69 FAQ, page 10.
70 Statement of Basis, pages 3 and 24.
71 Email from Kevin Draganchuk, P.E., CEA Engineers, to Michelle Kaysen, Environmental Scientist, EPA, Subject: RE: NIPSCO Bailly Generating Station Area C Cleanup Question, September 21, 2020.
72 Basis of Statement, pages 9-10.
73 Rothrock, Paul E., and Manning, George C., Report: Potential Impact of Fly-ash Groundwater Contamination on Vegetation of Cowles Bog, Indiana Dunes National Lakeshore, August 2011.

- Surveys of the native plant communities that have been observed to be naturally reestablishing themselves in the PBSA twice a year during the growing season for a period of at least five years to determine MNA effectiveness.
- Plant toxicity studies to determine the extent the COCs are continuing to impact plants in Indiana Dunes.

The reference data for plant toxicity cannot rely upon the plant toxicity study performed by NIPSCO as part of its BERA, since EPA identified inadequacies in NIPSCO's plant toxicity study. Plant toxicity studies as part of the LTSP should rely on the 2010 plant survey data contained in the Cowles Bog Report and soil and groundwater plant toxicity reference values for comparison and identification of trends in the existence and potential for plant toxicity due to COCs in soils and groundwater in Indiana Dunes.[74,75]

Based on the 40-year time frame natural attenuation has been occurring since elimination of the contaminant source to the PBSA, the LTSP needs to include criteria for extending plant surveys in the event vegetative conditions in the PBSA do not return to their natural state, or appear likely to do so in the near future.

MNA – Corrective Measures Implementation Work Plan

EPA will consider a contingency plan in the event source control and MNA do not meet groundwater corrective action objectives, consisting of options such as modifications to groundwater monitoring or additional remedial actions.[76] A minimum of five years of monitoring will be required before consideration of the contingency plan for meeting groundwater corrective action objectives. EPA will be producing a Corrective Measures Implementation Work Plan (CMIWP) that will include the decision logic and criteria for evaluation of source control and MNA effectiveness at meeting groundwater corrective action objectives and determining if a contingency plan is required.[77] EPA needs to make the CMIWP available for public review and comment, since the decision logic used to determine the effectiveness of source control and MNA at achieving groundwater corrective action objectives is a critical element of the Area C Cleanup groundwater remedy.

LTSP 5-Year Remedy Review

The criteria for the five-year remedy review and determining the effectiveness of MNA as a remedy are essential to the success of the LTSP and should be developed in conjunction with the CMIWP. Specific to groundwater, surface water, soil, and sediment contamination, the criteria needs to define how trends in COC concentrations over time will be determined and analyzed for

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74 EPA, Letter from Michelle Kaysen, EPA, to Dan Sullivan, Northern Indiana Public Service Company, RE: NIPSCO Bailly Generating Station EPA Area C BERA Comments, EPA IDL IND 000718114 March 15, 2013.

75 EPA, United States Environmental Protection Agency (EPA) review of the August 2011 Report: Potential Impact of Fly-ash Groundwater Contamination on Vegetation of Cowles Bog, Indiana Dunes National Lakeshore (Report), prepared by Taylor University, March 15, 2013.

76 Statement of Basis, page 3.

77 FAQ, page 10.

success in terms of reduction in COCs concentrations and ability to achieve the corrective action objectives in Indiana Dunes, including the PBSA. The analysis needs to consider not just the main risk-driver of the Area C Cleanup, boron, but all of the COCs with cleanup standards due to the potential for varying rates of natural attenuation of COCs. Criteria for determining the effectiveness of natives species establishment needs to be established. The criteria for the five-year remedy review needs to include the methodology for determining continued validity of the assumptions underlying remedy selection and that the remedy is ensuring protection of human health and the environment. A procedure must be included in the five-year remedy review for the actions that will commence in the event it is determined that the Area C Cleanup is not functioning as intended, MNA is not resulting in reductions in COC concentrations, the underlying assumptions for the Area C Cleanup are deemed invalid, or the Area C Cleanup is not protective of human health and the environment.

If the results of any five-year review as part of the LTSP determine that changes to the remedies that comprise the Area C Cleanup are required, EPA will determine whether the changes are fundamental, significant, or non-significant. EPA will inform the public of significant or fundamental changes, but may approve non-significant changes without public comment.[78] EPA needs to define the criteria it will use to determine whether required changes to the Area C Cleanup are fundamental, significant, or non-significant to ensure the public's ability to review and comment on any potential changes to the Area C Cleanup are not infringed.

Additional CEAPC Comments

Post-Excavation Confirmation Sampling

The GBA and EW contain a trail that visitors to Indiana Dunes can utilize. Though soil boring results do not show coal ash in the location of the trail itself, the trail is adjacent to the proposed excavation area in the GBA and EW and SWMU 15. Visitors who leave the trail can enter the area of the GBA and EW or SWMU 15 that contain coal ash and potentially be exposed the COCs.[79]

Confirmation sampling needs to be performed during excavation in SWMU 15 and the GBA and EW, including surface soil samples at the excavation boundaries and excavation bottom and sidewall sampling, to confirm that coal ash excavation is complete, exposure pathways to coal ash and its COCs are eliminated for both humans and ecological resources, and the excavation is fully protective of human health and the environment. Confirmation sampling in the GBA and EW need to demonstrate COC concentrations that meet the IDEM residential direct exposure criteria corrective action objective for the GBA and EW, lands managed at least in part by the NPS, and that result in no restrictions to future use. Confirmation sampling in SWMU 15 needs to demonstrate COC concentrations achieving the direct contact corrective action objective consisting of the IDEM RISC Industrial Soil Default Closure Levels for arsenic, cadmium,

78 Statement of Basis, page 24.
79 Statement of Basis, Figures 7, 8, and 9.

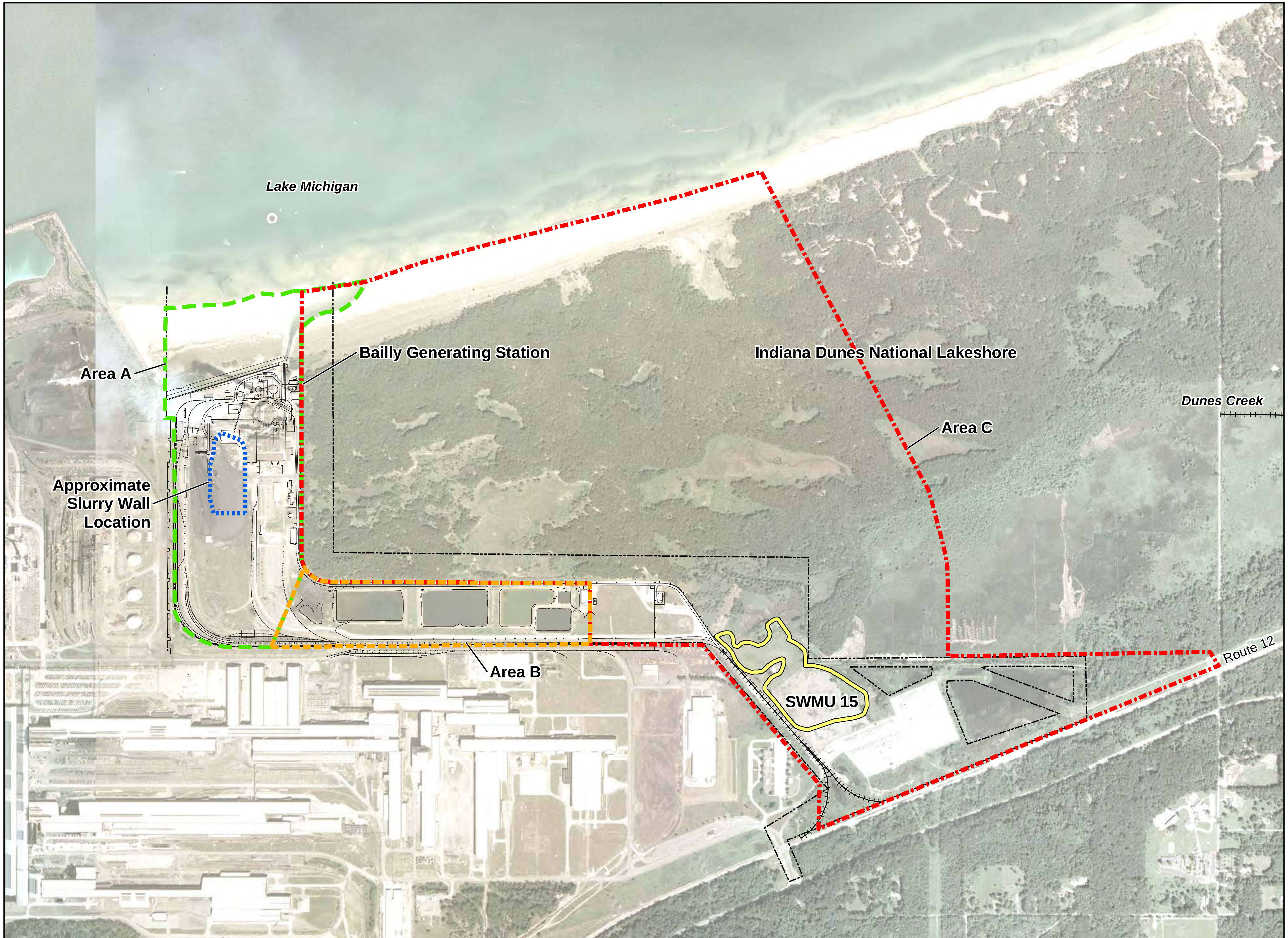
chromium, copper, lead, and selenium, or the EPA Industrial Soil Regional Screening Levels for boron, manganese, and molybdenum.[80]

Drinking Water

Human health will not be impacted through groundwater use as a drinking water supply on Area C. Use of groundwater as a drinking water source will be restricted on NIPSCO property through use of restrictive covenant consistent with the proposed future commercial or industrial use of the NIPSCO property.[81] At Indiana Dunes, groundwater in Area C in general and, specifically, within the groundwater plume is not presently a drinking water source.[82] EPA's policy regarding groundwater protection and cleanup under RCRA requires restoration of aquifers to their maximal beneficial use. EPA's policy requires that human health receptors are protected in a manner that will not limit future uses, and, as a result, groundwater at Indiana Dunes requires remediation to drinking water standards.[83] EPA's selected remediation alternative also includes installation of piping to provide potable water to the area of Indiana Dunes impacted by contaminated groundwater if needed.[84]

80 Statement of Basis, pages 15 – 16.
81 Statement of Basis, page 3.
82 Indiana American Water Company has an intake at Ogden Dunes from Lake Michigan and serve the northwest Indiana area, including the area where Indiana Dunes is located. It is more likely than not that Indiana Dunes drinking water is source from Indiana American Water Company and Lake Michigan. https://www.chicagotribune.com/suburbs/post-tribune/ct-ptb-portage-lake-spill-st-0907-20190906-mt3xntnchbhwrfr3ivb6nknclq-story.html.
83 Statement of Basis, page 13.
84 Statement of Basis, page 21.

ATTACHMENT A



Sitewide Overview and Site Features

Northern Indiana Public Service Company

Bailly Generating Station
Chesterton, Indiana

Legend

- Bailly Generating Station Property Boundary
- Approximate Slurry Wall Location
- Railroad
- Area A
- Area B
- Area C
- Solid Waste Management Unit Boundary

Location of Site

Notes and Sources

FIGURE 3

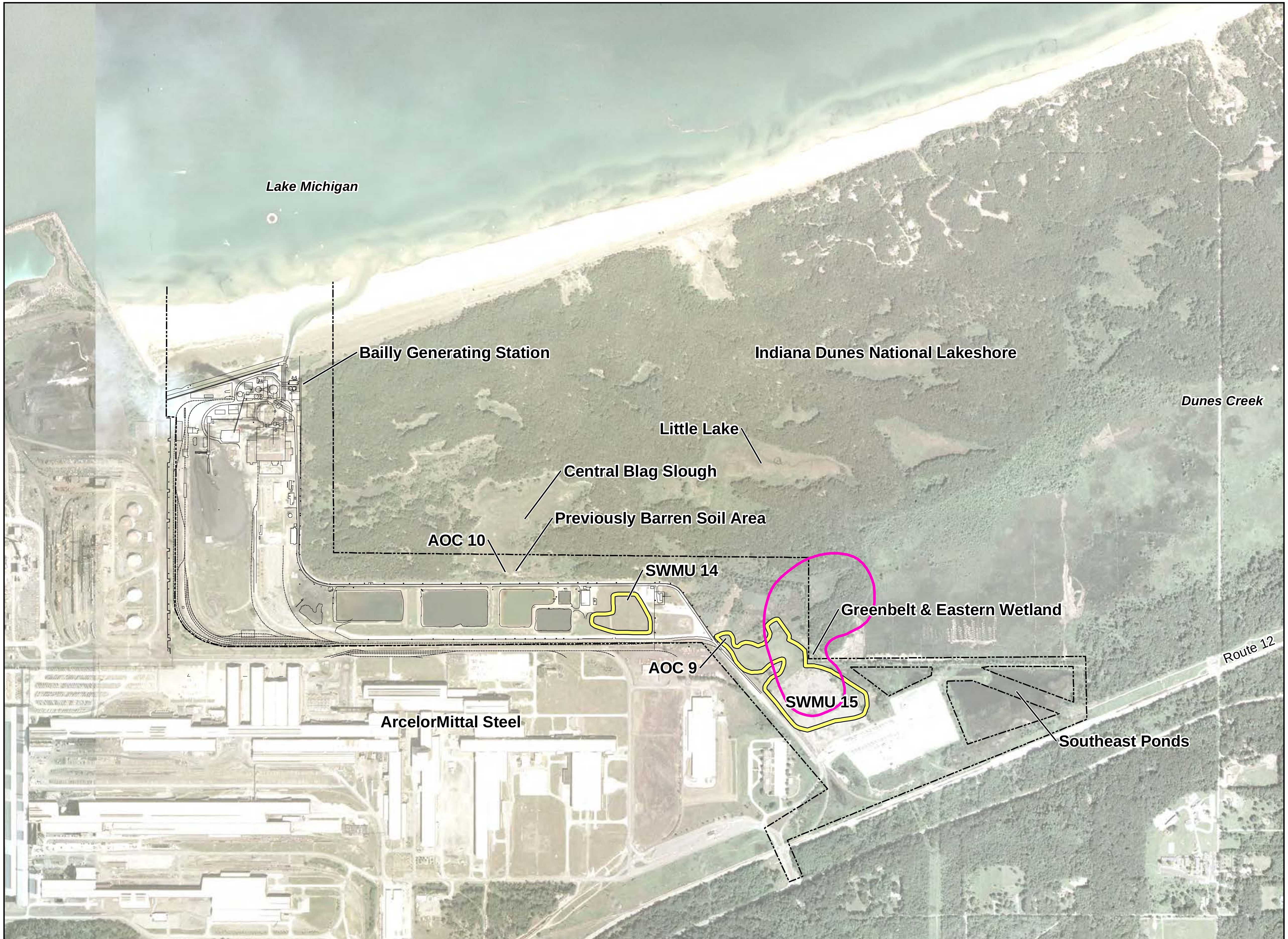
Aerial Photo: March 2003
Courtesy of Indiana Spatial Data Portal

0 1,000 Feet

N

wood.
Wood Environment & Infrastructure Solutions, Inc.
271 Mill Road
Chelmsford, MA 01824
(978) 692-9090

ATTACHMENT B



Sitewide Overview and Site Features

Northern Indiana Public Service Company

Bailly Generating Station
Chesterton, Indiana

Legend

Bailly Generating Station Property Boundary
Solid Waste Management Unit Boundary
Extent of Groundwater Contamination Above Clean-up Standards Based on 2018 Results

Location of Site

Notes and Sources

FIGURE 2

Aerial Photo: March 2003
Courtesy of Indiana Spatial Data Portal

0 1,000
Feet

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Wood Environment & Infrastructure Solutions, Inc.
271 Mill Road
Chelmsford, MA 01824
(978) 692-9090

H:\NiSource\BaillyGenerating\Task70\MXD\Fig2-1_A_SitewideOverview.mxd May 06, 2020 DWN: emily.gardiner CHKD: RAJ

SOUTHERN ENVIRONMENTAL LAW CENTER

Telephone 919-967-1450 | 601 WEST ROSEMARY STREET, SUITE 220
CHAPEL HILL, NC 27516-2356 | Facsimile 919-929-9421

October 19, 2020

Submitted via electronic mail

Kirstin Safakas
EPA Community Involvement Coordinator
U.S. Environmental Protection Agency, Region 5
77 West Jackson Boulevard
Mail Code: EC-19J
Chicago, IL 60604-3507
Safakas.kirstin@Epa.gov

RE: Statement of Basis, Area C
Northern Indiana Public Service Company (NIPSCO)
Bailly Generating Station

Dear Ms. Safakas:

We write to address a potential unintended consequence of EPA's approach in the Statement of Basis for Area C of the Bailly coal ash site. We have secured cleanup agreements and court orders requiring the excavation of numerous coal ash sites throughout the Southeast, and over 250 million tons of coal ash is now being excavated to lined, dry storage and recycling in our region. We are concerned that EPA's explanation for its approach in the Bailly Statement of Basis could be taken out of context and used to resist needed cleanups in our region and elsewhere in the country.

EPA should clarify that the presence of saturated ash below the groundwater table does not justify leaving ash in place, nor does dewatering and excavating saturated ash in and of itself pose any inherent worker safety concern. We are asking that you make clear that your concerns about excavation of saturated ash are based on the specific facts of the Bailly situation that you are addressing.

The Statement of Basis repeatedly references safety concerns related to the ash in groundwater; for example, the document states that "complete removal of the CCR would involve excavation to depths as great as 13 feet below the water table (22 feet below the land surface). These deeper excavations would require extensive dewatering to maintain water levels below the working surface and would present additional safety challenges due to excavation bottom and sidewall stability."[1] And EPA specifically references these "practical technical difficulties" as a reason to reject excavation of saturated ash at this site.[2]

[1] Statement of Basis, p. 20.
[2] *Id.*

We understand that in this specific case, the decision that the ash in the groundwater should not be dewatered may as a practical matter pose safety concerns for excavation. But more generally, in other situations when ash is dewatered, there is no question that ash can be removed, has been removed, and is being removed safely from deep impoundments and moved to dry lined storage which provides needed protection to the environment, water resources, and the surrounding community.

Indeed, in the situations we have faced in the Southeast, excavation is the only solution proven to stop the ongoing pollution of downgradient groundwater and surface waters, because ash that remains saturated will continue to leach contaminants into the groundwater even if the ash is capped or mixed with cement.

Nor is ash located 13 feet below the water table unusual or especially challenging to remove; at most of the coal ash sites we have worked on in the Southeast, coal ash sits 50, 60, 70, and even 80 feet deep in groundwater. These sites are now being fully excavated successfully.

North Carolina recently ordered Duke Energy to excavate its coal ash from six sites where the ash extends far below groundwater, all of which are far larger—and contain far more saturated coal ash—than the Bailly site.[3] For example, North Carolina specifically cited its environmental concerns with the amount of saturated ash at the Mayo site in Roxboro, N.C.[4] The final excavation order requires the removal of over 80 million tons of ash from these sites.[5] Saturated ash in groundwater is being excavated from many, many sites in the Southeast that are much, much larger than the one near this National Park, in a way that is safe for workers and the surrounding community.

Indeed, utilities are fully excavating ***over 250 million tons*** of coal ash from sites across the Southeast, much of it located in groundwater:

- In North Carolina, Duke Energy is required by court orders and settlement agreements to excavate all eight of its other coal ash sites in North Carolina, in addition to the six sites covered by the cleanup order discussed above. Together, the 14 North Carolina excavations total 126 million tons of coal ash.

- In South Carolina, Duke Energy is fully excavating both of its coal ash sites. And South Carolina utilities Santee Cooper and SCE&G (now owned by Dominion

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[3] N.C. Dept. of Environmental Quality, *DEQ Orders Duke Energy to Excavate Coal Ash at Six Remaining Sites*, (Apr. 1, 2019), https://deq.nc.gov/news/press-releases/2019/04/01/deq-orders-duke-energy-excavate-coal-ash-six-remaining-sites.

[4] NC DEQ, Coal Combustion Residuals Surface Impoundment Closure Determination - Mayo Steam Station, p. 6, https://files.nc.gov/ncdeq/Coal%20Ash/2019-april-decision/mayo/Mayo_FINAL_ImpoundmentClosureDeterminationReport_20190401.pdf.

[5] NC DEQ, *Court approves consent order to excavate more than 80 million tons of coal ash*, https://deq.nc.gov/news/press-releases/2020/02/05/court-approves-consent-order-excavate-more-80-million-tons-coal-ash.

Energy) also are excavating all of their unlined coal ash impoundments throughout South Carolina, totaling more than 15 million tons of coal ash.

- In Virginia, Dominion Energy is required to fully excavate the coal ash from all its sites, totaling 29 million tons, and Appalachian Power is required to excavate an additional site containing 7 million tons of coal ash.

- In Georgia, Georgia Power is fully excavating six sites totaling nearly 50 million tons of coal ash.

- In Tennessee, TVA is fully excavating two sites in Nashville and Memphis containing 15 million tons of coal ash.

In every instance, the utilities support or have accepted these cleanups. And while many utilities resisted cleaning up their coal ash sites initially, none have ever attempted to argue that it is unsafe to excavate coal ash located in groundwater. In short, there is no support for using the presence of saturated ash as a reason not to excavate coal ash; the opposite is true.

Nor are sandy, swampy conditions by themselves a barrier to excavation of saturated ash. In South Carolina, we secured a binding settlement agreement requiring Santee Cooper to fully excavate its Grainger coal ash site in Conway, S.C. This site is located in wetlands on the banks of the Waccamaw River. And Santee Cooper has now successfully excavated all of the ash, totaling 1.75 million tons, and restored the area to wetlands. The company used a phased approach, dividing the two large impoundments at the site into cells and smaller 3.5 acre "decision units" separated by temporary barriers to prevent water infiltration.[6] Excavation was completed in 2019, more than three years ahead of schedule, despite the final total of removed ash being significantly higher than originally estimated.[7] And since excavation began, groundwater contamination has dramatically improved as the source of the pollution is removed.[8]

In short, the decision at the Bailly site turns on the specific circumstances at this site beside wetlands in a National Park. EPA should remove general references to worker safety concerns based on the location of ash below the groundwater table, because there is no support for these statements and in fact the opposite is true: saturated ash is the most important reason to remove coal ash from unlined pits, in order to stop the ongoing contamination of groundwater and surface water. Utilities elsewhere in the country that are attempting to avoid cleaning up their coal ash will seize on EPA's statements here to try to justify less protective approaches to dealing with their saturated coal ash. Any comments concerning worker safety should be based

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[6] Santee Cooper, Grainger Generating Station Ash Impoundment Cell Closure Procedure (Apr. 22, 2015), attached as Exhibit 1.

[7] WMBF, *Coal Ash Milestone: Last Truckload of Stored Pond Ash Hauled from Grainger* (May 6, 2019), https://www.wmbfnews.com/2019/05/06/major-milestone-crews-haul-out-last-truckload-stored-pond-grainger/

[8] *E.g.*, David Wren, *Santee Cooper's Coal Ash Removal Reducing Arsenic Levels*, Post & Courier (June 5, 2016), https://www.postandcourier.com/business/santee-cooper-s-coal-ash-removal-reducing-arsenic-levels/article_eac23acd-89c7-52aa-b467-927deee37bd8.html.

on the specific circumstances of the Bailly site and specifically the fact that no dewatering is occurring there.

If scientists at the Indiana Dunes National Park have determined that dewatering the saturated ash at Bailly would be more harmful to the Dunes than stabilizing this ash in place, that is an entirely separate issue that is specific to the unique site conditions of the Dunes ecosystem. EPA should clarify that this is an unusual situation and that its determination is based on these unique site conditions.

Thank you for your consideration of these comments.

Sincerely,

Nicholas S. Torrey
Frank S. Holleman III

EXHIBIT 1

santee cooper®

CERTIFIED MAIL

April 30, 2015

Mr. G. Randall Thompson, P.E.
Industrial Wastewater Permitting Section
Water Facilities Permitting Division
South Carolina Department of Health and
Environmental Control
2600 Bull Street
Columbia, South Carolina 29201-1708

Re: Santee Cooper (SCPSA) – Grainger Generating Station
NPDES Permit # SC0001104
Horry County

Dear Mr. Thompson:

Attached is the Grainger Generating Station Ash Impoundment Cell Closure Procedure (Procedure). The Procedure outlines how the pond will be divided into discrete units for decision making during the closure process, the selected soil sampling methodology, laboratory analysis, and decision mechanisms.

The pond will be divided into discrete units using best management practices to control stormwater run-on and run-off and isolate cleaned units from ash containing areas. Soil sampling and analysis will be conducted after one-foot of over excavation is completed and the unit is isolated. The soil will be sampled using the incremental sampling methodology. Details of the sampling and analysis plan are included.

A background sample will be collected on Santee Cooper property located upgradient of the ash ponds and east of U.S. Highway 501. Decisions about the acceptable closure of each unit will be made in consultation with your office in accordance with the approach outlined in the Procedure.

Should you have any questions or need additional information, please feel free to call at your convenience.

Sincerely,

Susan W. Jackson, PE

Susan W. Jackson, P.E.
Manager
CCP & Waste Management

Attachment: Grainger Generating Station Ash Impoundment Cell Closure Procedure

SWJ:DBB:cgb

cc w/ attachment:

Ms. Crystal Rippy, Manager
Industrial Wastewater Permitting Section
Water Facilities Permitting Division
South Carolina Department of Health and
Environmental Control
2600 Bull Street
Columbia, South Carolina 29201-1708

Grainger Generating Station Ash Impoundment Cell Closure Procedure

CCP and Waste Management & Civil Projects

SOUTH CAROLINA PUBLIC SERVICE AUTHORITY (SANTEE COOPER)

April 22, 2015

Grainger Generating Station Ash Impoundment Cell Closure Procedure

CCP and Waste Management & Civil Projects

Table of Contents

Figures & Tables

1 Executive Summary

As set forth in the closure plan dated January, 2014, Santee Cooper proposed closure of the Grainger Generating Station impoundments by removing all coal combustion products (CCP) from the existing CCP impoundments and at least one (1) foot of in-situ soil underlying the CCP impoundments. Santee Cooper plans to convert the areas within the footprint of the disposal impoundments to wetlands after ash removal is completed. No later than December 31, 2023, Santee Cooper will complete excavation of ash from Ponds 1 and 2 and at least one foot of in-situ soil underlying the ash; and, will remove all the excavated ash and soil from the Site to be beneficially used or placed in a Class 3 or better landfill. Santee Cooper will make good faith efforts to complete the excavation and removal of ash and soil from the Site by December 31, 2020.

Santee Cooper proposes to utilize the methodology described within this document to complete a phased approach to clean closure of the CCP disposal impoundments at GGS as described in the SC DHEC approved Amended Closure Plan (Geosyntec, 2014). As sections of the impoundment(s) are emptied of CCPs they will be isolated from areas still undergoing excavation. This approach will reduce the area exposed to ash and accelerate the start of natural attenuation processes. In addition, this approach reduces the volume of stormwater contacting ash and resultant wastewater disposal requirements. Soil in the isolated areas will be sampled and analyzed. Results from the soil sampling and analysis will be used to make decisions about the individual cells and ultimately about the entire impoundment footprint prior to the conversion to wetlands.

2 Purpose and Scope

This ash pond cell closure procedure provides details about the depth of excavation, cell isolation procedure, soil sampling methodology, lab analysis for constituents of potential concern, and decision mechanisms. The depth of ash excavation is determined based on previous borings and visual confirmation. The boring logs are contained in the conceptual site model prepared by ARCADIS (2013). The Incremental Sampling Methodology (ISM) (ITRC, 2012) is the basis for the soil sampling procedure and terminology applicable to ISM is used throughout this document. Section 3 of this document describes the cell isolation procedure. In ISM terminology, each isolated cell becomes a decision unit (DU). The soil sampling methodology and the lab analysis are described in Sections 4 and 5 respectively. Results from the soil sampling and analysis will be used to make decisions about the individual cells and ultimately about the entire impoundment footprint prior to the conversion to wetlands. Decision mechanisms are discussed in Section 6.

Details for the future conversion to wetlands are not included in this document and will be provided at a later date.

The objective of this project is to remove the approximately 1.3 million tons of coal combustion byproducts from GGS for beneficial use in the cement industry. The purpose of the sampling and analysis plan is to sample the remaining soil, and determine if there are constituents of immediate concern or demonstrate the absence of contaminants above levels of concern (screening levels). The analytical results can be compared to human health screening levels, ecological screening levels, natural background metals concentrations, or groundwater protection soil concentrations. Because the ash pond footprint will be converted to wetlands, ecological screening levels are the basis for comparison. The objective will be met when the concentration of constituents of concern no longer pose an unacceptable risk to the environment.

3 Decision Unit Isolation Procedure

Santee Cooper is currently excavating, screening, processing, and recycling coal ash from the NPDES permitted wastewater impoundments at GGS. The 2014 Amended Closure Plan identified four phases to close Ash Pond 1 and three phases for Ash Pond 2. This cell closure procedure has further subdivided Pond 1 into eleven (11) DUs, with an average size of 3.5 acres. Pond 2 will be further subdivided into similar sized DUs.

The DUs are designed to be regularly spaced, of similar size and shape, and cover the entire footprint of the ash impoundment. This approach is consistent with knowledge of the site exposure as reflected in the conceptual site model and supports the objectives of the project to excavate and remove all ash. The sidewalls of the excavation are defined by the location of the perimeter dikes. The floor of the excavation is defined by the information collected during earlier site investigations.

The following is the general procedure to isolate each DU in the impoundment(s) as CCPs are removed:

1. Excavate to the bottom of ash - The elevation of the interface between the bottom of ash and native soil is determined from soil borings completed in 2012 during the planning phase of the project. Visual identification during excavation is utilized to confirm the interface between the ash and the native soil was reached and all ash was removed. Figure 3-1 illustrates the difference in appearance between in-situ soil and CCBs. Soils along the right hand side of the photograph on the slope appear brow in color. Ash is located in the center of the photograph on the bottom of the impoundment and appears black in color.

Figure 3-1. CCB/In-situ Soil Interface – Grainger Generating Station

2. Survey ash-soil interface – After the ash is excavated from the DU, Santee Cooper will survey to obtain accurate measurements of the elevation of the ground surface and develop a record drawing of the plan and profile. The survey will be performed under the direction of a Professional Land Surveyor registered in the State of South Carolina.

3. Excavate in-situ soil - Santee Cooper will excavate one (1) additional foot of soil or more as determined by SC DHEC, perform a follow-up survey and update the record drawing to verify the required depth of over excavation is achieved.

4. DU isolation - Santee Cooper will install small temporary barriers around the perimeter of the over excavated DU. These isolation barriers may consist of a clean soil berm, a composite material, or some combination of the two depending on conditions encountered.
    a. Soil berms are constructed from either offsite material or from soil borrowed from a previously closed portion of the pond. Soil selected for the berms shall be sandy clay or similar material to minimize hydraulic conductivity through the isolation barrier.
    b. Barriers are placed utilizing heavy equipment, including, but not limited to, bulldozers and tracked excavators. Silt fence, if necessary, is installed at the crest of a soil berm to ensure no CCPs are transported from active excavation areas of the pond back into areas already cleaned and closed.
    c. Barriers are constructed to contain (at a minimum) the 10-year, 24-hour storm (6.4 inches in 24 hours per the SCDHEC Storm Water Management BMP Handbook), preventing overtopping from areas still containing CCPs into cells already clean and closed. Action will be taken to minimize stormwater flow from active excavation areas towards cells already cleaned, closed, and isolated.

5. Barrier Inspections – Isolation barriers will be inspected monthly (at a minimum) and after any rain event exceeding two (2) inches in twenty-four (24) hours per established SCDHEC

Best Management Practices (BMP) standards for Construction Storm Water projects. Inspections will be conducted by a registered Professional Engineer or a Certified Erosion Prevention and Sediment Control Inspector (CEPSCI). Records of these inspections will be kept on-site until clean closure is completed.

6. Storm Water Management - Storm water management in cleaned and closed portions of the pond(s) will initially be accomplished with a combination of infiltration and pumping to the permitted NPDES outfall. After several DUs have been cleaned and closed, Santee Cooper anticipates stormwater management plans will be revised to allow direct discharge of clean stormwater through existing permitted industrial stormwater outfalls or through new stormwater outfalls. Any new outfalls will be permitted through SCDHEC's NPDES program for storm water at industrial sites.

4 Soil Sampling Methodology

Santee Cooper will conduct soil sampling and analysis after each cell is over-excavated and isolated to confirm source removal is complete. Source removal is the selected remedial method to reduce the risk of exposure to human and ecological receptors. The Incremental Sampling Methodology (ITRC, 2012) will be used to conduct soil sampling. The Incremental Sampling Methodology (ISM) is well suited to the Grainger Ash Ponds based on the Conceptual Site Model developed by ARCADIS (2013) and the end use described in the SC DHEC approved Amended Closure Plan prepared by Geosyntec (2014).

The objective of environmental sampling is to quantify some property of the media samples, such as the amount of a potential contaminant present in soil at a given site. Traditionally, environmental cleanup programs have relied on discrete sampling to characterize environmental media. However, the number of discrete samples often collected at a site does not lend itself to statistically valid interpretation. It is impossible to identify the true mean of a population without analyzing the entire mass. Since it is impossible to sample and analyze the entire population due to practical considerations, statistical methods are used to determine a representative concentration. ISM is based upon a theory of particulate sampling developed by geologist Pierre Gy to improve the quality of data gathered in support of mineral exploration and mining (Pitard, 1993). ISM is applicable to environmental sampling at contaminated sites.

In the case of site investigations, a representative sample of bulk material is one that has the same properties as the bulk material contained in the population. The population is the mass of contaminant in the environmental medium throughout the DU. A representative bulk material sample has all particulates (e.g., size, shape, concentrations) in the same proportion as the particulates present in the DU. When a representative sample is collected from the DU, we are more likely to obtain an unbiased estimate of the mean.

The Conceptual Site Model (ARCADIS, 2013) verified the native soils within the footprint of the ponds are relatively homogeneous, poorly graded ($5<Cu<15$), and have been uniformly exposed to a relatively homogeneous mixture of CCPs. Because of this, the anticipated degree of compositional and distributional heterogeneity within an individual cell and between cells within the impoundments is low. However, the presence of even minor amounts of compositional or distributional heterogeneity can introduce relative bias in the mean concentration of a constituent of concern. Bias can be reduced by collecting and combining multiple increments, each of the same mass. This is the fundamental motivation for applying ISM.

ISM is a well-documented approach to gather representative samples by collecting and compositing numerous increments to learn about a whole area. It is designed as a structured, composite sampling and processing protocol to reduce data variability and provide a reasonably unbiased estimate of mean contaminant concentrations in a volume of soil targeted for sampling. Each DU will be partitioned into a grid with 30 sections of nearly equal areas. The dimensions of each section will depend on the shape and size of the DU. Three (3) replicates of thirty (30) sample increments will be collected over the entire DU. When taken over the entire DU, replicates offer information on variability in the estimate of the mean provided by the ISM Samples. The relatively high density of sample increments will be field combined.

Just as with discrete sampling, a variety of sampling methods may be implemented with ISM sampling. The method selected for GGS ash pond closure is random sampling within a grid, also called "stratified random sampling" [USEPA 1995]. In this approach, the DU is divided in a grid pattern and samples are obtained sequentially from adjacent grid sections. The location of the sample within each grid section is random. Replicate ISM samples are collected with the same sampling method but not the same exact locations. Random sampling within a grid is somewhat of a compromise approach with elements of both simple random and systematic sampling, the other two common methods. While all three methods are statistically defensible and will yield unbiased parameter estimates for relatively homogeneous sites, the selected systematic method ensures relatively even spatial distribution of samples across the site and is easier to implement in the field. As illustrated in Figure 4-1, this method visually reinforces the fact that all areas within the DU are represented in the samples.

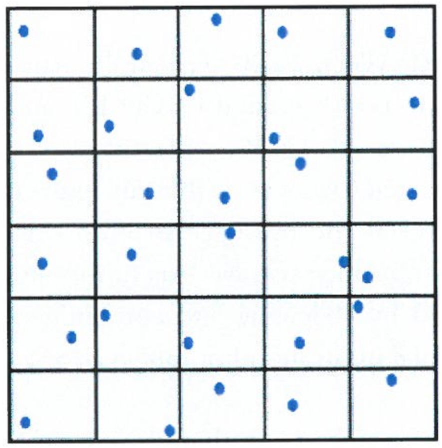


Figure 4-1. Random sampling within grids

The sampling tools required to field collect core-shaped soil increments of a uniform required are necessarily site specific and depend upon the properties of the material sampled. Care should be taken to obtain "core-shaped" increments over the entire depth of interest. For GGS, the in situ soil allows individual increments to be readily collected and dispensed into a sample container using an appropriate hand-operated tool and method. An "increment" is a small volume of material removed in a single operation of the sampling device from the predetermined grid section of the DU.

The recommended sampling device is a multi-incremental sampling tool. The diameter and length of the coring bore cutter is selected to insure representative samples are obtained. Properties for the natural soils located just beneath the ash were reported in the conceptual site model. The soils were characterized and described as being very fine sands, clays and silts from the Upper Socastee formation. Slightly coarser grained soils from the Lower Socastee formation may be exposed in a limited area of Pond 1. Sieve analysis results showed 100% of the soils routinely passed the #4 sieve, or a maximum particle size of 4.75 mm. The diameter of the tool's bore cutter must be a minimum of 3 times the maximum particle diameter plus 10 mm (plunger diameter = 3Dmax + 10mm). For this site, the minimum diameter will be 2.4 cm due to the soil grain size.

The length of the soil coring bore cutter is selected to capture the full depth of interest and collect a minimum of 1 kg of sample after the 30 increments are combined. One (1) kg is the recommended minimum sample mass to overcome compositional heterogeneity within the sample itself due to particle size. Standard lengths for the tool's bore cutter range from 1 to 5 cm. Based on an estimated dry unit weight of soil equal to 100 pcf, 30 increments, and bore cutter dimensions of 3 cm diameter x 4 cm length, a total sample mass of approximately 1.35 kg will be collected for each of three replicates.

The sampling device can be used within a DU without decontamination, but should be decontaminated between replicates and between DUs. Decontamination consists of removing soil particles from the sampling too, washing with lab grade soap, rinsing with deionized water, decontaminating with isopropyl alcohol, and drying.

Typically metals are the primary constituents of concern at sites used to dispose of fly ash. Metals are relatively immobile in subsurface systems as a result of precipitation or adsorption reactions. Source removal was the agreed upon remediation method. Analysis of the remaining soil as a potential source of metals will focus on the top layer of soil after the one-foot of over excavation is completed.

Arsenic has been the primary constituent of concern based on groundwater monitoring. Arsenic is a semi metallic element that is present in the fly ash residual from coal combustion. Arsenic exhibits fairly complex chemistry and can be present in several oxidation states (-III, 0, III, V) (Smith et al., 1995). Many arsenic compounds sorb strongly to soils and are therefore transported only over short distances in groundwater and surface water. Over excavation of one foot of soil is a very conservative approach to insure the removal of all soils that had been in direct contact with the ash. The sample depth of 4 cm is appropriate for the potential exposure to any ash remaining in the future wetland site.

ISM provides reliable, reproducible results leading to better, more defensible decisions than have typically been achieved with discrete sampling approaches. Rigorous quality assurance/quality control measures will be followed throughout the field and lab processes. Because of the advantages and improvements inherent in ISM, this methodology is increasingly being used in the environmental field for sampling contaminants in soil and is gaining wide acceptance and endorsement by state and federal regulators.

5 Laboratory Analysis

Santee Cooper operates a SCDHEC certified laboratory and will process samples in-house or at a certified contract lab. Field combined samples (ISM field replicates) will be composited (Sample Processing) in the laboratory and split using the cone and quartering method (Subsampling) prior to analysis (Analytical Aliquot). These process terms are illustrated in Figure 5-1.

Composited soil samples will be analyzed to:

- Define the nature and extent of chemicals of potential concern (COPCs);
- Assess potential risks to human and ecological receptors; and,
- Make decisions regarding completion of individual cell closure.

DHEC Form 1795, included in the Amended Closure Plan, identifies all pollutants that may be present in the wastewater treatment system. These include Ammonia, Antimony, Arsenic, Barium, Boron, Cadmium, Chromium, Copper, Fluoride, Lead, Mercury, Nickel, Selenium, Silver, Sulfate, Vanadium, and Zinc. Of these, Arsenic is the only constituent historically detected in some groundwater monitoring wells to exist above the maximum contaminant level (MCL) for drinking water.

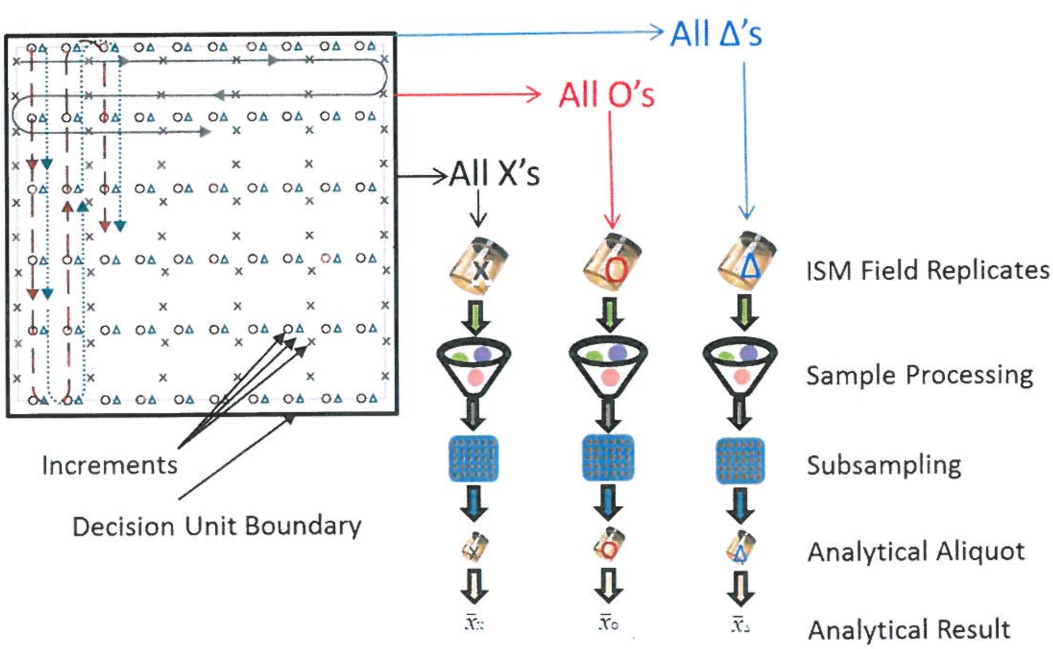


Figure 5-1. Key ISM Process Terms

To ensure the analysis of the soil and not the surrounding water, the laboratory will filter the sample (0.45 um filter) while rinsing with deionized water. The most common method for determining the concentration of metals contaminants in soil is via elemental analysis using acid digestion (U.S. EPA Method 3050B) for sample preparation. Analysis of the prepared samples is then made using U.S. EPA Methods 6010C (ICP-AES) or 6020A (ICP-MS). Supplemental analysis may use U.S. EPA Method 7062 for Arsenic. Total and dissolved analysis will be made for arsenic, the only constituent of concern detected at this site.

6 Decision Mechanisms

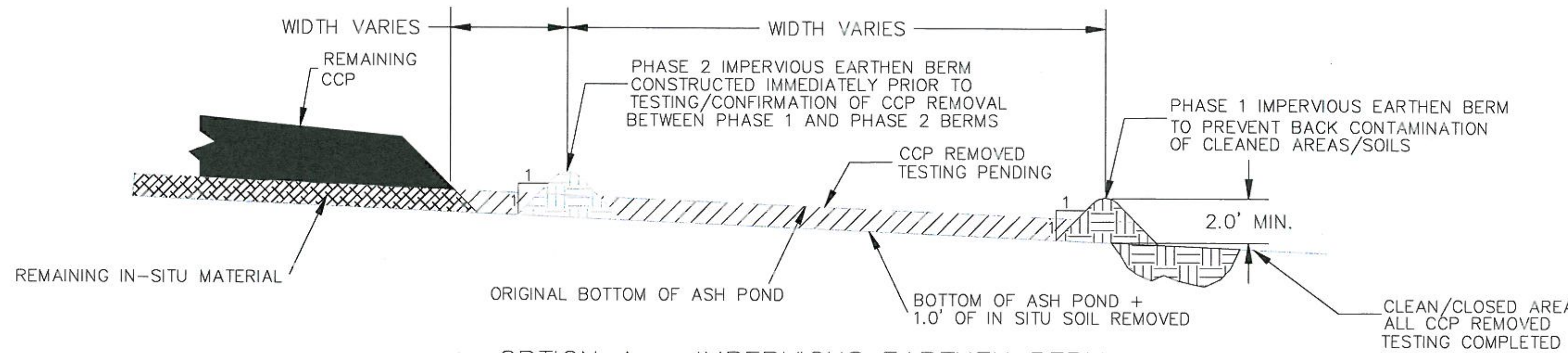
As discussed in the approved amended closure plan, the area within the ash impoundment footprints will ultimately be converted into forested or grassed wetlands with a resulting potential risk to ecological receptors exposed to sediment. The conversion will require breaching the dikes in one or more locations. The footprint of the generating station and appurtenant features, and the cooling pond are not included in the scope of this proposed cell closure procedure.

Environmental decisions are often based on the risks resulting from exposure to estimated mean concentrations of contaminants in volumes of soil. Decision mechanisms are selected to meet project objectives and include the procedures and inputs used to aid decision making based on environmental concentration data. In this investigation, the measured contaminant concentration for each replicate will be compared to evaluate the variability in the estimate of the mean provided by the ISM Samples. The contaminant concentration for the replicates is averaged to determine the estimate of the mean for the DU.

Decision mechanisms that apply to ISM are analogous to decisions made using discrete data. Santee Cooper proposes to compare a statistically valid 95% Upper Confidence Level (UCL) of the mean from each DU to EPA Region 4 recommended ecological screening values for soils. Constituents of potential concern that exceed the recommended ecological screening values for soils will be compared to measured background levels. It is understood if the 95% UCL for the DU meets background levels for constituents of potential concern, the entire DU passes. The potential decision alternatives include no additional action if the mean contaminant concentrations meet the appropriate background levels or if the potential risk is acceptable, monitored natural attenuation, or additional excavation.

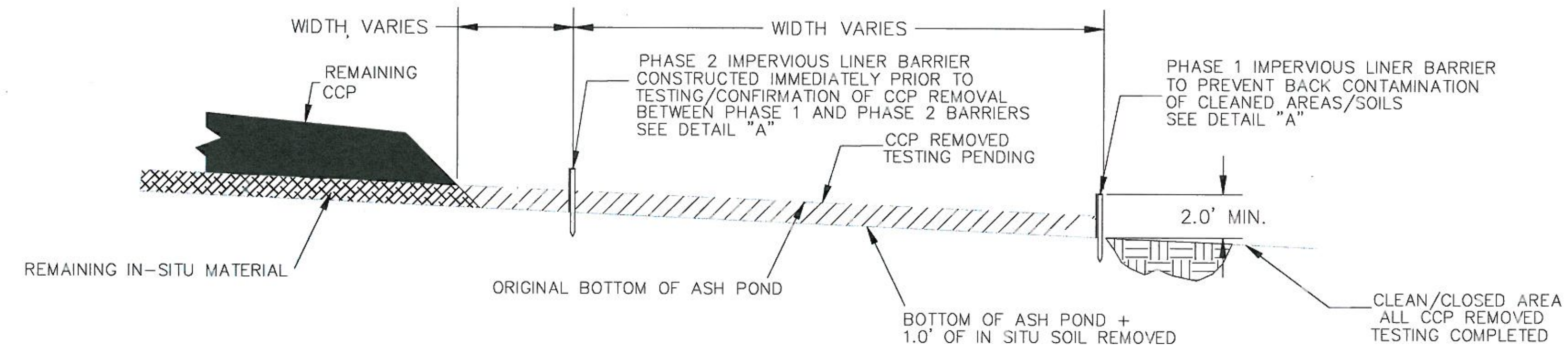
Table 6-1 EPA Region IV
Recommended Ecological Screening Values (mg/kg) for Soil
(WSRC-TR-98-00110)

Constituent	Screening Value
Arsenic	10
Barium	165
Cadmium	1.6
Chromium	0.4
Copper	40
Lead	50
Mercury (inorganic)	0.1
Nickel	30
Selenium	0.81
Silver	2.0
Zinc	50

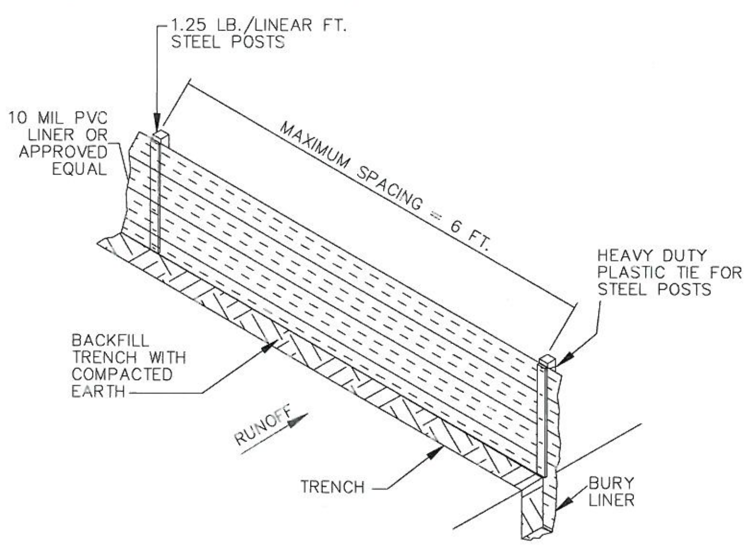


OPTION A – IMPERVIOUS EARTHEN BERM

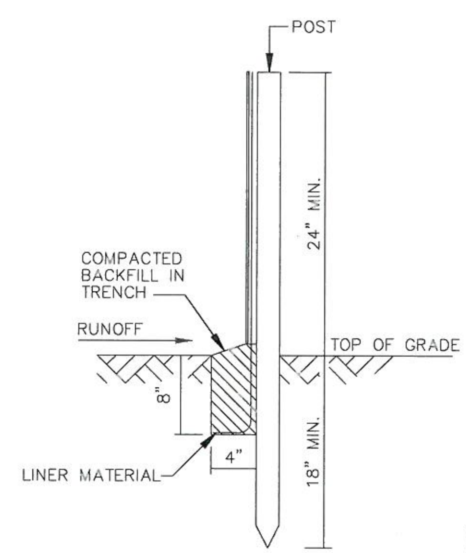
LANDFILL LINER OR APPROVED EQUAL TO BE OVERLAYED AS NEEDED TO PREVENT CCP TRANSPORT



OPTION B – IMPERVIOUS PVC LINER STRUCTURAL BARRIER



LINER BARRIER INSTALLATION



LINER BARRIER DETAIL

INSTALLATION PROCEDURE

1. DIG MINIMUM 4" X 8" TRENCH WHERE FENCE IS TO BE INSTALLED.
2. PLACE PVC LINER OR APPROVED EQUAL ALONG TRENCH OR PREDETERMINED PATH
3. DRIVE POST INTO UNDISTURBED SOIL UNTIL SUPPORT NETTING IS IN THE TRENCH OR BEGINNING TO LAY ON THE GROUND.
4. PLACE FILL MATERIAL IN TRENCH ON LINER FLAP AND COMPACT.

DETAIL (A)
LINER BARRIER INSTALLATION
SCALE: NONE

santee cooper
SOUTH CAROLINA PUBLIC SERVICE AUTHORITY

SANTEE COOPER
COAL COMBUSTION PRODUCT POND
CELL ISOLATION CONCEPTS

CIVIL PROJECTS	DES. ENGR: JMM		PROJ. NO. 116606
SUPERVISOR: ROM	DRAFTER: JMM		SCALE: NONE
DATE 2/10/2015	DRAWING NO.		SHEET 1 OF 1

ATTACHMENT E

SWMU 14 Investigation Results Memo – May 25, 2021

Targeted CCR Excavation at SWMU 14 Memo – June 25, 2021

Response to EPA Comments SWMU 14 Investigation Results – June 28, 2021

Wood Environment & Infrastructure Solutions, Inc.
271 Mill Road
3rd Floor
Chelmsford, MA 01824
USA
T: (978) 692-9090
www.woodplc.com

Memo

To:	Michelle Kaysen / EPA	**Reviewer:**	Russell Johnson / Wood
From:	Lindsay Caplinger / Wood Daniel Sullivan / NIPSCO		
cc:	Jeff Neumeier / NIPSCO	**Wood File No.:**	3651200111.2800
Date:	June 28, 2021		
Re.	Response to EPA Comments SWMU 14 Investigation Findings Memo		

Wood Environment & Infrastructure Solutions, Inc. (Wood) has prepared this memo on behalf of Northern Indiana Public Service Company, LLC (NIPSCO) to address EPA comments on the previously submitted SWMU 14 Investigation Findings memorandum dated May 25, 2021. EPA responded via email on May 26, 2021 with questions pertaining to recoverability and the subsequent accuracy or representativeness of CCR volume within the fill. EPA's questions are reproduced below with responses provided for each.

Question 1: It appears just over 30% of total feet cored was not recovered. The total non-recovery appears high, can you provide additional information about this rate of recovery within this geologic setting and at the Bailly site specifically?

Wood Response: The amount of soil not recovered is consistent with prior investigations using direct-push drilling techniques. Reduced recovery can be attributed to the periodic encounter of coarser material, such as steel slag, gravel, or coal fragments that block the sample liner. Conversely, loose material, such as dry sand, is not held in the liner by the catcher at the base of the sampler. The SWMU 14 area contains widespread slag and coal and abundant loose dune sand, which contributed to the reduced recovery of soil. For comparison, direct-push drilling conducted in December 2020 as part of the Beach Area Investigation included the advancement of four soil borings in fine-grained sand that is very similar to upland dune sand. The percent unrecovered soil in each of those borings was 32%, 29%, 44%, and 32%, for an average of 34%. As calculated on Page 2 of this memo, the amount of unrecovered native sand encountered below SWMU 14 is 37.5%, which falls within the range for beach sand.

Regarding the accuracy or representativeness of CCR volume, Wood expects the characteristics of the unrecovered fill not to differ much from that represented in the intervals recovered. To further evaluate this expectation, Wood made conservative adjustments to Table 1 from the May 25, 2021 memorandum for the intervals of no recovery (Attachment A). The original Table 1 documented the composition of fill for nearly 1,700 linear feet from 123 soil borings advanced during the SWMU 14 Investigation. The procedure for conservatively assigning fill composition for intervals of no recovery in the Revised Table 1 (Attachment A) included these steps:

- For fill material only, intervals (in feet) from the "No Recovery" column were moved to the "Fill" column (see entries in red font).
- If the fill percentages immediately above and below an interval of no recovery were the same, then those percentages were assigned to the interval of no recovery.

- If the fill percentages immediately above and below an interval of no recovery were different, then percentages from the interval that contained more CCR, particularly fine CCR, and/or material other than sand were assigned to the interval of no recovery.

Adjustments were made to intervals of no recovery in 110 of the 123 soil borings advanced at SWMU 14. No adjustments were needed for the remaining 13 borings, because there was full recovery at locations where fill was thin above native soil along the southern margin of SWMU 14 (see **Figure 1**; SB-100, SB-103 through SB-105, SB-108, SB-110 through SB-112, and SB-114 through SB-118). Sixteen (16) of the 47 soil borings that encountered fine CCR had intervals of no recovery where some percentage of fine CCR was observed directly above or below it. For these 16 borings, the fine CCR was typically mixed with other fill materials (not pure CCR), and it was these other materials that were more likely to be the cause of reduced recovery (such as slag, gravel, coal, or loose sand). There were only three identified instances where pure or nearly pure fine CCR was observed directly above or below an interval of no recovery (i.e., SB-18, SB-94, and SB-129). Coarse CCR was almost always mixed with sand and other fill components, so it's also unlikely layers of coarse CCR were missed in the unrecovered intervals. No adjustments were made to the unrecovered soil intervals once a boring penetrated the native sand – fill was never encountered below the first encounter of native sand, so missing intervals below the fill were assumed to be native sand with a high degree of confidence.

Once the fill adjustments were made, the revised percent compositions were compared to Table 1 of the May 25, 2021 memo. The summary at the bottom of Table 1 in the May 25, 2021 memorandum is reproduced below:

Total Drilled (feet)	Fill Recovered (feet)	Native Recovered (feet)	Total Unrecovered (feet)	Total Log Percentages (Fill Only)						
				sand (includes silt)	slag (includes brick)	coal	gravel	peat	coarse CCR	fine CCR
1691.4	679.2	424.2	588	74.2%	6.5%	7.3%	1.6%	0.0%	8.4%	2.1%

The summary at the bottom of Revised Table 1 from Attachment A is reproduced below:

Total Drilled (feet)	Revised Fill Recovered (feet)	Native Recovered (feet)	Native Unrecovered (feet)	Total Log Percentages (Fill Only)						
				sand (includes silt)	slag (includes brick)	coal	gravel	peat	coarse CCR	fine CCR
1691.4	1013.1	424.2	254.1	73.7%	6.3%	7.6%	1.4%	0.0%	9.0%	2.0%

As indicted in the above summaries, the total percentage for each component of fill material changed by 0.6% or less. The percentage of sand, slag/brick, gravel and fine CCR decreased slightly, while the percentages of coal and coarse CCR increased slightly.

The total unrecovered fill and native sand was 588 feet or 34.8% of the total 1,691.4 feet drilled. After assigning characteristic to the unrecovered fill intervals in Revised Table 1, the unrecovered amount decreased from 588 feet to 254.1 feet (i.e. the amount not recovered from native soil). The difference of 333.9 feet represents the total amount of unrecovered material from the fill. By moving this amount to the Revised Fill Recovered column, the total amount of fill material that was drilled through is calculated to be 1,013.1 feet and the total amount of native soil drill is 678.3 feet (i.e., 254.1+424.2). Therefore, the unrecovered fill material makes up 32.9% of the total fill drilled (i.e., 333.9/1013.1*100), whereas the unrecovered native soil makes up 37.5% of the amount of native soil drilled (i.e., 254.1/678.3*100). These calculations indicate that a greater relative percentage of native material was lost compared to fill material at SWMU 14.

Question 2: Is there any possibility that the relative density of CCR vs the surrounding materials inhibited the collection of CCR, or pushed the material away from the core barrel during advance?

Wood Response: The presence of CCR mixed in fill should not inhibit the collection of this material using direct-push acetate liners. In fact, the fine CCR observed at the site is more cohesive, and we are likely to see better recovery for that material than the surrounding material.

Question 3: For purposes of relying on the overall core data for determining the amount of CCR in SWMU 14, what other lines of evidence can be used to increase confidence?

Wood Response: See response to Question 1.

Question 4: Unrelated to recoverability, does this new information change the down gradient CSM for your team?

Wood Response: No, the new information does not change the downgradient conceptual site model (CSM) for SWMU 14. Wood (formerly Amec) completed a detailed plume evaluation in support of the revised human health and ecological risk assessments for SWMU 14 in a memo to EPA dated April 3, 2014. That evaluation was based on SWMU 14 characterization data from 2005 and 2010 that is now known to have over-stated the distribution of "suspected CCR" as denoted in boring logs from that time. The 2014 plume evaluation concluded the following regarding the discharge of groundwater from the upland area at and surrounding SWMU 14 to the nearest downgradient receptor, Central Blag Slough, for the following contaminants of potential ecological concern (COPECs):

- Aluminum and manganese concentrations in groundwater beneath and downgradient of SWMU 14 were below background. Therefore, the higher concentrations of aluminum and manganese in groundwater below Central Blag Slough could not be attributed to SWMU 14. Rather, the higher concentrations in Central Blag Slough are likely related to geochemical cycling between sediment and surface water that is controlled by temporal variations in redox conditions, as discussed in the Final Area C Corrective Measures Study dated July 9, 2019.
- Arsenic was detected above the background value of 3.23 micrograms per liter (ug/L) at source-area well MW-136 for each sampling event, ranging from 8.2J to 18.3 ug/L, but well below the Great Lakes Initiative (GLI) value of 148 ug/L in each instance. Arsenic was not detected in groundwater from the other source-area well MW-135 or near-downgradient well MW-116. Arsenic was not detected in three of the six remaining wells (INDL-GW06, IDNL-GW14 and IDNL-GW16). The few detected concentrations are below 148 ug/L, and in all but one case by more than a factor of 10.
- Boron concentrations have not exceeded the GLI value of 1,600 ug/L at any well in the upland area or Central Blag Slough since monitoring was initiated in 2005. Therefore, boron in groundwater from SWMU 14 does not pose an ecological risk in the IDNL.
- Although molybdenum concentrations in the upland area were above background, molybdenum was attenuated to concentrations below background with increasing distance into Central Blag Slough. None of the detected concentrations in groundwater at, or downgradient of SWMU 14 exceeded the GLI value of 800 ug/L. Moreover, the highest concentration of molybdenum in groundwater in Central Blag Slough was 10-fold less than the GLI value.
- Selenium was detected frequently in the upland area at concentrations that were above both the background value of 1 ug/L and the GLI value of 4.6 ug/L; however, the frequency of detection and concentrations of selenium decrease substantially to levels that were consistently below background in Central Blag Slough.

The April 2014 memo also evaluated the remaining non-COPEC inorganics and concluded the following. The only pathway from SWMU 14 to environmental media within Central Blag Slough is via infiltration of precipitation, seepage through the fill into the underlying saturated zone, and subsequent groundwater migration. Based on comparison to background concentrations in groundwater from the upland area, the pathway from SWMU 14 to Central Blag Slough is incomplete for aluminum, arsenic, barium, cadmium, chromium, copper, manganese, mercury, lead, and selenium. The concentrations of boron and molybdenum exceed background in both the upland and Central Blag Slough, but none of the concentrations exceeded the conservative GLI values. Therefore, SWMU 14 groundwater poses no ecological risk to receptors in Central Blag Slough.

Substantial new information regarding the nature of CCR at SWMU 14 was achieved in 2021 by advancing 123 borings through fill and into the underlying native sand. It was determined that 89.5% of the material used to backfill the ponded water in the area now designated as SWMU 14 was comprised primarily of materials not expected to leach inorganic constituents from the combustion of coal (sand and silt, coal, slag and brick, and gravel). Coarse CCR (i.e., boiler slag) comprises 8.4% of the fill material, which has a lower leaching potential than fly ash, which comprises 2.1% of the fill material. Material identified in the field as fine CCR was logged in 47 of the 123 borings. Where encountered, the CCR was identified in one or more layers of variable thickness and typically confined to a single boring. No significant deposits of fine CCR could be mapped between borings and no fine CCR was encountered below the water table. The 2021 findings further substantiate the conclusions in the April 2014 memo.

2021 Investigation Locations

Northern Indiana Public Service Company

Bailly Generating Station
Chesterton, Indiana

Legend

- Sampling Grid (50 ft Cell)
- Approximate Leach Field Location
- Bailly Generating Station Property Line
- Monitoring Well Location
- Soil Boring Location

Location of Site

Notes and Sources

FIGURE 1

Aerial Imagery: Orthophotography of Indiana, (2018) obtained through ArcGIS Online.

N

0 80 Feet

Wood Environment & Infrastructure Solutions, Inc.
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Chelmsford, MA 01824
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Attachment A

Revised Table 1
from
May 25, 2021 Memo to EPA

Revised Table 1. Composition of Fill at SWMU 14
Characteristics Assigned to No Recovery Intervals
Bailly Generating Station
Chesterton, IN

Boring	Fill (feet)	Native (feet)	No Recovery (feet)	Log Percentages						
				sand (includes silt)	slag (includes brick)	coal	gravel	peat	Coarse CCR	Fine CCR
SB-10	0.3			100%						
	1.1			50%	25%		25%			
	0.8			100%						
	1.8			100%						
	1.1			100%						
	1.7			90%	5%	5%				
	1.2			90%	5%	5%				
	0.3			95%		5%				
	1.2			60%		40%				
		1.7		100%						
			0.8							
12	9.5	1.7	0.8	86%	4%	7%	3%	0%	0%	0%
SB-11	0.4			85%			15%			
	0.2			60%			40%			
	0.3			0%						100%
	0.4			90%	5%					5%
	0.3			5%						95%
	0.4			100%						
	0.1			0%						100%
	0.9			95%		5%				
	1			95%		5%				
	1.5			90%		5%	5%			
	2.5			90%		5%	5%			
	0.2			90%		5%	5%			
	1.1			70%		25%	5%			
	0.2			0%	50%		50%			
		1.4		100%						
			1.1							
12	9.5	1.4	1.1	80%	1%	6%	5%	0%	0%	7%
SB-12	0.4			95%		5%				
	0.9			55%	5%	20%			20%	
	0.3			55%		20%	20%			5%
	0.6			0%						100%
	0.5			40%	20%	5%	30%			5%
	1.3			40%	20%	5%	30%			5%
	0.3			40%	20%	5%	30%			5%
	0.3			30%	20%	5%	30%			15%
	0.7			0%						100%
	0.8			35%	25%	5%	30%			5%
	1.9			35%	25%	5%	30%			5%
	0.4			35%	25%	5%	30%			5%
	0.1			0%						100%
	0.4			90%	5%		5%			
	0.4			70%		25%			5%	
		0.6		100%						
			2.1							
		2.5		100%						
			1.5							
16	9.3	3.1	3.6	40%	14%	7%	19%	0%	2%	18%
SB-13	0.3			100%						
	1.8			55%	5%				40%	
	1.9			55%	5%				40%	
	0.5			55%	5%				40%	
	0.3			50%	5%				40%	5%
	0.4			60%					40%	
	2.8			60%					40%	
	0.1			95%					5%	
	0.3			15%	80%					5%
	0.2			95%					5%	
	0.2			85%					15%	
		1		100%						
			2.2							
		2.9		100%						
			1.1							
16	8.8	3.9	3.3	59%	5%	0%	0%	0%	36%	0%

Revised Table 1. Composition of Fill at SWMU 14
Characteristics Assigned to No Recovery Intervals
Bailly Generating Station
Chesterton, IN

Boring	Fill (feet)	Native (feet)	No Recovery (feet)	Log Percentages						
				sand (includes silt)	slag (includes brick)	coal	gravel	peat	Coarse CCR	Fine CCR
SB-14	0.2			100%						
	1.2			55%	5%				40%	
	2.6			55%	5%				40%	
	0.6			55%	5%				40%	
	0.9			95%			5%			
	2.5			95%			5%			
	0.9			95%			5%			
	0.5			0%						100%
	0.3			65%	5%				15%	15%
		1		100%						
			1.3							
		3		100%						
			1							
16	9.7	4	2.3	71%	2%	0%	2%	0%	19%	6%
SB-15	1.7			60%					40%	
	2.3			60%					40%	
	0.9			50%	10%				40%	
	1.3			95%	5%					
	1.8			95%	5%					
	1.2			95%	5%					
	0.6			90%	5%	5%				
	0.3			80%		5%			15%	
		0.7		100%						
			1.2							
		2.9		100%						
			1.1							
16	10.1	3.6	2.3	76%	3%	0%	0%	0%	20%	0%
SB-16	0.3			85%					15%	
	0.4			25%	25%		25%		25%	
	0.4			25%	75%					
	1.5			80%	15%				5%	
	1.4			80%	15%				5%	
	2.9			90%	5%				5%	
	1.1			90%	5%				5%	
	0.1			90%	5%				5%	
	0.3			75%		25%				
	0.2			50%	25%	25%				
	0.5			15%		85%				
	0.2			100%						
	0.2			0%		100%				
		1.6		100%						
			0.9							
		3.3		100%						
			0.7							
16	9.5	4.9	1.6	74%	11%	8%	1%	0%	5%	0%
SB-17	0.1			100%						
	0.2			0%			100%			
	0.6			25%	25%	25%	25%			
	1.8			90%	5%				5%	
	1.3			90%	5%				5%	
	2.6			90%			5%		5%	
	0.1			0%		100%				
	1.3			0%		100%				
	0.1			60%		40%				
	0.4			34%		33%	33%			
	0.4			25%		75%				
	0.4			75%		25%				
		1.4		100%						
			1.3							
		3.3		100%						
			0.7							
16	9.3	4.7	2	64%	3%	23%	7%	0%	3%	0%

Revised Table 1. Composition of Fill at SWMU 14
Characteristics Assigned to No Recovery Intervals
Bailly Generating Station
Chesterton, IN

Boring	Fill (feet)	Native (feet)	No Recovery (feet)	Log Percentages						
				sand (includes silt)	slag (includes brick)	coal	gravel	peat	Coarse CCR	Fine CCR
SB-18	0.3			100%						
	0.1				100%					
	0.9			60%					40%	
	0.3			0%						100%
	0.3			13%		12%				75%
	0.1			50%	25%	25%				
	2			50%	25%	25%				
	0.4			50%	25%	25%				
	0.3			0%						100%
	0.1			50%	25%	25%				
	0.1			0%						100%
	0.3			45%	25%	25%				5%
	0.1			0%						100%
	0.5			50%	25%	25%				
	1.4			5%	5%					90%
	0.8			5%	5%					90%
	1.1			100%						
	0.1			0%	100%					
	0.1			100%						
	0.5			0%		100%				
		1		100%						
			1.2							
		3.1		100%						
			0.9							
16	9.8	4.1	2.1	40%	12%	14%	0%	0%	4%	31%
SB-19	0.4			100%						
	1.6			55%	5%				40%	
	2			55%	5%				40%	
	0.6			60%					40%	
	1.2			100%						
	2.2			100%						
	1.7			95%			5%			
	0.3			65%	15%	15%	5%			
	0.2			0%		100%				
		0.4		100%						
			1.4							
		2.9		100%						
			1.1							
16	10.2	3.3	2.5	78%	2%	2%	1%	0%	16%	0%
SB-20	2.2			85%					15%	
	1.8			85%					15%	
	2.4			85%					15%	
	1.6			85%					15%	
	2.5			95%			5%			
	0.2			0%		100%				
		0.1		100%						
			1.2							
		2.8		100%						
			1.2							
16	10.7	2.9	2.4	86%	0%	2%	1%	0%	11%	0%
SB-21	1.9			95%					5%	
	2.1			95%					5%	
	1.8			95%					5%	
	2.2			95%					5%	
	0.1			95%					5%	
	0.2			0%	50%	50%				
	1.1			100%						
	0.1			0%		100%				
		0.4		100%						
			2.1							
		2.7		100%						
			1.3							
16	9.5	3.1	3.4	93%	1%	2%	0%	0%	4%	0%

Revised Table 1. Composition of Fill at SWMU 14
Characteristics Assigned to No Recovery Intervals
Bailly Generating Station
Chesterton, IN

Boring	Fill (feet)	Native (feet)	No Recovery (feet)	Log Percentages						
				sand (includes silt)	slag (includes brick)	coal	gravel	peat	Coarse CCR	Fine CCR
SB-22	0.9			75%			25%			
	0.8			90%	5%				5%	
	2.3			90%	5%				5%	
	0.2			90%	5%				5%	
	2.3			95%			5%			
	1.5			95%			5%			
	0.7			95%			5%			
	0.2			0%		100%				
		1.8		100%						
			1.3							
12	8.9	1.8	1.3	89%	2%	2%	5%	0%	2%	0%
SB-23	0.5			50%	25%		25%			
	0.4			0%	100%					
	1.8			90%	5%				5%	
	1.3			90%	5%				5%	
	2			95%					5%	
	0.7			100%						
	0.2			20%	60%	20%				
	1.1			20%	60%	20%				
	0.1			20%	60%	20%				
	0.2			0%		100%				
	0.1			25%		75%				
	0.4			0%		100%				
	0.1			60%		40%				
		2		100%						
			1.1							
		3.2		100%						
			0.8							
16	8.9	5.2	1.9	67%	17%	11%	1%	0%	3%	0%
SB-24	0.4			85%					15%	
	0.7			25%	45%		30%			
	0.5			40%	35%	25%				
	0.2			0%						100%
	1.3			95%	5%					
	0.9			90%	5%	5%				
	2.9			90%	5%	5%				
	1.1			90%	5%	5%				
	0.2			100%						
	0.3			60%	20%	20%				
	0.1			100%						
	0.6			0%		100%				
	0.3			100%						
	0.2			0%		100%				
		1.4		100%						
			0.9							
		3.1		100%						
			0.9							
16	9.7	4.5	1.8	74%	9%	13%	2%	0%	1%	2%
SB-25	1.7			85%					15%	
	0.4			0%	5%					95%
	0.2			100%						
	1.7			85%	5%	5%	5%			
	2.4			85%	5%	5%	5%			
	1.6			85%	5%	5%	5%			
	1			100%						
	0.1			0%	100%					
	0.1			100%						
	0.1			0%	100%					
	0.7			15%		85%				
		1		100%						
			1							
		3.1		100%						
			0.9							
16	10	4.1	1.9	77%	5%	9%	3%	0%	3%	4%

Revised Table 1. Composition of Fill at SWMU 14
Characteristics Assigned to No Recovery Intervals
Bailly Generating Station
Chesterton, IN

Boring	Fill (feet)	Native (feet)	No Recovery (feet)	Log Percentages						
				sand (includes silt)	slag (includes brick)	coal	gravel	peat	Coarse CCR	Fine CCR
SB-26	2.4			80%	5%				15%	
	1.6			80%	5%				15%	
	0.7			80%	5%				15%	
	2			95%					5%	
	1.3			95%					5%	
	2.2			95%		5%				
	0.2			15%		85%				
	0.1			100%						
	0.1			0%		100%				
		0.2		100%						
			1.2							
		2.8		100%						
			1.2							
16	10.6	3	2.4	86%	2%	4%	0%	0%	8%	0%
SB-27	2.4			80%			5%		15%	
	1.6			80%			5%		15%	
	2.2			85%					15%	
	1.8			85%					15%	
	0.6			95%					5%	
	1.3			90%	5%		5%			
	0.1			75%		25%				
		0.4		100%						
			1.6							
		2.7		100%						
			1.3							
16	10	3.1	2.9	84%	1%	0%	3%	0%	12%	0%
SB-28	2			85%					15%	
	2			80%	5%				15%	
	2.3			80%	5%				15%	
	1.7			80%	5%				15%	
	2.3			90%	5%				5%	
	0.1			0%		100%				
	0.2						50%		50%	
		0.2		100%						
			1.2							
		3.6		100%						
			0.4							
16	10.6	3.8	1.6	81%	4%	1%	1%	0%	13%	0%
SB-29	0.5			60%					40%	
	1.7			75%	5%	5%			15%	
	1.8			75%	5%	5%			15%	
	0.4			85%					15%	
	0.1				100%					
	1.2			80%	5%				15%	
	0.9			95%					5%	
	1.4			95%					5%	
	1.6			95%					5%	
	0.1			0%		100%				
	0.6			90%		5%			5%	
		0.2		100%						
			1.5							
		2.7		100%						
			1.3							
16	10.3	2.9	2.8	82%	3%	3%	0%	0%	12%	0%
SB-30	2			80%	5%				15%	
	2			80%	5%				15%	
	1			85%					15%	
	1.3			90%	5%				5%	
	1.7			90%	5%				5%	
	1.5			90%	5%				5%	
	0.2			15%		85%				
		1		100%						
			1.3							
		2.9		100%						
			1.1							
16	9.7	3.9	2.4	84%	4%	2%	0%	0%	10%	0%

Revised Table 1. Composition of Fill at SWMU 14
Characteristics Assigned to No Recovery Intervals
Bailly Generating Station
Chesterton, IN

Boring	Fill (feet)	Native (feet)	No Recovery (feet)	Log Percentages						
				sand (includes silt)	slag (includes brick)	coal	gravel	peat	Coarse CCR	Fine CCR
SB-31	1.9			75%	5%		5%		15%	
	2.1			75%	5%		5%		15%	
	2.4			75%	5%		5%		15%	
	1.6			75%	5%		5%		15%	
	2			75%	5%		5%		15%	
	0.2			50%	25%	25%				
	0.2			5%		95%				
		0.1		100%						
			1.5							
		2.4		100%						
			1.6							
16	10.4	2.5	3.1	73%	5%	2%	5%	0%	14%	0%
SB-32	1.2			80%	5%				15%	
	0.3			0%	100%					
	0.1			80%	5%				15%	
	0.1			0%	100%					
	0.3			80%	5%				15%	
	2			80%	5%				15%	
	1.9			80%	5%				15%	
	2.1			80%	5%				15%	
	2.2			90%	5%				5%	
	0.3			85%	5%	5%			5%	
	1.5			85%	5%	5%			5%	
	0.1			60%		40%				
	0.4			90%	5%	5%				
	0.1			0%		100%				
		2		100%						
			1.4							
16	12.6	2	1.4	79%	8%	2%	0%	0%	11%	0%
SB-33	1.6			80%	5%				15%	
	2.4			70%	15%				15%	
	1.4			70%	15%				15%	
	1.2			95%					5%	
	1.4			95%					5%	
	2			95%					5%	
	0.2			5%		95%				
		0.4		100%						
			1.4							
		3		100%						
			1							
16	10.2	3.4	2.4	82%	6%	2%	0%	0%	10%	0%
SB-34	0.4			80%					20%	
	0.5			0%	100%					
	2.1			90%	5%				5%	
	1			90%	5%				5%	
	2			95%					5%	
	0.2			60%	20%	20%				
	0.7			15%		85%				
	1.1			15%		85%				
		3		100%						
			1							
12	8	3	1	68%	9%	20%	0%	0%	4%	0%

Revised Table 1. Composition of Fill at SWMU 14
Characteristics Assigned to No Recovery Intervals
Bailly Generating Station
Chesterton, IN

Boring	Fill (feet)	Native (feet)	No Recovery (feet)	Log Percentages						
				sand (includes silt)	slag (includes brick)	coal	gravel	peat	Coarse CCR	Fine CCR
SB-35	0.2			100%						
	0.3			75%	25%					
	0.5			0%	100%					
	1.6			95%					5%	
	1.4			90%	5%				5%	
	2.4			90%	5%				5%	
	0.1			90%		5%			5%	
	0.2			65%	25%	5%			5%	
	0.1			34%	33%	33%				
	0.1			0%		100%				
	1.1			0%		100%				
	0.4			15%		85%				
	0.3			100%						
	0.3			75%		25%				
		1.9		100%						
			1.1							
		3.6		100%						
			0.4							
16	9	5.5	1.5	69%	9%	18%	0%	0%	3%	0%
SB-36	0.2			95%					5%	
	1.5			90%	5%	5%				
	2.3			90%	5%	5%				
	2.9			95%	5%					
	1.1			40%		60%				
	0.3			40%		60%				
	0.3			100%						
	0.1			0%		100%				
	0.1			50%	50%					
	0.7			25%		75%				
		1.4		100%						
			1.1							
		3		100%						
			1							
16	9.5	4.4	2.1	78%	4%	17%	0%	0%	0%	0%
SB-37	1.8			80%	5%				15%	
	2.2			80%	5%				15%	
	1.4			90%			5%		5%	
	0.4			95%			5%			
	0.2			0%	100%					
	0.8			90%	5%		5%			
	1.2			90%	5%		5%			
	1.3			95%			5%			
	0.4			90%	5%		5%			
	0.6			5%		95%				
		0.7		100%						
			1							
		3.1		100%						
			0.9							
16	10.3	3.8	1.9	80%	5%	6%	3%	0%	7%	0%
SB-38	2			95%					5%	
	2			90%	5%				5%	
	2.6			90%	5%				5%	
	1.4			95%	5%					
	1.2			100%						
	0.1			95%	5%					
	0.1			60%		40%				
	0.1			0%		100%				
	0.2			75%		25%				
	0.3			0%		100%				
	0.1			85%		15%				
		0.6		100%						
			1.3							
		2.9		100%						
			1.1							
16	10.1	3.5	2.4	89%	3%	5%	0%	0%	3%	0%

Revised Table 1. Composition of Fill at SWMU 14
Characteristics Assigned to No Recovery Intervals
Bailly Generating Station
Chesterton, IN

Boring	Fill (feet)	Native (feet)	No Recovery (feet)	Log Percentages						
				sand (includes silt)	slag (includes brick)	coal	gravel	peat	Coarse CCR	Fine CCR
SB-39	2.2			90%			5%		5%	
	1.8			90%			5%		5%	
	0.2			0%	100%					
	2.5			95%	5%					
	1.3			95%	5%					
	1.1			95%	5%					
	0.2			75%	25%					
	0.8			5%		95%				
		0.9		100%						
			1							
		3		100%						
			1							
16	10.1	3.9	2	84%	5%	8%	2%	0%	2%	0%
SB-40	1.4			70%	5%				25%	
	2.6			70%	5%				25%	
	1.2			80%	5%				15%	
	1.4			90%			5%		5%	
	1.4			90%			5%		5%	
	1.7			90%			5%		5%	
	0.1			0%	100%					
	0.1			0%		100%				
	0.2			100%						
	0.3			0%	5%	95%				
		0.2		100%						
			1.4							
		2.8		100%						
			1.2							
16	10.4	3	2.6	77%	4%	4%	2%	0%	14%	0%
SB-41	1.9			70%			5%		25%	
	2.1			70%			5%		25%	
	1.5			80%	2%		3%		15%	
	0.7			40%	55%					5%
	0.4			100%						
	1.4			100%						
	2.6			100%						
	0.2			90%	5%	5%				
	1.2			60%		40%				
	0.1			60%		40%				
	0.1			90%		5%	5%			
		2		100%						
			1.8							
16	12.2	2	1.8	80%	3%	4%	2%	0%	10%	0%
SB-42	0.4			70%			5%		25%	
	1.5			70%	5%				25%	
	2.1			60%	15%				25%	
	0.2			60%	15%				25%	
	1.3			40%	45%					15%
	0.2			0%	100%					
	1.2			40%	45%					15%
	0.2			100%						
	0.3			40%	60%					
	0.2			100%						
	0.4			90%		5%	5%			
	2.6			90%		5%	5%			
	0.2			60%		40%				
	1.2			60%		40%				
	0.2			60%		40%				
		2.3		100%						
			1.5							
16	12.2	2.3	1.5	65%	16%	6%	1%	0%	9%	3%
SB-43	0.2			25%			75%			
	0.7			0%	100%					
	1.4			100%						
	1.7			95%		5%				
	2.7			95%		5%				
	1.3			95%		5%				
		2.6		100%						
			1.4							
12	8	2.6	1.4	86%	9%	4%	2%	0%	0%	0%

Revised Table 1. Composition of Fill at SWMU 14
Characteristics Assigned to No Recovery Intervals
Bailly Generating Station
Chesterton, IN

Boring	Fill (feet)	Native (feet)	No Recovery (feet)	Log Percentages						
				sand (includes silt)	slag (includes brick)	coal	gravel	peat	Coarse CCR	Fine CCR
SB-44	0.6			75%					25%	
	2.1			90%	5%				5%	
	0.1			0%		100%				
	1.2			0%		100%				
	1.9			90%	5%				5%	
	0.1			85%	5%				5%	5%
	0.4			95%	5%					
	0.2			95%		5%				
	1.4			95%		5%				
	0.3			95%		5%				
		2.3		100%						
			1.4							
12	8.3	2.3	1.4	76%	3%	17%	0%	0%	4%	0%
SB-45	0.3			60%		20%			20%	
	0.4			55%	5%		40%			
	0.5			25%	75%					
	1.7			90%	5%				5%	
	1.1			90%		5%			5%	
	2.1			90%		5%			5%	
	0.7			85%	5%	5%			5%	
	0.1			100%						
	1.1			75%		25%				
	0.1			75%		25%				
		2.8		100%						
			1.1							
12	8.1	2.8	1.1	81%	6%	7%	2%	0%	4%	0%
SB-46	0.2			100%						
	0.6			0%	100%					
	1.7			95%					5%	
	0.4			80%			5%		15%	
	1.1			80%			5%		15%	
	2			90%			5%		5%	
	0.5			25%	5%	70%				
		0.2		100%						
			1.3							
		2		100%						
			0							
		2		100%						
			0							
12	6.5	4.2	1.3	76%	10%	5%	3%	0%	6%	0%
SB-47	0.5			75%	17%				8%	
	0.1			0%	100%					
	2.1			90%	5%				5%	
	1.3			90%	5%				5%	
	2.8			90%	5%				5%	
	0.6			13%	12%	75%				
	0.6			13%	12%	75%				
	0.4			13%	12%	75%				
	0.2			85%	15%					
		2		100%						
			1.4							
		3.5		100%						
			0.5							
16	8.6	5.5	1.9	74%	8%	14%	0%	0%	4%	0%
SB-48	1.9			85%					15%	
	0.2			60%	25%				15%	
	1.9			60%	25%				15%	
	2.6			70%		5%	25%			
	0.1			50%	25%		25%			
	0.1			75%	25%					
	1.2			75%		25%				
	0.1			75%		25%				
	0.2			40%		60%				
	0.1			0%		100%				
	0.1			40%		60%				
	0.7			0%		100%				
		1.7		100%						
			1.1							
12	9.2	1.7	1.1	64%	6%	16%	7%	0%	7%	0%

Revised Table 1. Composition of Fill at SWMU 14
Characteristics Assigned to No Recovery Intervals
Bailly Generating Station
Chesterton, IN

Boring	Fill (feet)	Native (feet)	No Recovery (feet)	Log Percentages						
				sand (includes silt)	slag (includes brick)	coal	gravel	peat	Coarse CCR	Fine CCR
SB-49	0.2			100%						
	0.8			80%	5%				15%	
	0.1			70%	5%				25%	
	0.9			80%	5%				15%	
	2			80%	5%				15%	
	0.8			90%	5%				5%	
	0.2			0%	100%					
	0.1			0%	95%					5%
	0.2			0%	100%					
	1.7			95%		5%				
	1			95%		5%				
	1.2			95%		5%				
	0.1			60%	40%					
	0.2			95%	5%					
	0.2			15%		85%				
	0.3			95%		5%				
		0.7		100%						
			1.3							
12	10	0.7	1.3	82%	8%	4%	0%	0%	6%	0%
SB-50	2.2			80%	5%				15%	
	1.8			80%	5%				15%	
	2.3			90%	5%				5%	
	0.4			100%						
	1.3			100%						
	1.1			100%						
	1.2			5%		95%				
		0.7		100%						
			1							
		2.7		100%						
			1.3							
16	10.3	3.4	2.3	79%	3%	11%	0%	0%	7%	0%
SB-51	1.8			75%					25%	
	0.2			0%	100%					
	0.1			75%					25%	
	0.3			25%	45%					30%
	1.6			25%	45%					30%
	1.3			25%	45%		15%			15%
	1.7			90%	5%				5%	
	1			90%	5%				5%	
	1.7			95%					5%	
	0.2			60%		40%				
	0.2			0%		100%				
	0.2			100%						
	0.2			60%		40%				
		0.4		100%						
			1.1							
		3		100%						
			1							
16	10.5	3.4	2.1	64%	17%	3%	2%	0%	7%	7%
SB-52	1.7			80%	5%				15%	
	2.3			80%	5%				15%	
	0.2			85%					15%	
	0.7			65%	5%				15%	15%
	0.3			15%	85%					
	1.5			85%	15%					
	1.3			85%	15%					
	2.4			95%	5%					
	0.3			75%	25%					
	0.2			0%	75%	25%				
		0.1		100%						
			1							
		2.8		100%						
			1.2							
16	10.9	2.9	2.2	80%	12%	0%	0%	0%	7%	1%

Revised Table 1. Composition of Fill at SWMU 14
Characteristics Assigned to No Recovery Intervals
Bailly Generating Station
Chesterton, IN

Boring	Fill (feet)	Native (feet)	No Recovery (feet)	Log Percentages						
				sand (includes silt)	slag (includes brick)	coal	gravel	peat	Coarse CCR	Fine CCR
SB-53	2.1			80%	5%				15%	
	1.9			80%	5%				15%	
	0.1			85%					15%	
	0.5			5%	15%		10%			70%
	0.8			65%	10%		10%		10%	5%
	0.8			70%	15%		15%			
	1.8			70%	15%		15%			
	2.5			90%	5%		5%			
	0.3			15%		85%				
	1.2			15%		85%				
		2.5		100%						
			1.5							
16	12	2.5	1.5	68%	7%	11%	5%	0%	6%	3%
SB-54	0.2			100%						
	0.9			70%	5%				25%	
	1.6			35%	30%					35%
	1.3			35%	30%					35%
	1			35%	30%					35%
5	5	0	0	44%	24%	0%	0%	0%	5%	27%
SB-55	0.3			85%					15%	
	0.2			75%					25%	
	0.9			35%	30%					35%
	1			90%			5%		5%	
	1.6			85%	5%	5%			5%	
	2.8			85%	5%	5%			5%	
	1.2			85%	5%	5%			5%	
	0.1			90%		5%			5%	
	0.2			0%		100%				
		2.4		100%						
			1.3							
		3.5		100%						
			0.5							
16	8.3	5.9	1.8	78%	7%	6%	1%	0%	5%	4%
SB-56	0.4			85%					15%	
	0.7			38%	25%					37%
	1.3			85%	5%	5%			5%	
	1.6			85%	5%	5%			5%	
	2.3			85%	5%	5%			5%	
	1.7			85%	5%	5%			5%	
	0.1			85%	5%	5%			5%	
	0.7			15%		85%				
	0.3			95%		5%				
		1.6		100%						
			1.3							
		0.6		100%						
		0.7		0%				100%		
		0.9		100%						
			1.8							
		4		100%						
20	9.1	7.8	3.1	76%	6%	11%	0%	0%	5%	3%
SB-57	0.3			75%					25%	
	0.1			0%					100%	
	1.7			95%		5%				
	1.9			90%		5%			5%	
	1.8			90%		5%			5%	
		0.1		100%						
			2.1							
		2.9		100%						
			1.1							
		2.4		100%						
			1.6							
16	5.8	5.4	4.8	89%	0%	5%	0%	0%	6%	0%

Revised Table 1. Composition of Fill at SWMU 14
Characteristics Assigned to No Recovery Intervals
Bailly Generating Station
Chesterton, IN

Boring	Fill (feet)	Native (feet)	No Recovery (feet)	Log Percentages						
				sand (includes silt)	slag (includes brick)	coal	gravel	peat	Coarse CCR	Fine CCR
SB-58	0.2			100%						
	0.6			75%	13%		12%			
	1.7			85%					15%	
	0.2			60%					40%	
	1.3			60%					40%	
	2.6			90%	5%				5%	
	0.1			95%						5%
	0.1			80%	15%	5%				
	1.2			80%	15%	5%				
	0.7			95%		5%				
		1.7		100%						
			1.6							
12	8.7	1.7	1.6	82%	5%	1%	1%	0%	11%	0%
SB-59	0.2			100%						
	0.8			75%	12%		13%			
	0.6			85%					15%	
	0.2			55%	5%				40%	
	2.2			55%	5%				40%	
	0.9			55%	5%				40%	
	1.4			85%					15%	
	0.7			85%	5%	5%			5%	
	1			85%	5%	5%			5%	
	0.2			85%	5%	5%			5%	
	0.4			100%						
	0.3			0%		100%				
		1.9		100%						
			1.2							
		3.2		100%						
			0.8							
16	8.9	5.1	2	71%	4%	4%	1%	0%	19%	0%
SB-60	0.2			100%						
	0.3			85%					15%	
	1.8			50%	10%				40%	
	0.1			0%		50%				50%
	0.1			50%	10%				40%	
	1.5			50%	10%				40%	
	1.9			90%	5%				5%	
	0.1			75%	5%	15%			5%	
	0.1			0%		100%				
	1.9			0%		100%				
	0.3			0%		100%				
		2.5		100%						
			1.2							
12	8.3	2.5	1.2	47%	5%	28%	0%	0%	18%	1%
SB-61	0.2			100%						
	1			25%	38%		37%			
	0.5			75%					25%	
	0.1			0%	100%					
	1			55%	5%				40%	
	0.1			85%					15%	
	1.1			85%					15%	
	0.9			90%	5%				5%	
	1.4			85%	5%	5%				5%
	0.4			95%		5%				
	0.1			0%		100%				
	0.1			100%						
	0.2			25%		75%				
	0.9			0%		100%				
	0.2			0%		100%				
		2.3		100%						
			1.5							
12	8.2	2.3	1.5	60%	8%	18%	5%	0%	9%	1%

Revised Table 1. Composition of Fill at SWMU 14
Characteristics Assigned to No Recovery Intervals
Bailly Generating Station
Chesterton, IN

Boring	Fill (feet)	Native (feet)	No Recovery (feet)	Log Percentages						
				sand (includes silt)	slag (includes brick)	coal	gravel	peat	Coarse CCR	Fine CCR
SB-62	0.4			85%	15%					
	1.4			70%	5%				25%	
	2.2			70%	5%				25%	
	1.3			90%		5%			5%	
	0.7			95%		5%				
	0.5			95%						5%
	1.5			95%						5%
	0.6			75%	25%					
	0.2			40%	60%					
	0.6			0%		100%				
		1.3		100%						
			1.3							
		3.3		100%						
			0.7							
16	9.4	4.6	2	76%	5%	7%	0%	0%	10%	1%
SB-63	0.3			60%					40%	
	0.7			80%	5%				15%	
	3			80%	5%				15%	
	0.1			0%	100%					
	0.2			60%					40%	
	1.3			90%	5%				5%	
	1.1			95%		5%				
	1.3			95%		5%				
	0.2			95%		5%				
	0.1			0%						100%
	0.3			95%		5%				
	0.1			0%						100%
	0.2			95%		5%				
	0.6			70%	25%	5%				
	0.4			75%		25%				
	0.7			15%		85%				
	0.7			90%	5%	5%				
	0.7			90%	5%	5%				
		2.6		100%						
			1.4							
16	12	2.6	1.4	79%	5%	8%	0%	0%	7%	2%
SB-64	0.3			85%					15%	
	2			60%					40%	
	1.7			60%					40%	
	2.6			90%	5%				5%	
	1.4			90%	5%				5%	
	0.6			90%	5%				5%	
	0.7			95%		5%				
	0.1			25%		75%				
	0.1			100%						
	0.1			0%		100%				
	0.2			38%	37%	25%				
	0.3			25%		75%				
		0.8		100%						
			1.1							
		3.1		100%						
			0.9							
16	10.1	3.9	2	75%	3%	5%	0%	0%	17%	0%
SB-65	1.1			85%					15%	
	0.2			0%	100%					
	0.7			80%	5%				15%	
	2			80%	5%				15%	
	0.7			85%					15%	
	1.9			90%	5%				5%	
	1.4			90%	5%				5%	
	1.1			90%	5%				5%	
	0.4			15%		85%				
	0.1			25%		75%				
	0.2			15%		85%				
	0.3			25%		75%				
		0.8		100%						
			1.1							
		3		100%						
			1							
16	10.1	3.8	2.1	78%	5%	8%	0%	0%	9%	0%

Revised Table 1. Composition of Fill at SWMU 14
Characteristics Assigned to No Recovery Intervals
Bailly Generating Station
Chesterton, IN

Boring	Fill (feet)	Native (feet)	No Recovery (feet)	Log Percentages						
				sand (includes silt)	slag (includes brick)	coal	gravel	peat	Coarse CCR	Fine CCR
SB-66	2.2			80%	5%				15%	
	1.8			70%	15%				15%	
	0.8			70%	15%				15%	
	1.7			95%	5%					
	1.5			90%	5%	5%				
	1.9			90%	5%	5%				
	0.1			0%		100%				
	0.1			100%						
	0.3			50%		50%				
		0.3		100%						
			1.3							
		3.1		100%						
			0.9							
16	10.4	3.4	2.2	82%	7%	4%	0%	0%	7%	0%
SB-67	2			80%	5%				15%	
	2			75%					25%	
	1.2			75%					25%	
	1.2			80%	15%				5%	
	0.4			90%			5%		5%	
	1.2			90%			5%		5%	
	2.4			90%			5%		5%	
	0.2			75%		25%				
	0.1			0%		100%				
	0.1			100%						
	1.2			100%						
	0.1			100%						
	0.3			15%	15%	70%				
		2.5		100%						
			1.1							
16	12.4	2.5	1.1	82%	3%	3%	2%	0%	11%	0%
SB-68	1.6			70%	5%				25%	
	1			37%	25%					38%
	1.4			37%	25%					38%
	1.3			37%	25%					38%
	1.7			35%	30%					35%
	0.8			95%		5%				
	0.2			90%		5%	5%			
	2.6			90%		5%	5%			
	0.2			15%		85%				
	1.2			15%		85%				
	0.3			15%		85%				
		2.5		100%						
			1.2							
		4		100%						
20	12.3	6.5	1.2	54%	12%	13%	1%	0%	3%	16%
SB-69	1.1			70%	5%				25%	
	0.5			38%	25%					37%
	1.1			90%	5%				5%	
	1.3			85%	5%		5%		5%	
	2.5			85%	5%		5%		5%	
	1.5			85%	5%		5%		5%	
	0.6			85%	5%		5%		5%	
	0.4			15%		85%				
	0.3			95%		5%				
		1.4		100%						
			1.3							
		3.4		100%						
			0.6							
		3.5		100%						
			0.5							
20	9.3	8.3	2.4	79%	6%	4%	3%	0%	7%	2%

Revised Table 1. Composition of Fill at SWMU 14
Characteristics Assigned to No Recovery Intervals
Bailly Generating Station
Chesterton, IN

Boring	Fill (feet)	Native (feet)	No Recovery (feet)	Log Percentages						
				sand (includes silt)	slag (includes brick)	coal	gravel	peat	Coarse CCR	Fine CCR
SB-70	0.4			70%	15%				15%	
	1.6			90%			5%		5%	
	2			90%			5%		5%	
	0.5			90%			5%		5%	
	0.3			65%		25%	5%		5%	
	0.2			90%			5%		5%	
	0.2			65%		25%	5%		5%	
		0.6		100%						
			2.2							
		2		100%						
			2							
		1.8		100%						
		0.2		0%				100%		
		0.4		100%						
			1.6							
16	5.2	5	5.8	86%	1%	2%	5%	0%	6%	0%
SB-71	0.3			100%						
	0.7			55%	5%				40%	
	0.5			100%						
	0.1			0%	100%					
	0.5			100%						
	0.1			0%						100%
	0.3			100%						
	1.5			100%						
	2.1			100%						
	0.6			75%		25%				
	1.3			70%	5%	25%				
	0.7			70%	5%	25%				
		2.3		100%						
			1							
12	8.7	2.3	1	85%	3%	7%	0%	0%	3%	1%
SB-72	0.3			85%					15%	
	0.3			85%					15%	
	0.1			0%	100%					
	0.3			85%					15%	
	0.1			85%	8%		7%			
	1.3			60%					40%	
	0.2			75%			25%			
	0.1			60%					40%	
	1.3			60%					40%	
	0.1			60%					40%	
	2.7			90%	5%				5%	
	1.2			90%	5%				5%	
	0.9			90%	5%				5%	
	0.2			0%	15%	85%				
		1.9		100%						
			1							
12	9.1	1.9	1	77%	4%	2%	1%	0%	16%	0%
SB-73	0.5			95%	5%					
	0.4			70%	15%		15%			
	1.2			60%					40%	
	1.9			60%					40%	
	0.8			60%					40%	
	2			90%	5%				5%	
	1.2			90%	5%				5%	
	0.7			90%	5%				5%	
	0.1			80%	5%				15%	
	0.3			70%	25%				5%	
	0.1			0%		100%				
		1.6		100%						
			1.2							
		2.7		100%						
			1.3							
16	9.2	4.3	2.5	75%	4%	1%	1%	0%	19%	0%

Revised Table 1. Composition of Fill at SWMU 14

Characteristics Assigned to No Recovery Intervals

Bailly Generating Station

Chesterton, IN

Boring	Fill (feet)	Native (feet)	No Recovery (feet)	Log Percentages						
				sand (includes silt)	slag (includes brick)	coal	gravel	peat	Coarse CCR	Fine CCR
SB-74	0.3			100%						
	0.9			55%	5%				40%	
	2.8			55%	5%				40%	
	0.7			55%	5%				40%	
	0.7			90%	5%				5%	
	0.4			85%	5%				5%	5%
	0.9			100%						
	0.2			40%	30%	30%				
	1.1			40%	30%	30%				
	0.2			40%	30%	30%				
	0.4			95%	5%					
	0.4			0%		100%				
		1.7		100%						
			1.3							
12	9	1.7	1.3	62%	8%	9%	0%	0%	20%	0%
SB-75	0.2			100%						
	1			55%	5%				40%	
	0.3			45%	15%				40%	
	0.7			45%	5%				50%	
	0.1			30%	5%	25%			40%	
	0.4			95%					5%	
	1.3			95%					5%	
	0.4			95%					5%	
	0.1			70%		25%			5%	
	0.4			95%					5%	
	1.2			90%	5%				5%	
	0.2			50%	5%	40%			5%	
	0.3			75%	25%					
	0.2			0%	5%	95%				
	0.1			75%	25%					
	0.1			0%		100%				
	1			0%		100%				
	0.1			60%		40%				
	0.7			95%		5%				
		2.6		100%						
			0.6							
12	8.8	2.6	0.6	67%	4%	17%	0%	0%	13%	0%
SB-76	2.5			55%	5%				40%	
	1.5			55%	5%				40%	
	1.6			85%	5%	5%			5%	
	0.5			80%		15%				5%
	0.4			95%						5%
	1.5			95%						5%
	0.4			85%	15%					
	0.3			60%	20%	20%				
	0.1			0%		100%				
	0.1			100%						
	0.2			0%		100%				
	0.2			100%						
	0.4			0%		100%				
		1.5		100%						
			0.8							
12	9.7	1.5	0.8	68%	4%	9%	0%	0%	17%	1%

Revised Table 1. Composition of Fill at SWMU 14
Characteristics Assigned to No Recovery Intervals
Bailly Generating Station
Chesterton, IN

Boring	Fill (feet)	Native (feet)	No Recovery (feet)	Log Percentages						
				sand (includes silt)	slag (includes brick)	coal	gravel	peat	Coarse CCR	Fine CCR
SB-77	0.3			100%						
	0.8			45%	15%				40%	
	0.6			25%					75%	
	0.7			50%					50%	
	1.6			50%					50%	
	0.7			50%					50%	
	1.8			90%	5%				5%	
	0.2			90%	5%					5%
	1.3			90%	5%					5%
	0.4			90%	5%	5%				
	0.2			60%		40%				
	0.7			15%		85%				
	0.2			60%	40%					
	0.1			0%		100%				
	0.3			95%		5%				
	0.1			50%	50%					
			0							
	0.3			50%	50%					
	1.3			85%	15%					
		0.4		100%						
			0							
		4		100%						
			0							
16	11.6	4.4	0	65%	7%	7%	0%	0%	20%	1%
SB-78	0.3			100%						
	0.2			70%	25%				5%	
	0.1			0%	100%					
	1.8			70%	25%				5%	
	1.6			70%	25%				5%	
	0.5			70%	25%				5%	
	2.1			90%	5%				5%	
	1.4			90%	5%				5%	
	0.6			90%	5%				5%	
	0.2			95%		5%				
	0.1			85%		15%				
	0.6			95%		5%				
	0.5			0%		100%				
	0.1			100%						
	0.2			5%		95%				
		0.7		100%						
			1							
		3		100%						
			1							
16	10.3	3.7	2	76%	13%	7%	0%	0%	4%	0%
SB-79	0.5			95%	5%					
	1.5			70%	5%				25%	
	2			70%	5%				25%	
	2.4			90%	5%				5%	
	1.6			90%	5%				5%	
	1.6			90%	5%				5%	
	0.3			95%		5%				
	0.5			5%		95%				
		0.1		100%						
			1.5							
		2.6		100%						
			1.4							
16	10.4	2.7	2.9	80%	5%	5%	0%	0%	11%	0%

Revised Table 1. Composition of Fill at SWMU 14
Characteristics Assigned to No Recovery Intervals
Bailly Generating Station
Chesterton, IN

Boring	Fill (feet)	Native (feet)	No Recovery (feet)	Log Percentages						
				sand (includes silt)	slag (includes brick)	coal	gravel	peat	Coarse CCR	Fine CCR
SB-80	0.3			85%					15%	
	1.7			85%	5%				5%	5%
	2			85%	5%				5%	5%
	1.2			85%	5%				5%	5%
	1.1			95%					5%	
	1.7			85%	5%	5%			5%	
	1.9			85%	5%	5%			5%	
	0.1			65%	5%	25%			5%	
	0.1			85%	5%	5%			5%	
	0.1			65%	5%	25%			5%	
	0.3			37%	25%	38%				
	0.2			0%		100%				
	0.1			85%		15%				
		0.1		100%						
			1.1							
		2.8		100%						
			1.2							
16	10.8	2.9	2.3	83%	5%	5%	0%	0%	5%	2%
SB-81	1.1			80%	5%				15%	
	0.6			45%	30%				25%	
	0.3			65%	15%				15%	5%
	2			65%	15%				15%	5%
	0.4			50%	25%				25%	
	1			55%	5%				40%	
	0.8			70%	15%				15%	
	0.7			85%	5%		5%		5%	
	1.1			85%	5%		5%		5%	
	2.3			100%						
	0.3			50%	25%	25%				
	0.2			15%		85%				
	1.2			15%		85%				
		2.8		100%						
			1.2							
16	12	2.8	1.2	68%	8%	11%	1%	0%	11%	1%
SB-82	0.4			85%					15%	
	1.7			70%	15%				15%	
	1.9			38%	25%					37%
	1			38%	25%					37%
5	5	0	0	53%	20%	0%	0%	0%	6%	21%
SB-83	1.4			70%	5%				25%	
	1.2			38%	25%					37%
	0.5			95%					5%	
	0.9			85%		5%	5%		5%	
	2.7			85%		5%	5%		5%	
	1.3			85%		5%	5%		5%	
	0.8			85%		5%	5%		5%	
	0.4			51%	7%	34%			8%	
	0.2			15%		85%				
		1.2		100%						
			1.4							
		3.5		100%						
			0.5							
16	9.4	4.7	1.9	74%	4%	6%	3%	0%	7%	5%
SB-84	0.6			85%					15%	
	1.5			75%	5%		5%		15%	
	1.9			75%	5%		5%		15%	
	0.4			75%	5%		5%		15%	
	1.1			90%		5%			5%	
	0.4			85%		15%				
	0.1			25%		70%	5%			
		0.3		100%						
			1.7							
		2.4		100%						
			1.6							
12	6	2.7	3.3	79%	3%	3%	3%	0%	12%	0%

Revised Table 1. Composition of Fill at SWMU 14
Characteristics Assigned to No Recovery Intervals
Bailly Generating Station
Chesterton, IN

Boring	Fill (feet)	Native (feet)	No Recovery (feet)	Log Percentages						
				sand (includes silt)	slag (includes brick)	coal	gravel	peat	Coarse CCR	Fine CCR
SB-85	0.5			95%	5%					
	2			95%					5%	
	1.5			95%					5%	
	1.5			95%					5%	
	0.2			55%		40%			5%	
	0.2			90%	5%				5%	
	1.1			90%	5%	5%				
	1			85%		15%				
	2.9			85%		15%				
	1.1			85%		15%				
	1.5			80%	5%	15%				
		1.3		100%						
			1.2							
		3.8		100%						
			0.2							
20	13.5	5.1	1.4	89%	1%	8%	0%	0%	2%	0%
SB-86	0.6			75%	25%					
	1.1			54%	10%				36%	
	0.9			85%					15%	
	1.4			85%					15%	
	2.1			90%	5%	5%				
	1.9			95%					5%	
	0.7			95%					5%	
	0.2			0%		100%				
	0.1			25%		75%				
		1.9		100%						
			1.1							
		2		100%						
			2							
16	9	3.9	3.1	82%	4%	4%	0%	0%	10%	0%
SB-87	0.3			100%						
	0.2			75%	25%					
	0.4			55%	5%				40%	
	0.1			0%	100%					
	0.9			55%	5%				40%	
	0.2			0%	100%					
	0.6			55%	5%				40%	
	1.3			55%	5%				40%	
	0.2			55%	5%				40%	
	1.8			95%					5%	
	0.7			90%	5%	5%				
	1.3			90%	5%	5%				
	0.5			95%	5%					
	0.6			40%		60%				
		1.8		100%						
			1.1							
		1.9		100%						
			2.1							
16	9.1	3.7	3.2	72%	7%	5%	0%	0%	16%	0%
SB-88	0.3			100%						
	1.5			55%	5%				40%	
	2.2			55%	5%				40%	
	0.1			55%	5%				40%	
	1.7			80%	5%				15%	
	0.7			90%	5%				5%	
	1.5			90%	5%				5%	
	0.4			90%	5%				5%	
	0.3			55%	5%	40%				
	0.2			95%		5%				
	0.2			0%		100%				
		1.9		100%						
			1							
		3.4		100%						
			0.6							
16	9.1	5.3	1.6	71%	5%	4%	0%	0%	21%	0%

Revised Table 1. Composition of Fill at SWMU 14
Characteristics Assigned to No Recovery Intervals
Bailly Generating Station
Chesterton, IN

Boring	Fill (feet)	Native (feet)	No Recovery (feet)	Log Percentages						
				sand (includes silt)	slag (includes brick)	coal	gravel	peat	Coarse CCR	Fine CCR
SB-89	1.9			55%	5%				40%	
	0.6			85%					15%	
	1.5			25%	25%		25%		25%	
	0.7			25%	25%		25%		25%	
	0.2			95%					5%	
	0.1			0%						100%
	0.3			95%					5%	
	0.1			80%					5%	15%
	0.5			95%					5%	
	0.2			40%	60%					
	0.3			78%	5%	17%				
	0.8			15%		85%				
	0.8			0%		100%				
	0.2			0%		100%				
	0.3			25%		75%				
		2.1		100%						
			1.4							
		3.1		100%						
			0.9							
16	8.5	5.2	2.3	43%	9%	23%	6%	0%	17%	1%
SB-90	0.3			60%					40%	
	0.2			0%	100%					
	0.2			85%					15%	
	0.1			0%	100%					
	0.5			85%					15%	
	0.1			0%	100%					
	0.1			85%					15%	
	2.5			85%					15%	
	1.1			90%	5%				5%	
	0.6			70%	25%	5%				
	0.3			100%						
	0.5			50%		50%				
	0.4			90%	5%	5%				
	1.1			90%	5%	5%				
	0.9			90%	5%	5%				
		1.5		100%						
			1.6							
12	8.9	1.5	1.6	80%	8%	4%	0%	0%	8%	0%
SB-91	0.9			50%	5%				45%	
	0.8			95%					5%	
	0.5			50%					50%	
	0.3			15%	70%				15%	
	1.5			15%	70%				15%	
	0.3			90%	5%				5%	
	0.1			80%	15%				5%	
	2.3			90%	5%					5%
	0.1			0%	100%					
	1.2			0%	100%					
	0.2			75%	25%					
	0.5			95%	5%					
	0.2			50%		50%				
	0.2			95%		5%				
	1.1			90%	5%	5%				
		1.6		100%						
			0.2							
12	10.2	1.6	0.2	59%	28%	2%	0%	0%	10%	1%

Revised Table 1. Composition of Fill at SWMU 14
Characteristics Assigned to No Recovery Intervals
Bailly Generating Station
Chesterton, IN

Boring	Fill (feet)	Native (feet)	No Recovery (feet)	Log Percentages						
				sand (includes silt)	slag (includes brick)	coal	gravel	peat	Coarse CCR	Fine CCR
SB-92	1.4			60%					40%	
	0.2			85%					15%	
	0.8			80%	5%				15%	
	1.6			80%	5%				15%	
	0.6			90%	5%				5%	
	1.3			85%		5%	5%		5%	
	0.9			95%		5%				
	1.2			95%		5%				
	0.6			95%		5%				
	1			70%	15%				15%	
	0.1			60%	25%	15%				
	0.6			70%	15%				15%	
	1.7			70%	15%				15%	
12	12	0	0	79%	6%	2%	1%	0%	13%	0%
SB-93	1			60%	15%				25%	
	1.3			70%	5%				25%	
	1.7			70%	5%				25%	
	0.3			80%	5%				15%	
	2.5			90%		5%			5%	
	1.2			90%		5%			5%	
	0.5			90%		5%			5%	
	0.2			80%		15%			5%	
	0.1			55%	15%	25%			5%	
	0.9			60%	25%	15%				
	0.2			0%		100%				
		0.6		100%						
			1.5							
		3.3		100%						
			0.7							
16	9.9	3.9	2.2	76%	6%	6%	0%	0%	13%	0%
SB-94	0.9			70%	5%				25%	
	0.2			60%	15%				25%	
	1.3			90%	5%				5%	
	0.5			0%						100%
	1.1			0%						100%
	2.7			85%	5%	5%			5%	
	1.3			85%	5%	5%			5%	
	0.4			85%	5%	5%			5%	
	0.2			25%		75%				
		2.2		100%						
			1.2							
		3.8		100%						
			0.2							
16	8.6	6	1.4	66%	4%	4%	0%	0%	7%	19%
SB-95	0.4			85%					15%	
	1.9			45%	15%		5%		35%	
	1.7			20%	55%				20%	5%
	1			20%	55%				20%	5%
5	5	0	0	35%	35%	0%	2%	0%	25%	3%
SB-96	0.4			100%						
	1.2			70%	15%				15%	
	0.1			55%	25%				15%	5%
	0.1			0%	100%					
	0.3			55%	25%				15%	5%
	0.1			0%	100%					
	0.3			55%	25%				15%	5%
	0.3			90%	5%				5%	
	1.2			85%	5%	5%			5%	
	2.7			85%	5%	5%			5%	
	1.3			85%	5%	5%			5%	
	1.2			85%	5%	5%			5%	
	0.2			60%		40%				
	0.3			15%		85%				
		1.1		100%						
			1.2							
		3.5		100%						
			0.5							
16	9.7	4.6	1.7	77%	9%	7%	0%	0%	6%	0%

Revised Table 1. Composition of Fill at SWMU 14
Characteristics Assigned to No Recovery Intervals
Bailly Generating Station
Chesterton, IN

Boring	Fill (feet)	Native (feet)	No Recovery (feet)	Log Percentages						
				sand (includes silt)	slag (includes brick)	coal	gravel	peat	Coarse CCR	Fine CCR
SB-97	1.8			90%			5%		5%	
	2.2			90%			5%		5%	
	1.9			90%	5%				5%	
	2.1			90%	5%				5%	
	0.5			90%	5%				5%	
		1.7		100%						
			1.8							
12	8.5	1.7	1.8	90%	3%	0%	2%	0%	5%	0%
SB-98	0.1			100%						
	1.8			55%	5%				40%	
	2.1			55%	5%				40%	
	0.6			95%					5%	
	0.7			60%						40%
	0.9			75%						25%
		0.3		100%						
			1.5							
		2.9		100%						
			1.1							
12	6.2	3.2	2.6	63%	3%	0%	0%	0%	26%	8%
SB-99	1.4			55%	5%				40%	
	0.3			95%	5%					
	2.3			95%	5%					
	0.2			95%	5%					
	0.6			85%	5%	5%				5%
	1.1			95%		5%				
	2.1			95%		5%				
		2.2		100%						
			1.8							
12	8	2.2	1.8	87%	3%	2%	0%	0%	7%	0%
SB-100	0.3			100%						
	0.3			0%	100%					
	0.5			55%	5%				40%	
	0.1			0%	100%					
	0.6			55%	5%				40%	
	0.6			90%	5%				5%	
	0.2			60%		40%				
		0.2		100%						
			1.2							
	1.3			100%						
		1.9		100%						
			0.8							
		2.8		100%						
			1.2							
12	3.9	4.9	3.2	73%	12%	2%	0%	0%	12%	0%
SB-101	0.3			100%						
	0.9			75%	12%				13%	
	1.2			90%		5%			5%	
	1.6			90%		5%			5%	
	2.4			95%		5%				
	1.6			95%		5%				
		2.4		100%						
			1.6							
12	8	2.4	1.6	91%	1%	4%	0%	0%	3%	0%
SB-102	0.2			100%						
	0.5			95%					5%	
	1.2			45%	5%				50%	
	0.3			95%	5%					
	1.8			95%	5%					
		2.6		100%						
			1.4							
		2.1		100%						
			1.9							
12	4	4.7	3.3	80%	4%	0%	0%	0%	16%	0%

Revised Table 1. Composition of Fill at SWMU 14
Characteristics Assigned to No Recovery Intervals
Bailly Generating Station
Chesterton, IN

Boring	Fill (feet)	Native (feet)	No Recovery (feet)	Log Percentages						
				sand (includes silt)	slag (includes brick)	coal	gravel	peat	Coarse CCR	Fine CCR
SB-103	0.5			85%					15%	
	1.3			50%					50%	
	0.4			95%					5%	
		0.2		100%						
			1.6							
		2.9		100%						
			1.1							
8	2.2	3.1	2.7	66%	0%	0%	0%	0%	34%	0%
SB-104	0.4			75%					25%	
	1			50%					50%	
	0.8			95%					5%	
		0.7		100%						
			1.1							
		2.5		100%						
			1.5							
8	2.2	3.2	2.6	71%	0%	0%	0%	0%	29%	0%
SB-105	0.4			75%	25%					
	1.2			95%	5%					
		0.4		100%						
			2							
		2.7		100%						
			1.3							
8	1.6	3.1	3.3	90%	10%	0%	0%	0%	0%	0%
SB-106	0.2			100%						
	0.2			75%	12%		13%			
	0.6			90%	5%				5%	
	0.4			45%	25%				30%	
	0.2			40%	30%				30%	
	0.2			45%	25%				30%	
	0.7			90%	5%				5%	
	1.5			90%	5%				5%	
	0.3			90%	5%				5%	
	0.4			60%	20%					20%
	0.7			90%	5%				5%	
		1.3		100%						
			1.3							
		2.8		100%						
			1.2							
12	5.4	4.1	2.5	81%	9%	0%	0%	0%	8%	1%
SB-107	2.2			85%	5%	5%			5%	
	1.8			85%	5%	5%			5%	
		2.4		100%						
			1.6							
8	4	2.4	1.6	85%	5%	5%	0%	0%	5%	0%
SB-108	1.1			70%	5%				25%	
		1		100%						
			1.9							
		2.3		100%						
			1.7							
		2.7		100%						
			1.3							
12	1.1	6	4.9	70%	5%	0%	0%	0%	25%	0%
SB-109	0.4			100%						
	0.9			90%	5%		5%			
	1			95%		5%				
	1.7			95%		5%				
		2.8		100%						
			1.2							
		2.6		100%						
			1.4							
12	4	5.4	2.6	94%	1%	3%	1%	0%	0%	0%
SB-110	0.4			70%	15%		15%			
	0.7			85%	5%	5%			5%	
		0.9		100%						
			2							
		2.6		100%						
			1.4							
8	1.1	3.5	3.4	80%	9%	3%	5%	0%	3%	0%

Revised Table 1. Composition of Fill at SWMU 14
Characteristics Assigned to No Recovery Intervals
Bailly Generating Station
Chesterton, IN

Boring	Fill (feet)	Native (feet)	No Recovery (feet)	Log Percentages						
				sand (includes silt)	slag (includes brick)	coal	gravel	peat	Coarse CCR	Fine CCR
SB-111	0.4			85%					15%	
		2.5		100%						
			1.1							
		2.5		100%						
			1.5							
8	0.4	5	2.6	85%	0%	0%	0%	0%	15%	0%
SB-112	0.5			90%	5%				5%	
	0.6			90%	5%		5%			
		1.4		100%						
			1.5							
		2.7		100%						
			1.3							
8	1.1	4.1	2.8	90%	5%	0%	3%	0%	2%	0%
SB-113	0.5			90%	5%				5%	
	0.9			95%					5%	
	0.7			95%		5%				
	1.9			95%		5%				
		2		100%						
			2							
8	4	2	2	94%	1%	3%	0%	0%	2%	0%
SB-114	0.5			100%						
	0.1			85%	15%					
	0.8			95%					5%	
		1.2		100%						
			1.4							
		2.6		100%						
			1.4							
8	1.4	3.8	2.8	96%	1%	0%	0%	0%	3%	0%
SB-115	0.2			100%						
	0.1			0%	100%					
		0.2		100%						
			3.5							
		2.6		100%						
			1.4							
8	0.3	2.8	4.9	67%	33%	0%	0%	0%	0%	0%
SB-116	0.4			100%						
	0.9			90%	5%				5%	
	0.1			70%	25%	5%				
		1		100%						
			1.6							
		2.2		100%						
			1.8							
8	1.4	3.2	3.4	91%	5%	0%	0%	0%	3%	0%
SB-117	1.4			90%	5%	5%				
		0.8		100%						
			1.8							
		2.4		100%						
			1.6							
8	1.4	3.2	3.4	90%	5%	5%	0%	0%	0%	0%
SB-118	0.2			95%					5%	
	0.7			75%	12%				13%	
	0.9			38%	37%					25%
	0.2			38%	37%					25%
2	2	0	0	57%	25%	0%	0%	0%	5%	14%
SB-119	0.4			15%			70%		15%	
	0.6			5%	45%		45%		5%	
	1.4			30%	25%		15%		15%	15%
			0							
2.4	2.4	0	0	21%	26%	0%	32%	0%	13%	9%
SB-120	0.8			20%	30%	7%	30%		8%	5%
	0.2			75%		25%				
	3			75%		25%				
	1.9			90%		5%	5%			
	0.1			45%		50%	5%			
	2			15%		85%				
	0.1			15%		85%				
		2.2		100%						
			1.7							
12	8.1	2.2	1.7	57%	3%	34%	4%	0%	1%	0%

Revised Table 1. Composition of Fill at SWMU 14
Characteristics Assigned to No Recovery Intervals
Bailly Generating Station
Chesterton, IN

Boring	Fill (feet)	Native (feet)	No Recovery (feet)	Log Percentages						
				sand (includes silt)	slag (includes brick)	coal	gravel	peat	Coarse CCR	Fine CCR
SB-121	1.2			60%					40%	
	0.8			90%	5%				5%	
	0.2			45%	25%				30%	
	1.8			45%	25%				30%	
	0.5			80%	5%				15%	
	0.3			55%	5%				40%	
	1.2			80%	5%				15%	
	0.1			0%	85%	15%				
	1.9			60%		20%			20%	
	0.6			60%		20%			20%	
	0.2			15%		85%				
	0.2			95%		5%				
		1.4		100%						
			1.6							
		1.5		100%						
			2.5							
		2.2		100%						
			1.8							
20	9	5.1	5.9	62%	8%	8%	0%	0%	22%	0%
SB-122	0.9			50%	5%	5%			40%	
	0.1			0%						100%
	0.1			0%	100%					
	1.5			60%					40%	
	1.4			60%					40%	
	0.4			60%		20%			20%	
	0.6			15%		85%				
	0.1			85%		15%				
	0.9			15%		85%				
	0.9			95%		5%				
		0.6		100%						
			0.5							
		2.7		100%						
			1.3							
		2.7		100%						
			1.3							
16	6.9	6	3.1	52%	2%	21%	0%	0%	23%	1%
SB-123	0.4			50%	25%				25%	
	0.6			25%	37%		38%			
	0.4			60%		20%			20%	
	1.7			15%	5%	80%				
	0.9			15%	5%	80%				
	0.7			15%	5%	80%				
	0.5			95%		5%				
		1.7		100%						
			1.1							
		2.5		100%						
			1.5							
12	5.2	4.2	2.6	30%	9%	53%	4%	0%	3%	0%
SB-124	0.3			60%	20%		20%			
	0.7			15%	42%		43%			
	1.1			95%		5%				
	0.9			15%		85%				
	1			15%		85%				
	1.8			15%		85%				
	0.3			95%		5%				
		0.7		100%						
			1.2							
		2.5		100%						
			1.5							
12	6.1	3.2	2.7	36%	6%	53%	6%	0%	0%	0%

Revised Table 1. Composition of Fill at SWMU 14
Characteristics Assigned to No Recovery Intervals
Bailly Generating Station
Chesterton, IN

Boring	Fill (feet)	Native (feet)	No Recovery (feet)	Log Percentages						
				sand (includes silt)	slag (includes brick)	coal	gravel	peat	Coarse CCR	Fine CCR
SB-125	0.4			50%	25%				25%	
	0.5			55%	40%				5%	
	0.3			15%	43%		42%			
	1.7			90%		5%			5%	
	1.1			90%		5%			5%	
	0.4			90%		5%			5%	
	0.5			45%	15%	20%			20%	
	0.8			65%	5%	15%			15%	
	0.2			60%		20%			20%	
	0.4			90%		5%			5%	
	0.5			42%	25%	28%				5%
	1.2			42%	25%	28%				5%
	0.1			42%	25%	28%				5%
	0.2			15%		85%				
		2.2		100%						
			1.5							
		3.4		100%						
			0.6							
16	8.3	5.6	2.1	65%	12%	13%	2%	0%	7%	1%
SB-126	0.6			85%					15%	
	0.1			0%	50%		50%			
	0.1			85%					15%	
	0.5			0%	50%		50%			
	1.6			90%		5%			5%	
	1.1			90%		5%			5%	
	1.6			90%		5%			5%	
	0.5			70%	15%	15%				
	0.7			60%	15%	25%				
	1.2			60%	15%	25%				
	0.3			95%		5%				
	0.2			75%		25%				
	0.2			95%		5%				
	0.1			75%		25%				
	0.1			95%		5%				
	0.3			75%		25%				
		2		100%						
			0.8							
12	9.2	2	0.8	76%	7%	10%	3%	0%	3%	0%
SB-127	0.3			100%						
	0.4			75%					25%	
	0.1			25%	50%				13%	12%
	0.3			15%	43%		42%			
	1.6			85%	5%	5%			5%	
	1.3			85%	5%	5%			5%	
	1.6			85%	5%	5%			5%	
	0.3			75%	5%	15%			5%	
	0.9			85%	5%	5%			5%	
	1.2			60%		20%			20%	
	0.5			60%		20%			20%	
	0.1			0%						100%
	0.1			75%		25%				
		1.6		100%						
			1.7							
		3		100%						
			1							
16	8.7	4.6	2.7	76%	5%	8%	1%	0%	8%	1%

Revised Table 1. Composition of Fill at SWMU 14
Characteristics Assigned to No Recovery Intervals
Bailly Generating Station
Chesterton, IN

Boring	Fill (feet)	Native (feet)	No Recovery (feet)	Log Percentages						
				sand (includes silt)	slag (includes brick)	coal	gravel	peat	Coarse CCR	Fine CCR
SB-128	0.3			85%					15%	
	1			80%	5%				15%	
	0.1			0%	100%					
	0.8			85%	5%	5%			5%	
	1.8			85%	5%	5%			5%	
	0.7			85%	5%	5%			5%	
	0.1			25%	75%					
	1.4			85%	5%	5%			5%	
	0.3			75%	5%	15%			5%	
	0.1			85%	5%	5%			5%	
	1.4			85%	5%	5%			5%	
		2.8		100%						
			1.2							
12	8	2.8	1.2	82%	7%	4%	0%	0%	7%	0%
SB-129	0.8			85%					15%	
	1.5			85%	5%	5%			5%	
	1.7			70%		25%			5%	
	2.1			70%		25%			5%	
	0.1			0%						100%
	1.8			0%						100%
	0.1			0%						100%
	0.6			75%						25%
		1.6		100%						
			1.7							
		2.6		100%						
			1.4							
16	8.7	4.2	3.1	58%	1%	12%	0%	0%	4%	25%
SB-130	1.9			85%	5%	5%			5%	
	2.1			85%	5%	5%			5%	
	0.4			85%	5%	5%			5%	
	0.9			85%		15%				
	0.2			95%		5%				
	2.5			95%		5%				
	0.1			95%		5%				
	0.3			85%		15%				
	0.2			95%		5%				
	1			40%		60%				
	0.1			100%						
	0.3			40%		60%				
	1.2			95%		5%				
	0.8			95%		5%				
	0.6			100%						
	0.4			95%		5%				
		1.7		100%						
		0.1		0%				100%		
		0.3		100%						
			0.9							
		3.5		100%						
			0.5							
20	13	5.6	1.4	85%	2%	11%	0%	0%	2%	0%
SB-131	0.6			95%					5%	
	0.8			65%	5%	5%			25%	
	0.2			55%	5%	15%			25%	
	1.2			65%	5%	5%			25%	
	1.2			42%	5%	28%			25%	
	1			42%	5%	28%			25%	
	0.2			0%		100%				
	0.1			60%	20%	20%				
	0.2			75%		25%				
	0.2			85%		15%				
	0.1			75%		25%				
	0.3			85%		15%				
	0.5			60%		40%				
	0.3			95%		5%				
	1.1			95%		5%				
		3		100%						
			1							
		3.2		100%						
			0.8							
16	8	6.2	1.8	66%	3%	17%	0%	0%	14%	0%

Revised Table 1. Composition of Fill at SWMU 14
Characteristics Assigned to No Recovery Intervals
Bailly Generating Station
Chesterton, IN

Boring	Fill (feet)	Native (feet)	No Recovery (feet)	Log Percentages						
				sand (includes silt)	slag (includes brick)	coal	gravel	peat	Coarse CCR	Fine CCR
SB-132	0.2			85%					15%	
	1			75%					25%	
	1.1			85%	5%	5%			5%	
	1.7			85%	5%	5%			5%	
	0.5			85%	5%	5%			5%	
	0.2			25%		75%				
	1.6			95%		5%				
	1.7			15%		85%				
	0.3			15%		85%				
	1.2			85%		15%				
	0.8			95%		5%				
		0.5		100%						
			1.2							
		3.4		100%						
			0.6							
16	10.3	3.9	1.8	72%	2%	22%	0%	0%	4%	0%

Total Drilled (feet)	Revised Fill Recovered (feet)	Native Recovered (feet)	Native Unrecovered (feet)	Total Log Percentages (Fill Only)						
				sand (includes silt)	slag (includes brick)	coal	gravel	peat	c. CCR	f.CCR
1691.4	1013.1	424.2	254.1	73.7%	6.3%	7.6%	1.4%	0.0%	9.0%	2.0%

CCR = Coal Combustion Residual
Red Text indicates footage moved from "No Recovery (feet)" to "Fill (feet)", with assigned log percentages.

Proportional Term	Percent by Weight	Average Percent by Weight
trace =	0-10%	5%
little =	10-20%	15%
some =	20-30%	25%
with/-ly =	30-50%	40%
and =	50%	50%
pure =	100%	100%

Prepared by: LSC 04/14/2021
Reviewed by: RAJ 04/21/2021
Modified by: LSC 06/02/2021
Reviewed by: RAJ 06/14/2021

wood.

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Memo

To:	Michelle Kaysen / EPA	**Reviewer:**	Russell Johnson / Wood
From:	Lindsay Caplinger / Wood Daniel Sullivan / NIPSCO		
cc:	Jeff Neumeier / NIPSCO	**Wood File No.:**	3651200111.2800
Date:	May 25, 2021		
Re.	SWMU 14 Investigation Findings		

Wood Environment & Infrastructure Solutions, Inc. (Wood) has prepared this memorandum on behalf of Northern Indiana Public Service Company, LLC (NIPSCO) detailing the results of the SWMU 14 subsurface investigation conducted in March 2021 at the Bailly Generating Station (BGS). The investigation was conducted in response to a letter dated January 21, 2021, in which the Environmental Protection Agency (EPA) summarized comments received from the public regarding Solid Waste Management Unit (SWMU) 14. The public expressed concern that future water-table rise might possibly inundate the buried coal combustion residuals (CCR) at SWMU 14. In the January 21, 2021 letter, EPA provided lines of evidence that it thought might be substantive enough to recommend a presumptive remedy of excavation and offsite disposal in the Final Decision/Response to Comments.

Based on a plume evaluation and revised risk assessment for SWMU 14 in 2014, this unit was not included in the Statement of Basis for Area C at the BGS. The 2014 plume evaluation concluded that groundwater downgradient of SWMU 14 posed no ecological risk to receptors in Central Blag Slough and that no further evaluation of that pathway was required. Furthermore, the risk characterization concluded that conditions at SWMU 14 do not pose any risk to ecological receptors. Finally, the human health risk assessment concluded that carcinogenic risk is acceptable and that noncarcinogenic health effects are not expected to occur for the current or reasonably foreseeable conditions at SWMU 14. Review of groundwater data since the 2014 risk characterization has not changed those conclusions.

The 2021 subsurface investigation revealed that the vast majority (almost 90%) of backfill within the area designated SWMU 14 was sand, with lesser amounts of silt, slag, brick, coal, and gravel. Coarse CCR, or boiler slag (8.4%), and fine CCR, or fly ash (2.1%), were interspersed within the sandy matrix. Studies conducted elsewhere in Area C have shown that coarse CCR is relatively inert compared to fine CCR. Although small pockets of fine CCR were encountered at some borings, mappable units are not present at SWMU 14. By contrast, thick (i.e., >10 feet) and laterally continuous fine CCR does exist at SWMU 15. The characteristics of SWMU 14 do not indicate a landfill for the disposal of fine CCR as was the case for SWMU 15.

SWMU 14 History

Wood researched historical aerial photographs to better understand the development of the area now referred to as SWMU 14. Select photographs are included as **Attachment A**. The first photograph is a high-altitude aerial taken on March 17, 1961, which shows the early development of BGS. Light-colored areas are interpreted to be reworked sand in the absence of vegetation. The 1961 photograph at Page 7 of Attachment A includes added yellow arrows pointing to strips of land to the east and west of the area that later became known as SWMU 14. These strips of land were constructed to support electric transmission towers that remain in place today. The yellow arrows are included in subsequent photographs to establish consistent points of reference through time. The second and third oblique-angle photographs from 1962 and 1963 show an open area comprised of sand between the transmission towers, with what appeared to be a strip of vegetated land trending north-south along the margin nearest the western towers. Note that the future impoundments west of SWMU 14 had taken shape but did not appear to include water and may have still been vegetated. The July 15, 1965 high-altitude photograph resembled conditions in 1963. There was a dark-colored feature in the northwest portion of the SWMU 14 area that cannot be identified. This area was eventually occupied by the BGS Wastewater Treatment Plant (WWTP).

The June 28, 1969 high-altitude photograph shows water in the impoundments west of SWMU 14, which appeared to remain a flat surface with some revegetation compared to earlier in the decade. The dark feature to the northwest was visible but still not discernible. The May 3, 1971 high-altitude photograph depicted conditions that resembled conditions in 1969.

There was a gap in available photo-documentation between 1971 and 1977. An oblique-angle photograph from September 27, 1977 shows ponded water between the tower sets in the area now designated SWMU 14. It also appeared that filling had begun along the southern margin of this area. Some of the impoundments west of SWMU 14 were also visible in the 1977 photograph. By November 4, 1979 (next photograph in **Attachment A**), the open water at SWMU 14 appeared to have been nearly filled in; an L-shaped depression to the north still appeared to retain water. Note also it appeared the land surface in the northwest portion had been disturbed, perhaps as a precursor to the construction of the WWTP.

The final photograph from April 10, 1998 shows the WWTP as it is today. A portion of this area may have been constructed over formerly ponded water. Likewise, one of the three buildings in the northeast portion of the area, the civil lab / service building, may have been constructed within the footprint of the formerly ponded water. The two remaining buildings, known as the annex building (directly east of the civil lab) and security / truck scale (south east of the annex building), are located east of the tower set and not within the area of former ponding.

Prior Investigations and Findings

Previous investigation locations in SWMU 14 are depicted on **Figure 1**, as detailed in the RCRA Facility Investigation Report for Area C[1]. Test pits were excavated in 2005 to identify the extent of fill material in SWMU 14 (TP-1 through TP-22). Soil samples were also collected from randomly selected test pits to evaluate surface soil and near surface soil. In 2009 and 2010, additional test pitting was conducted to refine the delineation of CCR material (SWMU14-TP23 through -TP27), along with soil borings (SWMU14-SB01 through -SB09) and the installation of two additional monitoring wells (MW-135 and MW-136). Cone penetrometer (CPT) borings were also advanced in 2009 (SWMU14-CPT01, -CPT02, -CPT05, -CPT06, and -CPT08 through -CPT10) to provide a refined understanding of subsurface stratigraphy. The previous investigation findings were used to generate a model using Environmental Visualization System (EVS) software. The horizontal extent of CCR in SWMU 14 was estimated at approximately 3.89 acres, which is depicted by the yellow outline on **Figure 1**.

In 2020, based on a review of the available test pit and boring logs from the data collected between 2005 and 2010, Wood derived an average thickness of "suspected CCR" (as described in the Area C RFI) of 3.35 feet. Boiler slag and fly ash fractions were not differentiated in the "suspected CCR". Using that average over the estimated

[1] AMEC, 2011. RCRA Facility Investigation Report for Area C, NIPSCO Bailly Generating Station, RCRA Corrective Action Program, EPA ID# 000 718 114, Chesterton, Indiana. April 29, 2011.

3.89 acres, Wood calculated a volume of suspected CCR of 21,000 cubic yards (CY). This preliminary estimate of the CCR volume in SWMU 14 was provided in an e-mail to EPA dated October 21, 2020.

Field Activities – March 2021

The investigation locations were chosen based on a 50- by 50-foot grid, with some adjustments to account for previous boreholes and the active sanitary leach field. Originally, 108 soil borings were proposed, along with three contingency borings to the east. Beginning on March 17, 2021, the site surveyor located and staked the proposed soil borings based on horizontal coordinates provided by Wood. The surveyor also determined the ground surface elevation at each location, which was reported as North American Vertical Datum of 1988 (NAVD88), in US Survey Feet. Additionally, the surveyor completed a topographic map of SWMU 14 and the immediate surrounding area, which included surveying site features, such as buildings, roadways, and transmission towers/power lines. The surveyor also determined the catenary heights above the ground surface to ensure adequate clearance between the drill rig mast and the transmission lines. The topographic survey is provided in **Attachment B**, along with the surveyor's spreadsheet containing coordinates and ground surface elevations for each of the surveyed soil boring locations.

The drilling investigation began on March 22 and was completed on March 31, 2021. During the investigation, soil borings were added based on visual observations at completed perimeter soil borings. In total, 123 direct-push soil borings were advanced (SB-10 through SB-132), as depicted on **Figure 2**, to depths ranging from 2 to 20 feet below ground surface (bgs). Before drilling, depths to water were measured at wells in/near the SWMU 14 area (MW-116, MW-135, and MW-136) to aid in determining the depth to saturated soils in the borings. The measurements collected on March 22, 2021 are provided below, along with the corresponding depth bgs based on the well construction/survey details.

Well ID	Depth Below Top of Casing (feet)	Depth Below Ground Surface (feet)
MW-116	16.44	13.51
MW-135	15.44	12.49
MW-136	13.86	11.45

Direct-push borings were advanced using 4-foot acetate liners for a continuous record of the fill deposit until native sand was encountered at the base of the deepest fill interval. Saturated soil, where encountered, was observed at depths ranging from 8.3 to 14.1 feet bgs. Recovered soil was visually classified using the Unified Soil Classification System (USCS). Data collected from each boring consisted of field observations, including soil type, soil color (Munsell® soil color chart), relative moisture content (dry, damp, moist or saturated), as well as visual observations of fill material, if present. The stratigraphy of each core was documented in field boring logs, which are provided as **Attachment C**.

Soil samples were not collected for chemical analysis. Representative fill, some containing CCR, was collected in one-gallon plastic containers for storage at the BGS facility in the event additional testing of physical parameters or microscopy is warranted. A separate container of fine CCR was also collected from the few locations where pockets of this material were recovered in the acetate liner.

Investigation Findings – March 2021

As discussed above, in 2020 Wood had calculated a volume of suspected CCR of 21,000 CY based on a review of data from the 2005 to 2010 investigations. However, the EVS model assumed the "suspected CCR" layers were continuous, which the 2021 investigation has proven otherwise. A more accurate conceptual site model (CSM) of the fill at SWMU 14 is detailed below.

Fill Characteristics, Thickness, and Volume

Soil borehole information collected from the boring logs was tabulated in a spreadsheet to estimate the amount of each component observed in the field. **Table 1** provides detailed information for each soil boring, as well as totals for all 123 soil borings. The components were classified as follows: sand (including silt), slag (including brick), coal, gravel, peat, coarse CCR, and fine CCR. Based on the descriptors "pure, and, with, some, little and trace" (see the bottom of Page 28 in **Table 1**), the percentage of each fill component was estimated. These estimates are provided for each interval description for each boring. The distinct soil intervals were classified as either fill material or native soil. Additionally, since full recovery was seldom achieved, unrecovered soil intervals are also accounted for in the table, and these were not included in the percentage calculations.

Based on previous data, it was expected that definable layers of CCR would be observed; however, that was not the case. The fill material appeared to be comprised mainly of sand with varying amounts of the other components (slag/brick, coal, gravel, coarse CCR, and fine CCR). Uniform layers of CCR were seldomly observed, and where observed, they were typically small intervals and were not consistently seen across the area. More specifically, the overall observed fill material composition is detailed at the bottom of **Table 1**. The 123 soil borings represented a total of 1,691.4 feet drilled. Of that total, 679.2 feet was identified as fill, 424.2 feet was identified as native soil, and 588 feet was unrecovered. Out of the 679.2 feet of recovered soil classified as fill material, the total percentage of each component was calculated as follows: 74.2% sand (including silt), 8.4% coarse CCR, 7.3% coal, 6.5% slag (including brick), 2.1% fine CCR, and 1.6% gravel.

Soil borings were typically terminated in native sand. However, shallow refusal was encountered at five soil borings, ranging in depth from 2 to 5 feet bgs. The observed depth to native sand at each boring where encountered was entered into the elevation spreadsheet provided by the surveyor. From this, the native sand elevation at each boring was calculated. Note, refusal was also encountered in fill material at one other soil boring (SB-92) at 12 feet bgs, however, this depth was included based on surrounding soil boring observations. The depths to native sand and resulting surface elevations are provided in **Attachment B**. The average fill thickness across the investigation area was calculated at 8.4 feet (not including soil borings with shallow refusal). As mentioned earlier, depth to water observed during drilling ranged from 8.3 to 14.1 feet bgs, when encountered. Of the soil borings which extended into the water table, groundwater was encountered in the native sand in all but two of them. In soil boring SB-69, saturated soil was noted 0.8 foot above the native sand in the fill material (fine sand, trace coal); and similarly in SB-85, saturated soil was noted 0.7 foot above the native sand in the fill material (fine sand, little coal, trace slag). Not all soil borings were advanced to groundwater, but all borings that did not encounter refusal were extended into the native sand to define the fill/native sand interface. Overall, the water table was never observed in or above intervals containing CCR.

The spreadsheet referenced above was then used to generate a fill thickness map using AutoCAD® as depicted on **Figure 3**. Fill thickness was separated into the following categories: 0 to 2, 2 to 6, 6 to 10, and 10 to 14 feet. Thicker fill was observed in the east-central portion of the investigation area, along with a smaller portion in the southwest corner. The fill material began to thin out towards the south along the roadway and appeared to begin thinning to the north and east. It is expected that the limits of fill containing CCR are defined by the roads to the north and south and the sand embankments to the east and west where the transmission towers were constructed before all previous uses of the area now referred to as SWMU 14. The extent of fill and its characteristics were not investigated beneath the former WWTP and Civil Lab/Service Building. Those two areas appeared to be within the footprint of the area of ponded water c. 1977. For those areas where the fill thickness was defined as shown on **Figure 3**, AutoCAD® was used to estimate a volume of fill material between the surveyed land surface and native sand surface, which was calculated to be approximately 87,000 CY over an investigation area of approximately 5.98 acres.

Distribution of Fine CCR

The CCR generated by the coal-fired units that once operated at BGS included fly ash and boiler slag. As described by EPRI[2], fly ash particles are composed mainly of small spheres of amorphous or glassy aluminosilicates that rise with the flue gas in a boiler and are captured by particulate controls. Elements that become volatile at high temperatures preferentially condense on the surface of the fly ash particles as the flue gas cools. Boiler slag is formed in wet-bottom furnaces, where the non-combustible minerals melt into a liquid which is quenched in the ash hopper furnace. Boiler slag is comprised of larger particles that fall to the bottom of the boiler and are also composed primarily of amorphous or glassy aluminosilicate materials derived from the melted mineral phases. The availability of a constituent for leaching depends on whether the element resides on the surface of the ash particle, in the outer glass hull, or within the interior glass matrix. Because fly ash particulates are much smaller than boiler slag particulates, they have a larger surface area. The constituents that have condensed on the surface of the fly ash are more available for leaching. Thus, boiler slag has a much lower potential to leach inorganics than fly ash, as demonstrated by leach testing performed on samples collected at SWMU 15 (fly ash) and the Greenbelt (boiler slag).

As indicated in **Table 1** and detailed above, 89.5% of the material used to backfill the ponded water in the area now designated as SWMU 14 was comprised primarily of materials not expected to leach inorganic constituents from the combustion of coal (sand and silt, coal, slag and brick, and gravel). Coarse CCR (i.e., boiler slag) comprises 8.4% of the fill material, which has a lower leaching potential than fly ash, which comprises 2.1% of the fill material. Material identified in the field as fine CCR was logged in 47 of the 123 borings. Where encountered, the CCR was identified in one or more layers of variable thickness. Because the fine CCR has the greatest leaching potential, the aggregate thickness of the layer(s) and number of borings is summarized below by category.

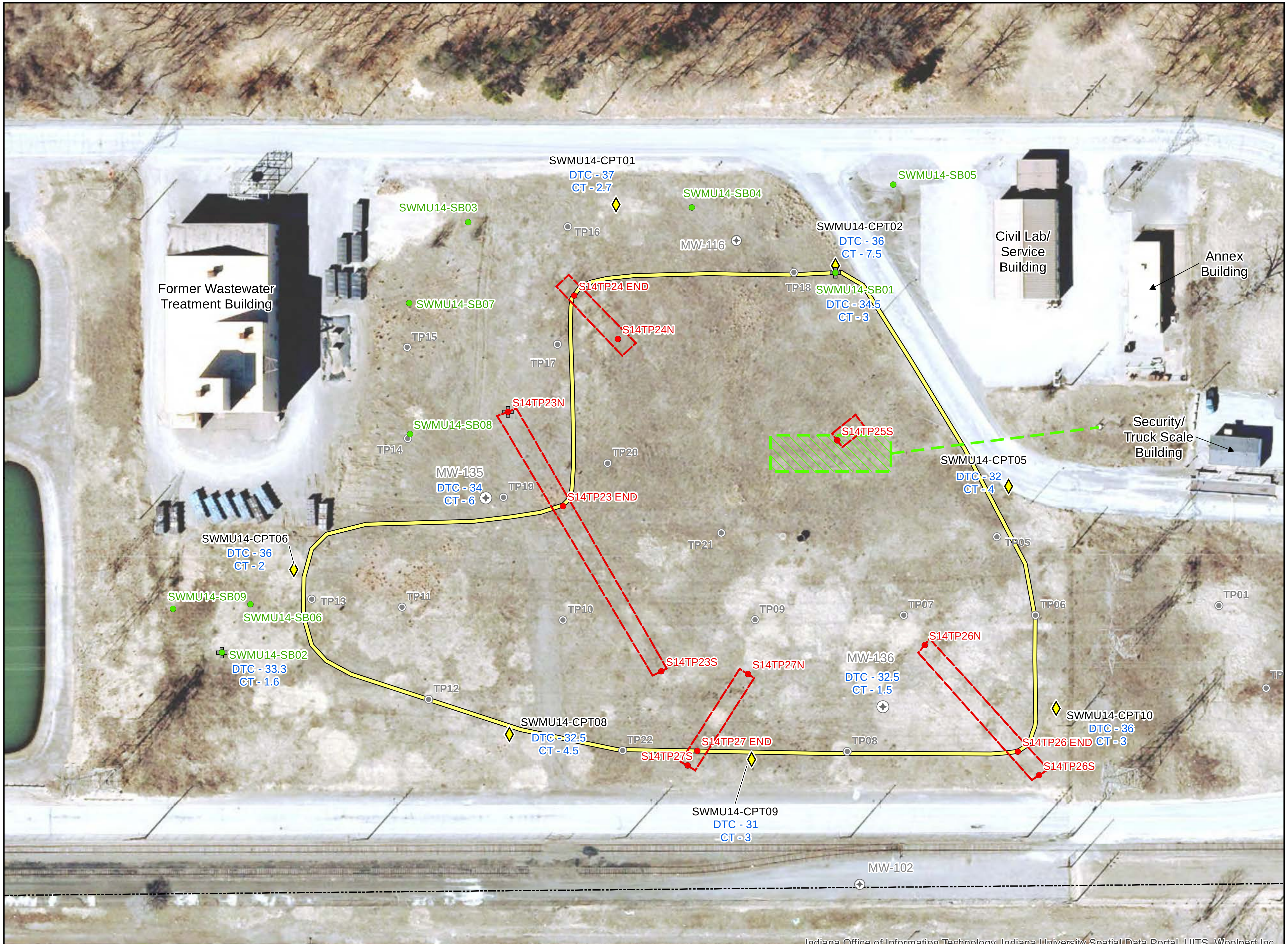
Thickness Category	Number of Borings
No fine CCR	76
≤0.10 foot	20
≤0.25 foot	10
≤0.50 foot	10
≤1.0 foot	4
≤2.0 foot	2
≤3.0 foot	1

The distribution of fly ash and the aggregate thickness of the layer(s) by the same categories summarized above are depicted on **Figure 3**. The greatest aggregate thickness (2.3 feet) was identified at SB-18 and is the sum of seven layers (see **Table 1**). The thickest aggregate layer (1.26 feet) of fine CCR comprised 90% of the overall matrix at that interval. The areas where the most aggregate layers of fine CCR were found are in the north- and east-central portions of the investigation area. The deepest suspected fine CCR observed was in soil boring SB-14 at 9.7 feet bgs.

[2] EPRI, 2009. Coal Ash: Characteristics, Management and Environmental Issues. Technical Update – Coal Combustion Products - Environmental Issues. Electric Power Research Institute. Document No. 1019022. September 2009.

Conclusions and Recommendation

The March 2021 investigation consisted of 123 direct-push soil borings to further refine the nature and distribution of CCR in SWMU 14. Following a review of data from the 2005 to 2010 investigations, Wood had previously calculated a volume of suspected CCR of 21,000 CY assuming a continuous average thickness of 3.35 feet over the entire 3.89 acres. On the contrary, the 2021 investigation revealed approximately 87,000 CY of fill material over almost 6 acres comprised mainly of sand that is mixed with much lower percentages of other aggregate, and only 2.1% fine CCR. With this new information, it no longer seems practical to excavate such a large volume of sandy fill material comprised of 8.4% boiler slag (relatively inert) and 2.1% fly ash. NIPSCO looks forward to additional dialogue related to our findings, including possible additional studies that would further support our conclusion that a presumptive remedy of excavation for offsite disposal is not warranted.



Previous Investigation Locations

Northern Indiana Public Service Company

Bailly Generating Station
Chesterton, Indiana

Legend

- Cone Penetrometer Sounding Location
- Soil Boring Location
- Test Pit End Location 2009
- Soil Sample Location
- Direct Push Groundwater Sample Location
- Test Pit End Location 2005
- Monitoring Well Location
- Test Pit Location 2009
- Approximate Leach Field Location
- Coal Combustion Residual Fill Area as Mapped in 2011
- Bailly Generating Station Property Line
- DTC - 31 Depth to Clay (ft)
- CT - 3 Clay Thickness (ft)

Location of Site

Notes and Sources

FIGURE 1

Aerial Imagery: Orthophotography of Indiana, (2018) obtained through ArcGIS Online.

Area of SWMU 14 landfill is 3.89 acres based on 2011 boundary.

N

0 80 Feet

wood.

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2021
Investigation Locations

Northern Indiana Public
Service Company

Bailly Generating Station
Chesterton, Indiana

Legend

- Sampling Grid (50 ft Cell)
- Approximate Leach Field Location
- Bailly Generating Station Property Line
- Monitoring Well Location
- Soil Boring Location

Location of Site

Notes and Sources

FIGURE 2

Aerial Imagery: Orthophotography of Indiana, (2018) obtained through ArcGIS Online.

N

0 80 Feet

wood.

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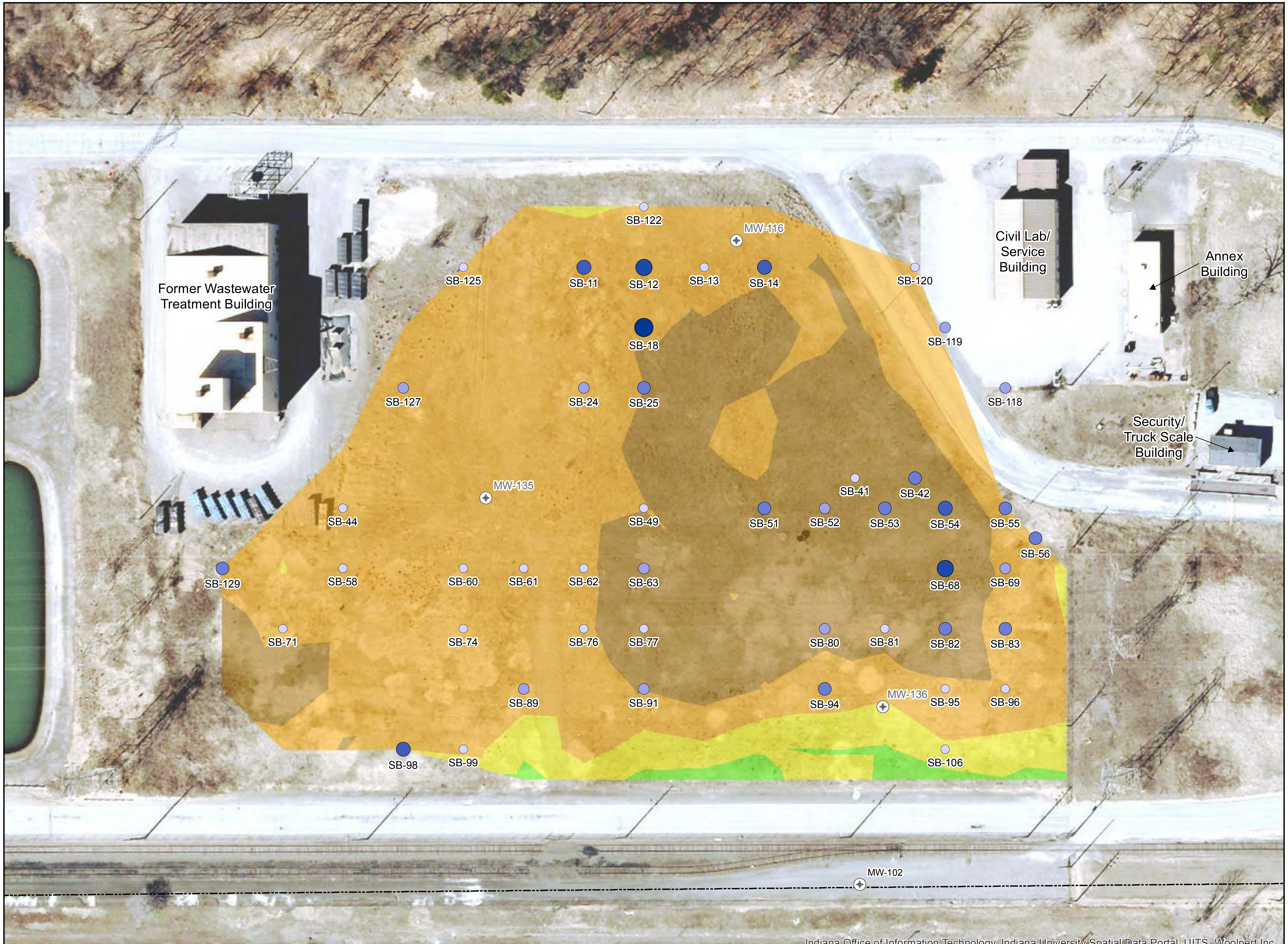
(978) 692-9090

H:\NiSource\BaillyGenerating\Task81\MXD\Fig2_SWMU14SoilBorings.mxd May 04, 2021 DWN: emily.gardiner CHKD: LC



2021
Investigation Findings

Northern Indiana Public Service Company

Bailly Generating Station
Chesterton, Indiana

Legend

- Bailly Generating Station Property Line
- Monitoring Well Location

Fill Thickness (Feet)
- 0-2
- 2-6
- 6-10
- 10-14

2021 Soil Boring Aggregate Fly Ash Thickness (Feet)
- ≤ 0.1
- ≤ 0.25
- ≤ 0.5
- ≤ 1
- ≤ 2
- ≤ 3

Location of Site

Notes and Sources

FIGURE 3

Aerial Imagery: Orthophotography of Indiana, (2018) obtained through ArcGIS Online.

wood.
Wood Environment & Infrastructure Solutions, Inc.
271 Mill Road
Chelmsford, MA 01824
(978) 692-9090

Table 1. Composition of Fill at SWMU 14
Bailly Generating Station
Chesterton, IN

Boring	Fill (feet)	Native (feet)	No Recovery (feet)	Log Percentages						
				sand (includes silt)	slag (includes brick)	coal	gravel	peat	Coarse CCR	Fine CCR
SB-10	0.3			100%						
	1.1			50%	25%		25%			
	0.8			100%						
			1.8							
	1.1			100%						
	1.7			90%	5%	5%				
			1.2							
	0.3			95%		5%				
	1.2			60%		40%				
		1.7		100%						
			0.8							
12	6.5	1.7	3.8	81%	6%	9%	4%	0%	0%	0%
SB-11	0.4			85%			15%			
	0.2			60%			40%			
	0.3			0%						100%
	0.4			90%	5%					5%
	0.3			5%						95%
	0.4			100%						
	0.1			0%						100%
	0.9			95%		5%				
			1							
	1.5			90%		5%	5%			
			2.5							
	0.2			90%		5%	5%			
	1.1			70%		25%	5%			
	0.2			0%	50%		50%			
		1.4		100%						
			1.1							
12	6	1.4	4.6	73%	2%	7%	6%	0%	0%	12%
SB-12	0.4			95%		5%				
	0.9			55%	5%	20%			20%	
	0.3			55%		20%	20%			5%
	0.6			0%						100%
	0.5			40%	20%	5%	30%			5%
			1.3							
	0.3			40%	20%	5%	30%			5%
	0.3			30%	20%	5%	30%			15%
	0.7			0%						100%
	0.8			35%	25%	5%	30%			5%
			1.9							
	0.4			35%	25%	5%	30%			5%
	0.1			0%						100%
	0.4			90%	5%		5%			
	0.4			70%		25%			5%	
		0.6		100%						
			2.1							
		2.5		100%						
			1.5							
16	6.1	3.1	6.8	41%	10%	8%	13%	0%	3%	26%
SB-13	0.3			100%						
	1.8			55%	5%				40%	
			1.9							
	0.5			55%	5%				40%	
	0.3			50%	5%				40%	5%
	0.4			60%					40%	
			2.8							
	0.1			95%					5%	
	0.3			15%	80%					5%
	0.2			95%					5%	
	0.2			85%					15%	
		1		100%						
			2.2							
		2.9		100%						
			1.1							
16	4.1	3.9	8	60%	9%	0%	0%	0%	30%	1%

Table 1. Composition of Fill at SWMU 14
Bailly Generating Station
Chesterton, IN

Boring	Fill (feet)	Native (feet)	No Recovery (feet)	Log Percentages						
				sand (includes silt)	slag (includes brick)	coal	gravel	peat	Coarse CCR	Fine CCR
SB-14	0.2			100%						
	1.2			55%	5%				40%	
			2.6							
	0.6			55%	5%				40%	
	0.9			95%			5%			
			2.5							
	0.9			95%			5%			
	0.5			0%						100%
	0.3			65%	5%				15%	15%
		1		100%						
			1.3							
		3		100%						
			1							
16	4.6	4	7.4	67%	2%	0%	2%	0%	17%	12%
SB-15	1.7			60%					40%	
			2.3							
	0.9			50%	10%				40%	
	1.3			95%	5%					
			1.8							
	1.2			95%	5%					
	0.6			90%	5%	5%				
	0.3			80%		5%			15%	
		0.7		100%						
			1.2							
		2.9		100%						
			1.1							
16	6	3.6	6.4	77%	4%	1%	0%	0%	18%	0%
SB-16	0.3			85%					15%	
	0.4			25%	25%		25%		25%	
	0.4			25%	75%					
	1.5			80%	15%				5%	
			1.4							
	2.9			90%	5%				5%	
			1.1							
	0.1			90%	5%				5%	
	0.3			75%		25%				
	0.2			50%	25%	25%				
	0.5			15%		85%				
	0.2			100%						
	0.2			0%		100%				
		1.6		100%						
			0.9							
		3.3		100%						
			0.7							
16	7	4.9	4.1	71%	12%	11%	1%	0%	5%	0%
SB-17	0.1			100%						
	0.2			0%			100%			
	0.6			25%	25%	25%	25%			
	1.8			90%	5%				5%	
			1.3							
	2.6			90%			5%		5%	
	0.1			0%		100%				
			1.3							
	0.1			60%		40%				
	0.4			34%		33%	33%			
	0.4			25%		75%				
	0.4			75%		25%				
		1.4		100%						
			1.3							
		3.3		100%						
			0.7							
16	6.7	4.7	4.6	72%	4%	12%	9%	0%	3%	0%

Table 1. Composition of Fill at SWMU 14
Bailly Generating Station
Chesterton, IN

Boring	Fill (feet)	Native (feet)	No Recovery (feet)	Log Percentages						
				sand (includes silt)	slag (includes brick)	coal	gravel	peat	Coarse CCR	Fine CCR
SB-18	0.3			100%						
	0.1				100%					
	0.9			60%					40%	
	0.3			0%						100%
	0.3			13%		12%				75%
	0.1			50%	25%	25%				
			2							
	0.4			50%	25%	25%				
	0.3			0%						100%
	0.1			50%	25%	25%				
	0.1			0%						100%
	0.3			45%	25%	25%				5%
	0.1			0%						100%
	0.5			50%	25%	25%				
	1.4			5%	5%					90%
			0.8							
	1.1			100%						
	0.1			0%	100%					
	0.1			100%						
	0.5			0%		100%				
		1		100%						
			1.2							
		3.1		100%						
			0.9							
16	7	4.1	4.9	40%	9%	13%	0%	0%	5%	33%
SB-19	0.4			100%						
	1.6			55%	5%				40%	
			2							
	0.6			60%					40%	
	1.2			100%						
			2.2							
	1.7			95%			5%			
	0.3			65%	15%	15%	5%			
	0.2			0%		100%				
		0.4		100%						
			1.4							
		2.9		100%						
			1.1							
16	6	3.3	6.7	78%	2%	4%	2%	0%	15%	0%
SB-20	2.2			85%					15%	
			1.8							
	2.4			85%					15%	
			1.6							
	2.5			95%			5%			
	0.2			0%		100%				
		0.1		100%						
			1.2							
		2.8		100%						
			1.2							
16	7.3	2.9	5.8	86%	0%	3%	2%	0%	9%	0%
SB-21	1.9			95%					5%	
			2.1							
	1.8			95%					5%	
			2.2							
	0.1			95%					5%	
	0.2			0%	50%	50%				
	1.1			100%						
	0.1			0%		100%				
		0.4		100%						
			2.1							
		2.7		100%						
			1.3							
16	5.2	3.1	7.7	91%	2%	4%	0%	0%	4%	0%

Table 1. Composition of Fill at SWMU 14
Bailly Generating Station
Chesterton, IN

Boring	Fill (feet)	Native (feet)	No Recovery (feet)	Log Percentages						
				sand (includes silt)	slag (includes brick)	coal	gravel	peat	Coarse CCR	Fine CCR
SB-22	0.9			75%			25%			
	0.8			90%	5%				5%	
			2.3							
	0.2			90%	5%				5%	
	2.3			95%			5%			
			1.5							
	0.7			95%			5%			
	0.2			0%		100%				
		1.8		100%						
			1.3							
12	5.1	1.8	5.1	87%	1%	4%	7%	0%	1%	0%
SB-23	0.5			50%	25%		25%			
	0.4			0%	100%					
	1.8			90%	5%				5%	
			1.3							
	2			95%					5%	
	0.7			100%						
	0.2			20%	60%	20%				
			1.1							
	0.1			20%	60%	20%				
	0.2			0%		100%				
	0.1			25%		75%				
	0.4			0%		100%				
	0.1			60%		40%				
		2		100%						
			1.1							
		3.2		100%						
			0.8							
16	6.5	5.2	4.3	71%	12%	12%	2%	0%	3%	0%
SB-24	0.4			85%					15%	
	0.7			25%	45%		30%			
	0.5			40%	35%	25%				
	0.2			0%						100%
	1.3			95%	5%					
			0.9							
	2.9			90%	5%	5%				
			1.1							
	0.2			100%						
	0.3			60%	20%	20%				
	0.1			100%						
	0.6			0%		100%				
	0.3			100%						
	0.2			0%		100%				
		1.4		100%						
			0.9							
		3.1		100%						
			0.9							
16	7.7	4.5	3.8	69%	10%	15%	3%	0%	1%	3%
SB-25	1.7			85%					15%	
	0.4			0%	5%					95%
	0.2			100%						
			1.7							
	2.4			85%	5%	5%	5%			
			1.6							
	1			100%						
	0.1			0%	100%					
	0.1			100%						
	0.1			0%	100%					
	0.7			15%		85%				
		1		100%						
			1							
		3.1		100%						
			0.9							
16	6.7	4.1	5.2	73%	5%	11%	2%	0%	4%	6%

Table 1. Composition of Fill at SWMU 14
Bailly Generating Station
Chesterton, IN

Boring	Fill (feet)	Native (feet)	No Recovery (feet)	Log Percentages						
				sand (includes silt)	slag (includes brick)	coal	gravel	peat	Coarse CCR	Fine CCR
SB-26	2.4			80%	5%				15%	
			1.6							
	0.7			80%	5%				15%	
	2			95%					5%	
			1.3							
	2.2			95%		5%				
	0.2			15%		85%				
	0.1			100%						
	0.1			0%		100%				
		0.2		100%						
			1.2							
		2.8		100%						
			1.2							
16	7.7	3	5.3	86%	2%	5%	0%	0%	7%	0%
SB-27	2.4			80%			5%		15%	
			1.6							
	2.2			85%					15%	
			1.8							
	0.6			95%					5%	
	1.3			90%	5%		5%			
	0.1			75%		25%				
		0.4		100%						
			1.6							
		2.7		100%						
			1.3							
16	6.6	3.1	6.3	85%	1%	0%	3%	0%	11%	0%
SB-28	2			85%					15%	
			2							
	2.3			80%	5%				15%	
			1.7							
	2.3			90%	5%				5%	
	0.1			0%		100%				
	0.2						50%		50%	
		0.2		100%						
			1.2							
		3.6		100%						
			0.4							
16	6.9	3.8	5.3	81%	3%	1%	1%	0%	12%	0%
SB-29	0.5			60%					40%	
	1.7			75%	5%	5%			15%	
			1.8							
	0.4			85%					15%	
	0.1				100%					
	1.2			80%	5%				15%	
	0.9			95%					5%	
			1.4							
	1.6			95%					5%	
	0.1			0%		100%				
	0.6			90%		5%			5%	
		0.2		100%						
			1.5							
		2.7		100%						
			1.3							
16	7.1	2.9	6	82%	3%	3%	0%	0%	12%	0%
SB-30	2			80%	5%				15%	
			2							
	1			85%					15%	
	1.3			90%	5%				5%	
			1.7							
	1.5			90%	5%				5%	
	0.2			15%		85%				
		1		100%						
			1.3							
		2.9		100%						
			1.1							
16	6	3.9	6.1	83%	4%	3%	0%	0%	10%	0%

Table 1. Composition of Fill at SWMU 14
Bailly Generating Station
Chesterton, IN

Boring	Fill (feet)	Native (feet)	No Recovery (feet)	Log Percentages						
				sand (includes silt)	slag (includes brick)	coal	gravel	peat	Coarse CCR	Fine CCR
SB-31	1.9			75%	5%		5%		15%	
			2.1							
	2.4			75%	5%		5%		15%	
			1.6							
	2			75%	5%		5%		15%	
	0.2			50%	25%	25%				
	0.2			5%		95%				
		0.1		100%						
			1.5							
		2.4		100%						
			1.6							
16	6.7	2.5	6.8	72%	5%	4%	5%	0%	14%	0%
SB-32	1.2			80%	5%				15%	
	0.3			0%	100%					
	0.1			80%	5%				15%	
	0.1			0%	100%					
	0.3			80%	5%				15%	
			2							
	1.9			80%	5%				15%	
			2.1							
	2.2			90%	5%				5%	
	0.3			85%	5%	5%			5%	
			1.5							
	0.1			60%		40%				
	0.4			90%	5%	5%				
	0.1			0%		100%				
		2		100%						
			1.4							
16	7	2	7	78%	10%	3%	0%	0%	9%	0%
SB-33	1.6			80%	5%				15%	
			2.4							
	1.4			70%	15%				15%	
	1.2			95%					5%	
			1.4							
	2			95%					5%	
	0.2			5%		95%				
		0.4		100%						
			1.4							
		3		100%						
			1							
16	6.4	3.4	6.2	83%	5%	3%	0%	0%	10%	0%
SB-34	0.4			80%					20%	
	0.5			0%	100%					
	2.1			90%	5%				5%	
			1							
	2			95%					5%	
	0.2			60%	20%	20%				
	0.7			15%		85%				
			1.1							
		3		100%						
			1							
12	5.9	3	3.1	73%	11%	11%	0%	0%	5%	0%

Table 1. Composition of Fill at SWMU 14
Bailly Generating Station
Chesterton, IN

Boring	Fill (feet)	Native (feet)	No Recovery (feet)	Log Percentages						
				sand (includes silt)	slag (includes brick)	coal	gravel	peat	Coarse CCR	Fine CCR
SB-35	0.2			100%						
	0.3			75%	25%					
	0.5			0%	100%					
	1.6			95%					5%	
			1.4							
	2.4			90%	5%				5%	
	0.1			90%		5%			5%	
	0.2			65%	25%	5%			5%	
	0.1			34%	33%	33%				
	0.1			0%		100%				
			1.1							
	0.4			15%		85%				
	0.3			100%						
	0.3			75%		25%				
		1.9		100%						
			1.1							
		3.6		100%						
			0.4							
16	6.5	5.5	4	76%	12%	9%	0%	0%	3%	0%
SB-36	0.2			95%					5%	
	1.5			90%	5%	5%				
			2.3							
	2.9			95%	5%					
			1.1							
	0.3			40%		60%				
	0.3			100%						
	0.1			0%		100%				
	0.1			50%	50%					
	0.7			25%		75%				
		1.4		100%						
			1.1							
		3		100%						
			1							
16	6.1	4.4	5.5	81%	4%	14%	0%	0%	0%	0%
SB-37	1.8			80%	5%				15%	
			2.2							
	1.4			90%			5%		5%	
	0.4			95%			5%			
	0.2			0%	100%					
	0.8			90%	5%		5%			
			1.2							
	1.3			95%			5%			
	0.4			90%	5%		5%			
	0.6			5%		95%				
		0.7		100%						
			1							
		3.1		100%						
			0.9							
16	6.9	3.8	5.3	79%	5%	8%	3%	0%	5%	0%
SB-38	2			95%					5%	
			2							
	2.6			90%	5%				5%	
			1.4							
	1.2			100%						
	0.1			95%	5%					
	0.1			60%		40%				
	0.1			0%		100%				
	0.2			75%		25%				
	0.3			0%		100%				
	0.1			85%		15%				
		0.6		100%						
			1.3							
		2.9		100%						
			1.1							
16	6.7	3.5	5.8	87%	2%	8%	0%	0%	3%	0%

Table 1. Composition of Fill at SWMU 14
Bailly Generating Station
Chesterton, IN

Boring	Fill (feet)	Native (feet)	No Recovery (feet)	Log Percentages						
				sand (includes silt)	slag (includes brick)	coal	gravel	peat	Coarse CCR	Fine CCR
SB-39	2.2			90%			5%		5%	
			1.8							
	0.2			0%	100%					
	2.5			95%	5%					
			1.3							
	1.1			95%	5%					
	0.2			75%	25%					
	0.8			5%		95%				
		0.9		100%						
			1							
		3		100%						
			1							
16	7	3.9	5.1	80%	6%	11%	2%	0%	2%	0%
SB-40	1.4			70%	5%				25%	
			2.6							
	1.2			80%	5%				15%	
	1.4			90%			5%		5%	
			1.4							
	1.7			90%			5%		5%	
	0.1			0%	100%					
	0.1			0%		100%				
	0.2			100%						
	0.3			0%	5%	95%				
		0.2		100%						
			1.4							
		2.8		100%						
			1.2							
16	6.4	3	6.6	77%	4%	6%	2%	0%	11%	0%
SB-41	1.9			70%			5%		25%	
			2.1							
	1.5			80%	2%		3%		15%	
	0.7			40%	55%					5%
	0.4			100%						
			1.4							
	2.6			100%						
	0.2			90%	5%	5%				
			1.2							
	0.1			60%		40%				
	0.1			90%		5%	5%			
		2		100%						
			1.8							
16	7.5	2	6.5	82%	6%	1%	2%	0%	9%	0%
SB-42	0.4			70%			5%		25%	
	1.5			70%	5%				25%	
			2.1							
	0.2			60%	15%				25%	
	1.3			40%	45%					15%
	0.2			0%	100%					
	1.2			40%	45%					15%
	0.2			100%						
	0.3			40%	60%					
	0.2			100%						
			0.4							
	2.6			90%		5%	5%			
	0.2			60%		40%				
			1.2							
	0.2			60%		40%				
		2.3		100%						
			1.5							
16	8.5	2.3	5.2	65%	19%	3%	2%	0%	6%	4%
SB-43	0.2			25%			75%			
	0.7			0%	100%					
	1.4			100%						
			1.7							
	2.7			95%		5%				
			1.3							
		2.6		100%						
			1.4							
12	5	2.6	4.4	80%	14%	3%	3%	0%	0%	0%

Table 1. Composition of Fill at SWMU 14
Bailly Generating Station
Chesterton, IN

Boring	Fill (feet)	Native (feet)	No Recovery (feet)	Log Percentages						
				sand (includes silt)	slag (includes brick)	coal	gravel	peat	Coarse CCR	Fine CCR
SB-44	0.6			75%					25%	
	2.1			90%	5%				5%	
	0.1			0%		100%				
			1.2							
	1.9			90%	5%				5%	
	0.1			85%	5%				5%	5%
	0.4			95%	5%					
	0.2			95%		5%				
			1.4							
	0.3			95%		5%				
		2.3		100%						
			1.4							
12	5.7	2.3	4	88%	4%	2%	0%	0%	6%	0%
SB-45	0.3			60%		20%			20%	
	0.4			55%	5%		40%			
	0.5			25%	75%					
	1.7			90%	5%				5%	
			1.1							
	2.1			90%		5%			5%	
	0.7			85%	5%	5%			5%	
	0.1			100%						
			1.1							
	0.1			75%		25%				
		2.8		100%						
			1.1							
12	5.9	2.8	3.3	80%	9%	4%	3%	0%	5%	0%
SB-46	0.2			100%						
	0.6			0%	100%					
	1.7			95%					5%	
	0.4			80%			5%		15%	
			1.1							
	2			90%			5%		5%	
	0.5			25%	5%	70%				
		0.2		100%						
			1.3							
		2		100%						
			0							
		2		100%						
			0							
12	5.4	4.2	2.4	75%	12%	6%	2%	0%	5%	0%
SB-47	0.5			75%	17%				8%	
	0.1			0%	100%					
	2.1			90%	5%				5%	
			1.3							
	2.8			90%	5%				5%	
	0.6			13%	12%	75%				
			0.6							
	0.4			13%	12%	75%				
	0.2			85%	15%					
		2		100%						
			1.4							
		3.5		100%						
			0.5							
16	6.7	5.5	3.8	76%	9%	11%	0%	0%	4%	0%
SB-48	1.9			85%					15%	
	0.2			60%	25%				15%	
			1.9							
	2.6			70%		5%	25%			
	0.1			50%	25%		25%			
	0.1			75%	25%					
			1.2							
	0.1			75%		25%				
	0.2			40%		60%				
	0.1			0%		100%				
	0.1			40%		60%				
	0.7			0%		100%				
		1.7		100%						
			1.1							
12	6.1	1.7	4.2	64%	2%	19%	11%	0%	5%	0%

Table 1. Composition of Fill at SWMU 14
Bailly Generating Station
Chesterton, IN

Boring	Fill (feet)	Native (feet)	No Recovery (feet)	Log Percentages						
				sand (includes silt)	slag (includes brick)	coal	gravel	peat	Coarse CCR	Fine CCR
SB-49	0.2			100%						
	0.8			80%	5%				15%	
	0.1			70%	5%				25%	
	0.9			80%	5%				15%	
			2							
	0.8			90%	5%				5%	
	0.2			0%	100%					
	0.1			0%	95%					5%
	0.2			0%	100%					
	1.7			95%		5%				
			1							
	1.2			95%		5%				
	0.1			60%	40%					
	0.2			95%	5%					
	0.2			15%		85%				
	0.3			95%		5%				
		0.7		100%						
			1.3							
12	7	0.7	4.3	81%	10%	5%	0%	0%	5%	0%
SB-50	2.2			80%	5%				15%	
			1.8							
	2.3			90%	5%				5%	
	0.4			100%						
			1.3							
	1.1			100%						
	1.2			5%		95%				
		0.7		100%						
			1							
		2.7		100%						
			1.3							
16	7.2	3.4	5.4	75%	3%	16%	0%	0%	6%	0%
SB-51	1.8			75%					25%	
	0.2			0%	100%					
	0.1			75%					25%	
	0.3			25%	45%					30%
			1.6							
	1.3			25%	45%		15%			15%
	1.7			90%	5%				5%	
			1							
	1.7			95%					5%	
	0.2			60%		40%				
	0.2			0%		100%				
	0.2			100%						
	0.2			60%		40%				
		0.4		100%						
			1.1							
		3		100%						
			1							
16	7.9	3.4	4.7	68%	13%	5%	2%	0%	8%	4%
SB-52	1.7			80%	5%				15%	
			2.3							
	0.2			85%					15%	
	0.7			65%	5%				15%	15%
	0.3			15%	85%					
	1.5			85%	15%					
			1.3							
	2.4			95%	5%					
	0.3			75%	25%					
	0.2			0%	75%	25%				
		0.1		100%						
			1							
		2.8		100%						
			1.2							
16	7.3	2.9	5.8	80%	13%	1%	0%	0%	5%	1%

Table 1. Composition of Fill at SWMU 14
Bailly Generating Station
Chesterton, IN

Boring	Fill (feet)	Native (feet)	No Recovery (feet)	Log Percentages						
				sand (includes silt)	slag (includes brick)	coal	gravel	peat	Coarse CCR	Fine CCR
SB-53	2.1			80%	5%				15%	
			1.9							
	0.1			85%					15%	
	0.5			5%	15%		10%			70%
	0.8			65%	10%		10%		10%	5%
	0.8			70%	15%		15%			
			1.8							
	2.5			90%	5%		5%			
	0.3			15%		85%				
			1.2							
		2.5		100%						
			1.5							
16	7.1	2.5	6.4	73%	7%	4%	5%	0%	6%	5%
SB-54	0.2			100%						
	0.9			70%	5%				25%	
	1.6			35%	30%					35%
			1.3							
	1			35%	30%					35%
5	3.7	0	1.3	47%	22%	0%	0%	0%	6%	25%
SB-55	0.3			85%					15%	
	0.2			75%					25%	
	0.9			35%	30%					35%
	1			90%			5%		5%	
			1.6							
	2.8			85%	5%	5%			5%	
			1.2							
	0.1			90%		5%			5%	
	0.2			0%		100%				
		2.4		100%						
			1.3							
		3.5		100%						
			0.5							
16	5.5	5.9	4.6	74%	7%	6%	1%	0%	5%	6%
SB-56	0.4			85%					15%	
	0.7			38%	25%					37%
	1.3			85%	5%	5%			5%	
			1.6							
	2.3			85%	5%	5%			5%	
			1.7							
	0.1			85%	5%	5%			5%	
	0.7			15%		85%				
	0.3			95%		5%				
		1.6		100%						
			1.3							
		0.6		100%						
		0.7		0%				100%		
		0.9		100%						
			1.8							
		4		100%						
20	5.8	7.8	6.4	71%	6%	14%	0%	0%	4%	4%
SB-57	0.3			75%					25%	
	0.1			0%					100%	
	1.7			95%		5%				
			1.9							
	1.8			90%		5%			5%	
		0.1		100%						
			2.1							
		2.9		100%						
			1.1							
		2.4		100%						
			1.6							
16	3.9	5.4	6.7	89%	0%	4%	0%	0%	7%	0%

Table 1. Composition of Fill at SWMU 14
Bailly Generating Station
Chesterton, IN

Boring	Fill (feet)	Native (feet)	No Recovery (feet)	Log Percentages						
				sand (includes silt)	slag (includes brick)	coal	gravel	peat	Coarse CCR	Fine CCR
SB-58	0.2			100%						
	0.6			75%	13%		12%			
	1.7			85%					15%	
	0.2			60%					40%	
			1.3							
	2.6			90%	5%				5%	
	0.1			95%						5%
	0.1			80%	15%	5%				
			1.2							
	0.7			95%		5%				
		1.7		100%						
			1.6							
12	6.2	1.7	4.1	87%	4%	1%	1%	0%	8%	0%
SB-59	0.2			100%						
	0.8			75%	12%		13%			
	0.6			85%					15%	
	0.2			55%	5%				40%	
			2.2							
	0.9			55%	5%				40%	
	1.4			85%					15%	
	0.7			85%	5%	5%			5%	
			1							
	0.2			85%	5%	5%			5%	
	0.4			100%						
	0.3			0%		100%				
		1.9		100%						
			1.2							
		3.2		100%						
			0.8							
16	5.7	5.1	5.2	75%	3%	6%	2%	0%	14%	0%
SB-60	0.2			100%						
	0.3			85%					15%	
	1.8			50%	10%				40%	
	0.1			0%		50%				50%
	0.1			50%	10%				40%	
			1.5							
	1.9			90%	5%				5%	
	0.1			75%	5%	15%			5%	
	0.1			0%		100%				
			1.9							
	0.3			0%		100%				
		2.5		100%						
			1.2							
12	4.9	2.5	4.6	65%	6%	9%	0%	0%	18%	1%
SB-61	0.2			100%						
	1			25%	38%		37%			
	0.5			75%					25%	
	0.1			0%	100%					
	1			55%	5%				40%	
	0.1			85%					15%	
			1.1							
	0.9			90%	5%				5%	
	1.4			85%	5%	5%				5%
	0.4			95%		5%				
	0.1			0%		100%				
	0.1			100%						
	0.2			25%		75%				
			0.9							
	0.2			0%		100%				
		2.3		100%						
			1.5							
12	6.2	2.3	3.5	64%	10%	9%	6%	0%	9%	1%

Table 1. Composition of Fill at SWMU 14
Bailly Generating Station
Chesterton, IN

Boring	Fill (feet)	Native (feet)	No Recovery (feet)	Log Percentages						
				sand (includes silt)	slag (includes brick)	coal	gravel	peat	Coarse CCR	Fine CCR
SB-62	0.4			85%	15%					
	1.4			70%	5%				25%	
			2.2							
	1.3			90%		5%			5%	
	0.7			95%		5%				
	0.5			95%						5%
			1.5							
	0.6			75%	25%					
	0.2			40%	60%					
	0.6			0%		100%				
		1.3		100%						
			1.3							
		3.3		100%						
			0.7							
16	5.7	4.6	5.7	73%	7%	12%	0%	0%	7%	0%
SB-63	0.3			60%					40%	
	0.7			80%	5%				15%	
			3							
	0.1			0%	100%					
	0.2			60%					40%	
	1.3			90%	5%				5%	
	1.1			95%		5%				
			1.3							
	0.2			95%		5%				
	0.1			0%						100%
	0.3			95%		5%				
	0.1			0%						100%
	0.2			95%		5%				
	0.6			70%	25%	5%				
	0.4			75%		25%				
	0.7			15%		85%				
	0.7			90%	5%	5%				
			0.7							
		2.6		100%						
			1.4							
16	7	2.6	6.4	74%	6%	12%	0%	0%	5%	3%
SB-64	0.3			85%					15%	
	2			60%					40%	
			1.7							
	2.6			90%	5%				5%	
			1.4							
	0.6			90%	5%				5%	
	0.7			95%		5%				
	0.1			25%		75%				
	0.1			100%						
	0.1			0%		100%				
	0.2			38%	37%	25%				
	0.3			25%		75%				
		0.8		100%						
			1.1							
		3.1		100%						
			0.9							
16	7	3.9	5.1	75%	3%	7%	0%	0%	14%	0%
SB-65	1.1			85%					15%	
	0.2			0%	100%					
	0.7			80%	5%				15%	
			2							
	0.7			85%					15%	
	1.9			90%	5%				5%	
			1.4							
	1.1			90%	5%				5%	
	0.4			15%		85%				
	0.1			25%		75%				
	0.2			15%		85%				
	0.3			25%		75%				
		0.8		100%						
			1.1							
		3		100%						
			1							
16	6.7	3.8	5.5	74%	6%	12%	0%	0%	8%	0%

Table 1. Composition of Fill at SWMU 14
Bailly Generating Station
Chesterton, IN

Boring	Fill (feet)	Native (feet)	No Recovery (feet)	Log Percentages						
				sand (includes silt)	slag (includes brick)	coal	gravel	peat	Coarse CCR	Fine CCR
SB-66	2.2			80%	5%				15%	
			1.8							
	0.8			70%	15%				15%	
	1.7			95%	5%					
			1.5							
	1.9			90%	5%	5%				
	0.1			0%		100%				
	0.1			100%						
	0.3			50%		50%				
		0.3		100%						
			1.3							
		3.1		100%						
			0.9							
16	7.1	3.4	5.5	83%	6%	5%	0%	0%	6%	0%
SB-67	2			80%	5%				15%	
			2							
	1.2			75%					25%	
	1.2			80%	15%				5%	
	0.4			90%			5%		5%	
			1.2							
	2.4			90%			5%		5%	
	0.2			75%		25%				
	0.1			0%		100%				
	0.1			100%						
			1.2							
	0.1			100%						
	0.3			15%	15%	70%				
		2.5		100%						
			1.1							
16	8	2.5	5.5	80%	4%	5%	2%	0%	10%	0%
SB-68	1.6			70%	5%				25%	
	1			37%	25%					38%
			1.4							
	1.3			37%	25%					38%
	1.7			35%	30%					35%
	0.8			95%		5%				
			0.2							
	2.6			90%		5%	5%			
	0.2			15%		85%				
			1.2							
	0.3			15%		85%				
		2.5		100%						
			1.2							
		4		100%						
20	9.5	6.5	4	60%	12%	6%	1%	0%	4%	15%
SB-69	1.1			70%	5%				25%	
	0.5			38%	25%					37%
	1.1			90%	5%				5%	
			1.3							
	2.5			85%	5%		5%		5%	
			1.5							
	0.6			85%	5%		5%		5%	
	0.4			15%		85%				
	0.3			95%		5%				
		1.4		100%						
			1.3							
		3.4		100%						
			0.6							
		3.5		100%						
			0.5							
20	6.5	8.3	5.2	76%	6%	5%	2%	0%	7%	3%

Table 1. Composition of Fill at SWMU 14
Bailly Generating Station
Chesterton, IN

Boring	Fill (feet)	Native (feet)	No Recovery (feet)	Log Percentages						
				sand (includes silt)	slag (includes brick)	coal	gravel	peat	Coarse CCR	Fine CCR
SB-70	0.4			70%	15%				15%	
	1.6			90%			5%		5%	
			2							
	0.5			90%			5%		5%	
	0.3			65%		25%	5%		5%	
	0.2			90%			5%		5%	
	0.2			65%		25%	5%		5%	
		0.6		100%						
			2.2							
		2		100%						
			2							
		1.8		100%						
		0.2		0%				100%		
		0.4		100%						
			1.6							
16	3.2	5	7.8	84%	2%	4%	4%	0%	6%	0%
SB-71	0.3			100%						
	0.7			55%	5%				40%	
	0.5			100%						
	0.1			0%	100%					
	0.5			100%						
	0.1			0%						100%
	0.3			100%						
			1.5							
	2.1			100%						
	0.6			75%		25%				
			1.3							
	0.7			70%	5%	25%				
		2.3		100%						
			1							
12	5.9	2.3	3.8	85%	3%	6%	0%	0%	5%	2%
SB-72	0.3			85%					15%	
	0.3			85%					15%	
	0.1			0%	100%					
	0.3			85%					15%	
	0.1			85%	8%		7%			
	1.3			60%					40%	
	0.2			75%			25%			
	0.1			60%					40%	
			1.3							
	0.1			60%					40%	
	2.7			90%	5%				5%	
			1.2							
	0.9			90%	5%				5%	
	0.2			0%	15%	85%				
		1.9		100%						
			1							
12	6.6	1.9	3.5	78%	5%	3%	1%	0%	14%	0%
SB-73	0.5			95%	5%					
	0.4			70%	15%		15%			
	1.2			60%					40%	
			1.9							
	0.8			60%					40%	
	2			90%	5%				5%	
			1.2							
	0.7			90%	5%				5%	
	0.1			80%	5%				15%	
	0.3			70%	25%				5%	
	0.1			0%		100%				
		1.6		100%						
			1.2							
		2.7		100%						
			1.3							
16	6.1	4.3	5.6	77%	5%	2%	1%	0%	16%	0%

Table 1. Composition of Fill at SWMU 14
Bailly Generating Station
Chesterton, IN

Boring	Fill (feet)	Native (feet)	No Recovery (feet)	Log Percentages						
				sand (includes silt)	slag (includes brick)	coal	gravel	peat	Coarse CCR	Fine CCR
SB-74	0.3			100%						
	0.9			55%	5%				40%	
			2.8							
	0.7			55%	5%				40%	
	0.7			90%	5%				5%	
	0.4			85%	5%				5%	5%
	0.9			100%						
	0.2			40%	30%	30%				
			1.1							
	0.2			40%	30%	30%				
	0.4			95%	5%					
	0.4			0%		100%				
		1.7		100%						
			1.3							
12	5.1	1.7	5.2	70%	5%	10%	0%	0%	14%	0%
SB-75	0.2			100%						
	1			55%	5%				40%	
	0.3			45%	15%				40%	
	0.7			45%	5%				50%	
	0.1			30%	5%	25%			40%	
	0.4			95%					5%	
			1.3							
	0.4			95%					5%	
	0.1			70%		25%			5%	
	0.4			95%					5%	
	1.2			90%	5%				5%	
	0.2			50%	5%	40%			5%	
	0.3			75%	25%					
	0.2			0%	5%	95%				
	0.1			75%	25%					
	0.1			0%		100%				
			1							
	0.1			60%		40%				
	0.7			95%		5%				
		2.6		100%						
			0.6							
12	6.5	2.6	2.9	71%	5%	8%	0%	0%	16%	0%
SB-76	2.5			55%	5%				40%	
			1.5							
	1.6			85%	5%	5%			5%	
	0.5			80%		15%				5%
	0.4			95%						5%
			1.5							
	0.4			85%	15%					
	0.3			60%	20%	20%				
	0.1			0%		100%				
	0.1			100%						
	0.2			0%		100%				
	0.2			100%						
	0.4			0%		100%				
		1.5		100%						
			0.8							
12	6.7	1.5	3.8	65%	5%	14%	0%	0%	16%	1%

Table 1. Composition of Fill at SWMU 14
Bailly Generating Station
Chesterton, IN

Boring	Fill (feet)	Native (feet)	No Recovery (feet)	Log Percentages						
				sand (includes silt)	slag (includes brick)	coal	gravel	peat	Coarse CCR	Fine CCR
SB-77	0.3			100%						
	0.8			45%	15%				40%	
	0.6			25%					75%	
	0.7			50%					50%	
			1.6							
	0.7			50%					50%	
	1.8			90%	5%				5%	
	0.2			90%	5%					5%
			1.3							
	0.4			90%	5%	5%				
	0.2			60%		40%				
	0.7			15%		85%				
	0.2			60%	40%					
	0.1			0%		100%				
	0.3			95%		5%				
	0.1			50%	50%					
			0							
	0.3			50%	50%					
	1.3			85%	15%					
		0.4		100%						
			0							
		4		100%						
			0							
16	8.7	4.4	2.9	64%	8%	9%	0%	0%	18%	0%
SB-78	0.3			100%						
	0.2			70%	25%				5%	
	0.1			0%	100%					
	1.8			70%	25%				5%	
			1.6							
	0.5			70%	25%				5%	
	2.1			90%	5%				5%	
			1.4							
	0.6			90%	5%				5%	
	0.2			95%		5%				
	0.1			85%		15%				
	0.6			95%		5%				
	0.5			0%		100%				
	0.1			100%						
	0.2			5%		95%				
		0.7		100%						
			1							
		3		100%						
			1							
16	7.3	3.7	5	74%	12%	10%	0%	0%	4%	0%
SB-79	0.5			95%	5%					
	1.5			70%	5%				25%	
			2							
	2.4			90%	5%				5%	
			1.6							
	1.6			90%	5%				5%	
	0.3			95%		5%				
	0.5			5%		95%				
		0.1		100%						
			1.5							
		2.6		100%						
			1.4							
16	6.8	2.7	6.5	80%	4%	7%	0%	0%	8%	0%

Table 1. Composition of Fill at SWMU 14
Bailly Generating Station
Chesterton, IN

Boring	Fill (feet)	Native (feet)	No Recovery (feet)	Log Percentages						
				sand (includes silt)	slag (includes brick)	coal	gravel	peat	Coarse CCR	Fine CCR
SB-80	0.3			85%					15%	
	1.7			85%	5%				5%	5%
			2							
	1.2			85%	5%				5%	5%
	1.1			95%					5%	
			1.7							
	1.9			85%	5%	5%			5%	
	0.1			65%	5%	25%			5%	
	0.1			85%	5%	5%			5%	
	0.1			65%	5%	25%			5%	
	0.3			37%	25%	38%				
	0.2			0%		100%				
	0.1			85%		15%				
		0.1		100%						
			1.1							
		2.8		100%						
			1.2							
16	7.1	2.9	6	82%	5%	7%	0%	0%	5%	2%
SB-81	1.1			80%	5%				15%	
	0.6			45%	30%				25%	
	0.3			65%	15%				15%	5%
			2							
	0.4			50%	25%				25%	
	1			55%	5%				40%	
	0.8			70%	15%				15%	
	0.7			85%	5%		5%		5%	
			1.1							
	2.3			100%						
	0.3			50%	25%	25%				
	0.2			15%		85%				
			1.2							
		2.8		100%						
			1.2							
16	7.7	2.8	5.5	74%	9%	3%	0%	0%	13%	0%
SB-82	0.4			85%					15%	
	1.7			70%	15%				15%	
			1.9							
	1			38%	25%					37%
5	3.1	0	1.9	62%	16%	0%	0%	0%	10%	12%
SB-83	1.4			70%	5%				25%	
	1.2			38%	25%					37%
	0.5			95%					5%	
			0.9							
	2.7			85%		5%	5%		5%	
			1.3							
	0.8			85%		5%	5%		5%	
	0.4			51%	7%	34%			8%	
	0.2			15%		85%				
		1.2		100%						
			1.4							
		3.5		100%						
			0.5							
16	7.2	4.7	4.1	71%	6%	7%	2%	0%	8%	6%
SB-84	0.6			85%					15%	
	1.5			75%	5%		5%		15%	
			1.9							
	0.4			75%	5%		5%		15%	
	1.1			90%		5%			5%	
	0.4			85%		15%				
	0.1			25%		70%	5%			
		0.3		100%						
			1.7							
		2.4		100%						
			1.6							
12	4.1	2.7	5.2	80%	2%	5%	2%	0%	10%	0%

Table 1. Composition of Fill at SWMU 14
Bailly Generating Station
Chesterton, IN

Boring	Fill (feet)	Native (feet)	No Recovery (feet)	Log Percentages						
				sand (includes silt)	slag (includes brick)	coal	gravel	peat	Coarse CCR	Fine CCR
SB-85	0.5			95%	5%					
	2			95%					5%	
			1.5							
	1.5			95%					5%	
	0.2			55%		40%			5%	
	0.2			90%	5%				5%	
	1.1			90%	5%	5%				
			1							
	2.9			85%		15%				
			1.1							
	1.5			80%	5%	15%				
		1.3		100%						
			1.2							
		3.8		100%						
			0.2							
20	9.9	5.1	5	88%	2%	8%	0%	0%	2%	0%
SB-86	0.6			75%	25%					
	1.1			54%	10%				36%	
	0.9			85%					15%	
			1.4							
	2.1			90%	5%	5%				
			1.9							
	0.7			95%					5%	
	0.2			0%		100%				
	0.1			25%		75%				
		1.9		100%						
			1.1							
		2		100%						
			2							
16	5.7	3.9	6.4	77%	6%	7%	0%	0%	10%	0%
SB-87	0.3			100%						
	0.2			75%	25%					
	0.4			55%	5%				40%	
	0.1			0%	100%					
	0.9			55%	5%				40%	
	0.2			0%	100%					
	0.6			55%	5%				40%	
			1.3							
	0.2			55%	5%				40%	
	1.8			95%					5%	
	0.7			90%	5%	5%				
			1.3							
	0.5			95%	5%					
	0.6			40%		60%				
		1.8		100%						
			1.1							
		1.9		100%						
			2.1							
16	6.5	3.7	5.8	72%	8%	6%	0%	0%	14%	0%
SB-88	0.3			100%						
	1.5			55%	5%				40%	
			2.2							
	0.1			55%	5%				40%	
	1.7			80%	5%				15%	
	0.7			90%	5%				5%	
			1.5							
	0.4			90%	5%				5%	
	0.3			55%	5%	40%				
	0.2			95%		5%				
	0.2			0%		100%				
		1.9		100%						
			1							
		3.4		100%						
			0.6							
16	5.4	5.3	5.3	72%	4%	6%	0%	0%	18%	0%

Table 1. Composition of Fill at SWMU 14
Bailly Generating Station
Chesterton, IN

Boring	Fill (feet)	Native (feet)	No Recovery (feet)	Log Percentages						
				sand (includes silt)	slag (includes brick)	coal	gravel	peat	Coarse CCR	Fine CCR
SB-89	1.9			55%	5%				40%	
	0.6			85%					15%	
			1.5							
	0.7			25%	25%		25%		25%	
	0.2			95%					5%	
	0.1			0%						100%
	0.3			95%					5%	
	0.1			80%					5%	15%
	0.5			95%					5%	
	0.2			40%	60%					
	0.3			78%	5%	17%				
	0.8			15%		85%				
			0.8							
	0.2			0%		100%				
	0.3			25%		75%				
		2.1		100%						
			1.4							
		3.1		100%						
			0.9							
16	6.2	5.2	4.6	53%	7%	19%	3%	0%	17%	2%
SB-90	0.3			60%					40%	
	0.2			0%	100%					
	0.2			85%					15%	
	0.1			0%	100%					
	0.5			85%					15%	
	0.1			0%	100%					
	0.1			85%					15%	
			2.5							
	1.1			90%	5%				5%	
	0.6			70%	25%	5%				
	0.3			100%						
	0.5			50%		50%				
	0.4			90%	5%	5%				
			1.1							
	0.9			90%	5%	5%				
		1.5		100%						
			1.6							
12	5.3	1.5	5.2	75%	13%	7%	0%	0%	6%	0%
SB-91	0.9			50%	5%				45%	
	0.8			95%					5%	
	0.5			50%					50%	
	0.3			15%	70%				15%	
			1.5							
	0.3			90%	5%				5%	
	0.1			80%	15%				5%	
	2.3			90%	5%					5%
	0.1			0%	100%					
			1.2							
	0.2			75%	25%					
	0.5			95%	5%					
	0.2			50%		50%				
	0.2			95%		5%				
	1.1			90%	5%	5%				
		1.6		100%						
			0.2							
12	7.5	1.6	2.9	78%	8%	2%	0%	0%	10%	2%

Table 1. Composition of Fill at SWMU 14
Bailly Generating Station
Chesterton, IN

Boring	Fill (feet)	Native (feet)	No Recovery (feet)	Log Percentages						
				sand (includes silt)	slag (includes brick)	coal	gravel	peat	Coarse CCR	Fine CCR
SB-92	1.4			60%					40%	
	0.2			85%					15%	
	0.8			80%	5%				15%	
			1.6							
	0.6			90%	5%				5%	
	1.3			85%		5%	5%		5%	
	0.9			95%		5%				
			1.2							
	0.6			95%		5%				
	1			70%	15%				15%	
	0.1			60%	25%	15%				
	0.6			70%	15%				15%	
			1.7							
12	7.5	0	4.5	79%	4%	2%	1%	0%	14%	0%
SB-93	1			60%	15%				25%	
	1.3			70%	5%				25%	
			1.7							
	0.3			80%	5%				15%	
	2.5			90%		5%			5%	
			1.2							
	0.5			90%		5%			5%	
	0.2			80%		15%			5%	
	0.1			55%	15%	25%			5%	
	0.9			60%	25%	15%				
	0.2			0%		100%				
		0.6		100%						
			1.5							
		3.3		100%						
			0.7							
16	7	3.9	5.1	74%	7%	8%	0%	0%	11%	0%
SB-94	0.9			70%	5%				25%	
	0.2			60%	15%				25%	
	1.3			90%	5%				5%	
	0.5			0%						100%
			1.1							
	2.7			85%	5%	5%			5%	
			1.3							
	0.4			85%	5%	5%			5%	
	0.2			25%		75%				
		2.2		100%						
			1.2							
		3.8		100%						
			0.2							
16	6.2	6	3.8	74%	5%	5%	0%	0%	8%	8%
SB-95	0.4			85%					15%	
	1.9			45%	15%		5%		35%	
			1.7							
	1			20%	55%				20%	5%
5	3.3	0	1.7	42%	25%	0%	3%	0%	28%	2%
SB-96	0.4			100%						
	1.2			70%	15%				15%	
	0.1			55%	25%				15%	5%
	0.1			0%	100%					
	0.3			55%	25%				15%	5%
	0.1			0%	100%					
	0.3			55%	25%				15%	5%
	0.3			90%	5%				5%	
			1.2							
	2.7			85%	5%	5%			5%	
			1.3							
	1.2			85%	5%	5%			5%	
	0.2			60%		40%				
	0.3			15%		85%				
		1.1		100%						
			1.2							
		3.5		100%						
			0.5							
16	7.2	4.6	4.2	75%	11%	7%	0%	0%	7%	0%

Table 1. Composition of Fill at SWMU 14
Bailly Generating Station
Chesterton, IN

Boring	Fill (feet)	Native (feet)	No Recovery (feet)	Log Percentages						
				sand (includes silt)	slag (includes brick)	coal	gravel	peat	Coarse CCR	Fine CCR
SB-97	1.8			90%			5%		5%	
			2.2							
	1.9			90%	5%				5%	
			2.1							
	0.5			90%	5%				5%	
		1.7		100%						
			1.8							
12	4.2	1.7	6.1	90%	3%	0%	2%	0%	5%	0%
SB-98	0.1			100%						
	1.8			55%	5%				40%	
			2.1							
	0.6			95%					5%	
	0.7			60%						40%
	0.9			75%						25%
		0.3		100%						
			1.5							
		2.9		100%						
			1.1							
12	4.1	3.2	4.7	67%	2%	0%	0%	0%	18%	12%
SB-99	1.4			55%	5%				40%	
	0.3			95%	5%					
			2.3							
	0.2			95%	5%					
	0.6			85%	5%	5%				5%
	1.1			95%		5%				
			2.1							
		2.2		100%						
			1.8							
12	3.6	2.2	6.2	78%	3%	2%	0%	0%	16%	1%
SB-100	0.3			100%						
	0.3			0%	100%					
	0.5			55%	5%				40%	
	0.1			0%	100%					
	0.6			55%	5%				40%	
	0.6			90%	5%				5%	
	0.2			60%		40%				
		0.2		100%						
			1.2							
	1.3			100%						
		1.9		100%						
			0.8							
		2.8		100%						
			1.2							
12	3.9	4.9	3.2	73%	12%	2%	0%	0%	12%	0%
SB-101	0.3			100%						
	0.9			75%	12%				13%	
	1.2			90%		5%			5%	
			1.6							
	2.4			95%		5%				
			1.6							
		2.4		100%						
			1.6							
12	4.8	2.4	4.8	90%	2%	4%	0%	0%	4%	0%
SB-102	0.2			100%						
	0.5			95%					5%	
	1.2			45%	5%				50%	
	0.3			95%	5%					
			1.8							
		2.6		100%						
			1.4							
		2.1		100%						
			1.9							
12	2.2	4.7	5.1	68%	3%	0%	0%	0%	28%	0%

Table 1. Composition of Fill at SWMU 14
Bailly Generating Station
Chesterton, IN

Boring	Fill (feet)	Native (feet)	No Recovery (feet)	Log Percentages						
				sand (includes silt)	slag (includes brick)	coal	gravel	peat	Coarse CCR	Fine CCR
SB-103	0.5			85%					15%	
	1.3			50%					50%	
	0.4			95%					5%	
		0.2		100%						
			1.6							
		2.9		100%						
			1.1							
8	2.2	3.1	2.7	66%	0%	0%	0%	0%	34%	0%
SB-104	0.4			75%					25%	
	1			50%					50%	
	0.8			95%					5%	
		0.7		100%						
			1.1							
		2.5		100%						
			1.5							
8	2.2	3.2	2.6	71%	0%	0%	0%	0%	29%	0%
SB-105	0.4			75%	25%					
	1.2			95%	5%					
		0.4		100%						
			2							
		2.7		100%						
			1.3							
8	1.6	3.1	3.3	90%	10%	0%	0%	0%	0%	0%
SB-106	0.2			100%						
	0.2			75%	12%		13%			
	0.6			90%	5%				5%	
	0.4			45%	25%				30%	
	0.2			40%	30%				30%	
	0.2			45%	25%				30%	
	0.7			90%	5%				5%	
			1.5							
	0.3			90%	5%				5%	
	0.4			60%	20%					20%
	0.7			90%	5%				5%	
		1.3		100%						
			1.3							
		2.8		100%						
			1.2							
12	3.9	4.1	4	77%	11%	0%	1%	0%	9%	2%
SB-107	2.2			85%	5%	5%			5%	
			1.8							
		2.4		100%						
			1.6							
8	2.2	2.4	3.4	85%	5%	5%	0%	0%	5%	0%
SB-108	1.1			70%	5%				25%	
		1		100%						
			1.9							
		2.3		100%						
			1.7							
		2.7		100%						
			1.3							
12	1.1	6	4.9	70%	5%	0%	0%	0%	25%	0%
SB-109	0.4			100%						
	0.9			90%	5%		5%			
	1			95%		5%				
			1.7							
		2.8		100%						
			1.2							
		2.6		100%						
			1.4							
12	2.3	5.4	4.3	94%	2%	2%	2%	0%	0%	0%
SB-110	0.4			70%	15%		15%			
	0.7			85%	5%	5%			5%	
		0.9		100%						
			2							
		2.6		100%						
			1.4							
8	1.1	3.5	3.4	80%	9%	3%	5%	0%	3%	0%

Table 1. Composition of Fill at SWMU 14
Bailly Generating Station
Chesterton, IN

Boring	Fill (feet)	Native (feet)	No Recovery (feet)	Log Percentages						
				sand (includes silt)	slag (includes brick)	coal	gravel	peat	Coarse CCR	Fine CCR
SB-111	0.4			85%					15%	
		2.5		100%						
			1.1							
		2.5		100%						
			1.5							
8	0.4	5	2.6	85%	0%	0%	0%	0%	15%	0%
SB-112	0.5			90%	5%				5%	
	0.6			90%	5%		5%			
		1.4		100%						
			1.5							
		2.7		100%						
			1.3							
8	1.1	4.1	2.8	90%	5%	0%	3%	0%	2%	0%
SB-113	0.5			90%	5%				5%	
	0.9			95%					5%	
	0.7			95%		5%				
			1.9							
		2		100%						
			2							
8	2.1	2	3.9	94%	1%	2%	0%	0%	3%	0%
SB-114	0.5			100%						
	0.1			85%	15%					
	0.8			95%					5%	
		1.2		100%						
			1.4							
		2.6		100%						
			1.4							
8	1.4	3.8	2.8	96%	1%	0%	0%	0%	3%	0%
SB-115	0.2			100%						
	0.1			0%	100%					
		0.2		100%						
			3.5							
		2.6		100%						
			1.4							
8	0.3	2.8	4.9	67%	33%	0%	0%	0%	0%	0%
SB-116	0.4			100%						
	0.9			90%	5%				5%	
	0.1			70%	25%	5%				
		1		100%						
			1.6							
		2.2		100%						
			1.8							
8	1.4	3.2	3.4	91%	5%	0%	0%	0%	3%	0%
SB-117	1.4			90%	5%	5%				
		0.8		100%						
			1.8							
		2.4		100%						
			1.6							
8	1.4	3.2	3.4	90%	5%	5%	0%	0%	0%	0%
SB-118	0.2			95%					5%	
	0.7			75%	12%				13%	
	0.9			38%	37%					25%
			0.2							
2	1.8	0	0.2	59%	23%	0%	0%	0%	6%	13%
SB-119	0.4			15%			70%		15%	
	0.6			5%	45%		45%		5%	
	1.4			30%	25%		15%		15%	15%
			0							
2.4	2.4	0	0	21%	26%	0%	32%	0%	13%	9%
SB-120	0.8			20%	30%	7%	30%		8%	5%
	0.2			75%		25%				
			3							
	1.9			90%		5%	5%			
	0.1			45%		50%	5%			
			2							
	0.1			15%		85%				
		2.2		100%						
			1.7							
12	3.1	2.2	6.7	67%	8%	11%	11%	0%	2%	1%

Table 1. Composition of Fill at SWMU 14
Bailly Generating Station
Chesterton, IN

Boring	Fill (feet)	Native (feet)	No Recovery (feet)	Log Percentages						
				sand (includes silt)	slag (includes brick)	coal	gravel	peat	Coarse CCR	Fine CCR
SB-121	1.2			60%					40%	
	0.8			90%	5%				5%	
	0.2			45%	25%				30%	
			1.8							
	0.5			80%	5%				15%	
	0.3			55%	5%				40%	
	1.2			80%	5%				15%	
	0.1			0%	85%	15%				
			1.9							
	0.6			60%		20%			20%	
	0.2			15%		85%				
	0.2			95%		5%				
		1.4		100%						
			1.6							
		1.5		100%						
			2.5							
		2.2		100%						
			1.8							
20	5.3	5.1	9.6	69%	5%	6%	0%	0%	20%	0%
SB-122	0.9			50%	5%	5%			40%	
	0.1			0%						100%
	0.1			0%	100%					
	1.5			60%					40%	
			1.4							
	0.4			60%		20%			20%	
	0.6			15%		85%				
	0.1			85%		15%				
	0.9			15%		85%				
	0.9			95%		5%				
		0.6		100%						
			0.5							
		2.7		100%						
			1.3							
		2.7		100%						
			1.3							
16	5.5	6	4.5	50%	3%	27%	0%	0%	19%	2%
SB-123	0.4			50%	25%				25%	
	0.6			25%	37%		38%			
	0.4			60%		20%			20%	
	1.7			15%	5%	80%				
			0.9							
	0.7			15%	5%	80%				
	0.5			95%		5%				
		1.7		100%						
			1.1							
		2.5		100%						
			1.5							
12	4.3	4.2	3.5	33%	10%	47%	5%	0%	4%	0%
SB-124	0.3			60%	20%		20%			
	0.7			15%	42%		43%			
	1.1			95%		5%				
	0.9			15%		85%				
			1							
	1.8			15%		85%				
	0.3			95%		5%				
		0.7		100%						
			1.2							
		2.5		100%						
			1.5							
12	5.1	3.2	3.7	40%	7%	46%	7%	0%	0%	0%

Table 1. Composition of Fill at SWMU 14
Bailly Generating Station
Chesterton, IN

Boring	Fill (feet)	Native (feet)	No Recovery (feet)	Log Percentages						
				sand (includes silt)	slag (includes brick)	coal	gravel	peat	Coarse CCR	Fine CCR
SB-125	0.4			50%	25%				25%	
	0.5			55%	40%				5%	
	0.3			15%	43%		42%			
	1.7			90%		5%			5%	
			1.1							
	0.4			90%		5%			5%	
	0.5			45%	15%	20%			20%	
	0.8			65%	5%	15%			15%	
	0.2			60%		20%			20%	
	0.4			90%		5%			5%	
	0.5			42%	25%	28%				5%
			1.2							
	0.1			42%	25%	28%				5%
	0.2			15%		85%				
		2.2		100%						
			1.5							
		3.4		100%						
			0.6							
16	6	5.6	4.4	65%	12%	12%	2%	0%	9%	1%
SB-126	0.6			85%					15%	
	0.1			0%	50%		50%			
	0.1			85%					15%	
	0.5			0%	50%		50%			
	1.6			90%		5%			5%	
			1.1							
	1.6			90%		5%			5%	
	0.5			70%	15%	15%				
	0.7			60%	15%	25%				
			1.2							
	0.3			95%		5%				
	0.2			75%		25%				
	0.2			95%		5%				
	0.1			75%		25%				
	0.1			95%		5%				
	0.3			75%		25%				
		2		100%						
			0.8							
12	6.9	2	3.1	76%	7%	9%	4%	0%	4%	0%
SB-127	0.3			100%						
	0.4			75%					25%	
	0.1			25%	50%				13%	12%
	0.3			15%	43%		42%			
	1.6			85%	5%	5%			5%	
			1.3							
	1.6			85%	5%	5%			5%	
	0.3			75%	5%	15%			5%	
	0.9			85%	5%	5%			5%	
			1.2							
	0.5			60%		20%			20%	
	0.1			0%						100%
	0.1			75%		25%				
		1.6		100%						
			1.7							
		3		100%						
			1							
16	6.2	4.6	5.2	77%	6%	6%	2%	0%	7%	2%

Table 1. Composition of Fill at SWMU 14
Bailly Generating Station
Chesterton, IN

Boring	Fill (feet)	Native (feet)	No Recovery (feet)	Log Percentages						
				sand (includes silt)	slag (includes brick)	coal	gravel	peat	Coarse CCR	Fine CCR
SB-128	0.3			85%					15%	
	1			80%	5%				15%	
	0.1			0%	100%					
	0.8			85%	5%	5%			5%	
			1.8							
	0.7			85%	5%	5%			5%	
	0.1			25%	75%					
	1.4			85%	5%	5%			5%	
	0.3			75%	5%	15%			5%	
	0.1			85%	5%	5%			5%	
			1.4							
		2.8		100%						
			1.2							
12	4.8	2.8	4.4	80%	8%	4%	0%	0%	8%	0%
SB-129	0.8			85%					15%	
	1.5			85%	5%	5%			5%	
			1.7							
	2.1			70%		25%			5%	
	0.1			0%						100%
			1.8							
	0.1			0%						100%
	0.6			75%						25%
		1.6		100%						
			1.7							
		2.6		100%						
			1.4							
16	5.2	4.2	6.6	75%	1%	12%	0%	0%	6%	7%
SB-130	1.9			85%	5%	5%			5%	
			2.1							
	0.4			85%	5%	5%			5%	
	0.9			85%		15%				
	0.2			95%		5%				
			2.5							
	0.1			95%		5%				
	0.3			85%		15%				
	0.2			95%		5%				
	1			40%		60%				
	0.1			100%						
	0.3			40%		60%				
	1.2			95%		5%				
			0.8							
	0.6			100%						
	0.4			95%		5%				
		1.7		100%						
		0.1		0%				100%		
		0.3		100%						
			0.9							
		3.5		100%						
			0.5							
20	7.6	5.6	6.8	81%	2%	16%	0%	0%	2%	0%
SB-131	0.6			95%					5%	
	0.8			65%	5%	5%			25%	
	0.2			55%	5%	15%			25%	
	1.2			65%	5%	5%			25%	
			1.2							
	1			42%	5%	28%			25%	
	0.2			0%		100%				
	0.1			60%	20%	20%				
	0.2			75%		25%				
	0.2			85%		15%				
	0.1			75%		25%				
	0.3			85%		15%				
	0.5			60%		40%				
	0.3			95%		5%				
			1.1							
		3		100%						
			1							
		3.2		100%						
			0.8							
16	5.7	6.2	4.1	65%	3%	17%	0%	0%	15%	0%

Table 1. Composition of Fill at SWMU 14
Bailly Generating Station
Chesterton, IN

Boring	Fill (feet)	Native (feet)	No Recovery (feet)	Log Percentages						
				sand (includes silt)	slag (includes brick)	coal	gravel	peat	Coarse CCR	Fine CCR
SB-132	0.2			85%					15%	
	1			75%					25%	
	1.1			85%	5%	5%			5%	
			1.7							
	0.5			85%	5%	5%			5%	
	0.2			25%		75%				
	1.6			95%		5%				
			1.7							
	0.3			15%		85%				
	1.2			85%		15%				
	0.8			95%		5%				
		0.5		100%						
			1.2							
		3.4		100%						
			0.6							
16	6.9	3.9	5.2	82%	1%	11%	0%	0%	5%	0%

Total Drilled (feet)	Total Fill (feet)	Total Native (feet)	Total Unrecovered (feet)	Total Log Percentages (Fill Only)						
				sand (includes silt)	slag (includes brick)	coal	gravel	peat	c. CCR	f.CCR
1691.4	679.2	424.2	588	74.2%	6.5%	7.3%	1.6%	0.0%	8.4%	2.1%

CCR = Coal Combustion Residual

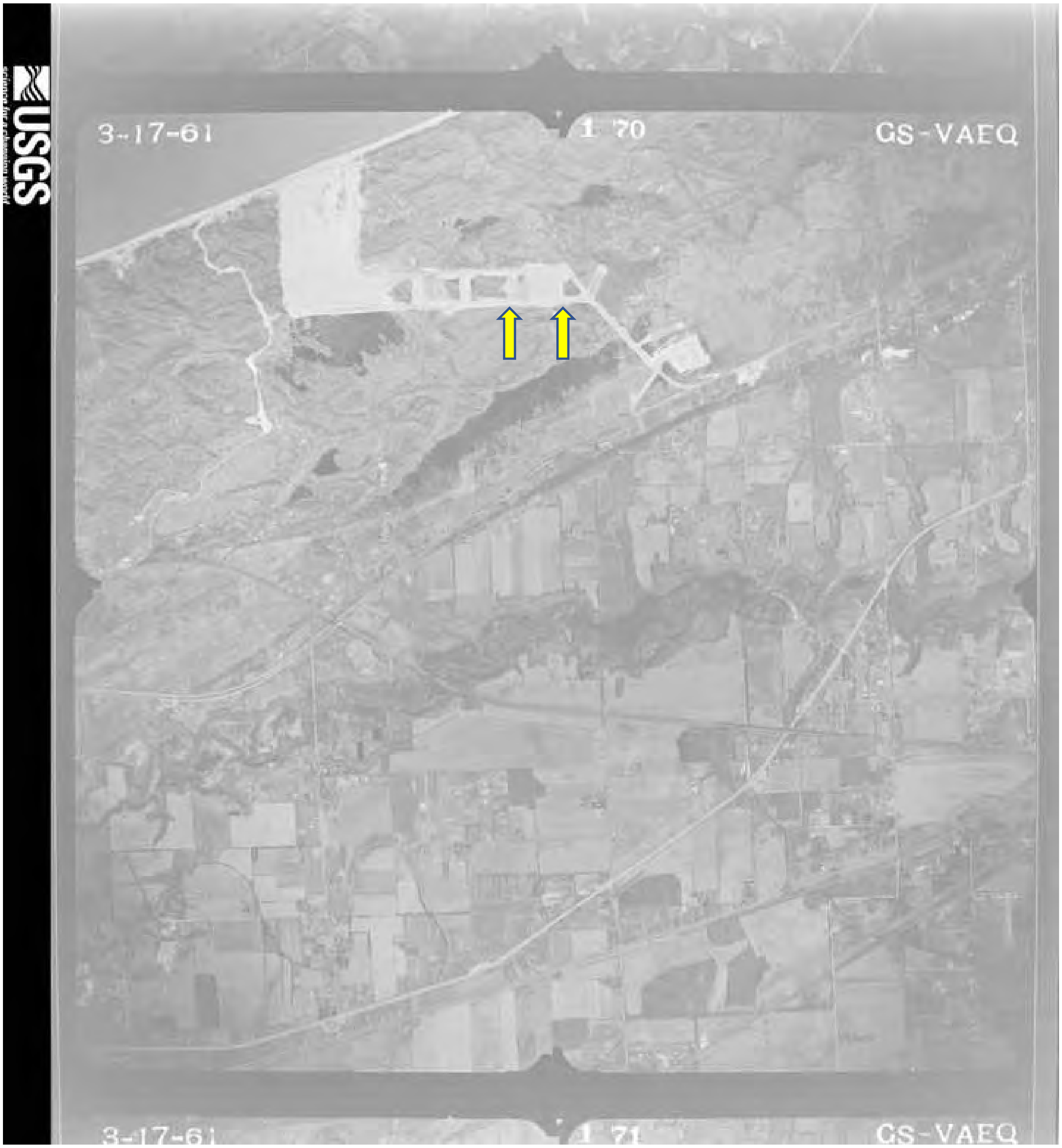
Proportional Term	Percent by Weight	Average Percent by Weight
trace =	0-10%	5%
little =	10-20%	15%
some =	20-30%	25%
with/-ly =	30-50%	40%
and =	50%	50%
pure =	100%	100%

Prepared by: LSC 04/14/2021
Reviewed by: RAJ 04/21/2021

wood.

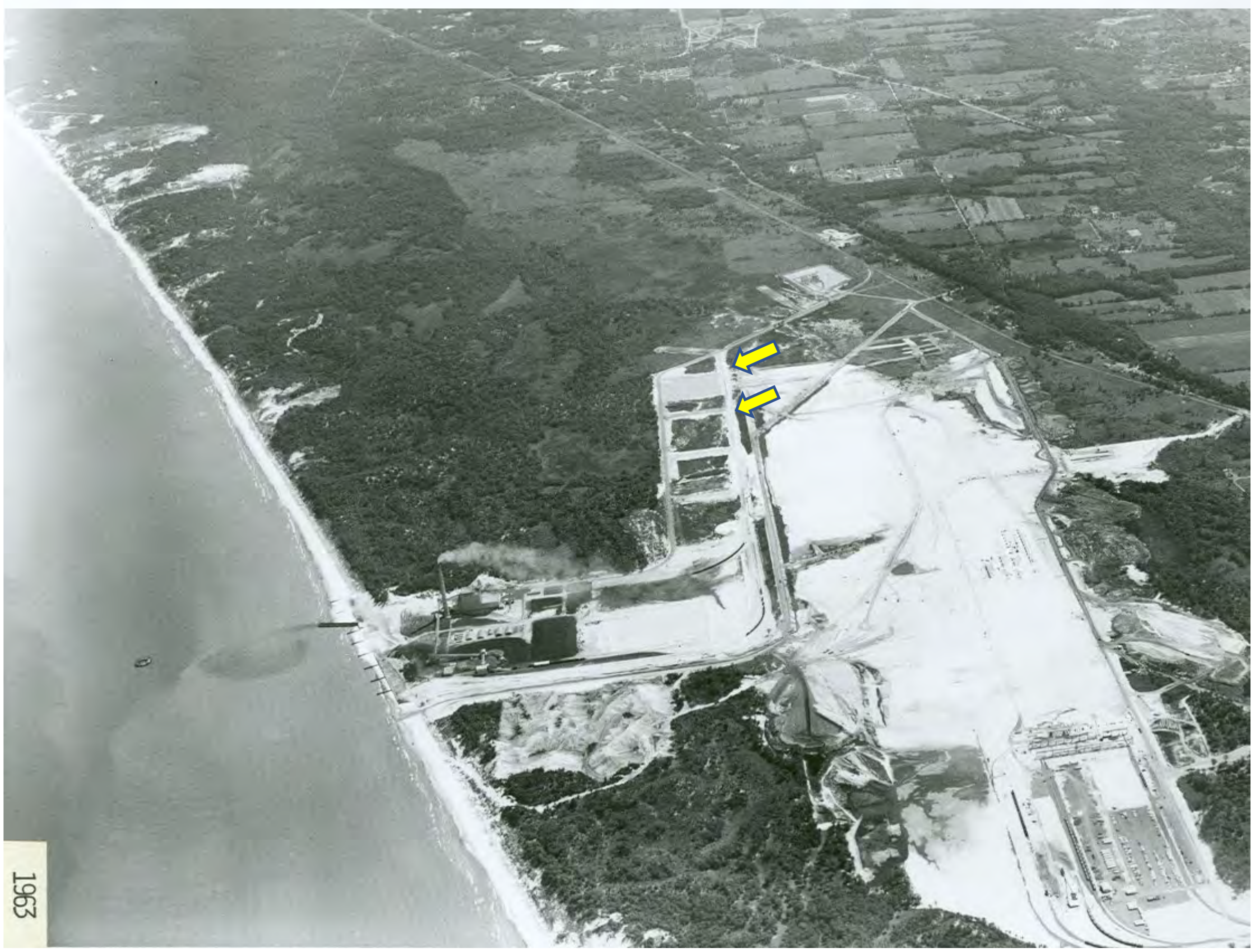
Attachment A

Historical Aerial Photographs



March 17, 1961 – Early development of the Bailly Generating Station.

Approximate location of earthen berms for transmission towers, east and west of the area eventually designated SWMU 14. To be included in subsequent photographs for location reference over time.



No discernable changes in 1962 and 1963. No apparent water in the future impoundments.

July 15, 1965 - Resembled 1963, but dark feature in upper northwest portion of SWMU 14. Difficult to tell if impoundments west of SWMU 14 contained water.

June 28, 1969 - Dark feature in upper northwest portion of SWMU 14 still present, but area appeared to remain open and flat and had begun revegetating. Water now evident in the impoundments west of SWMU 14.

wood.

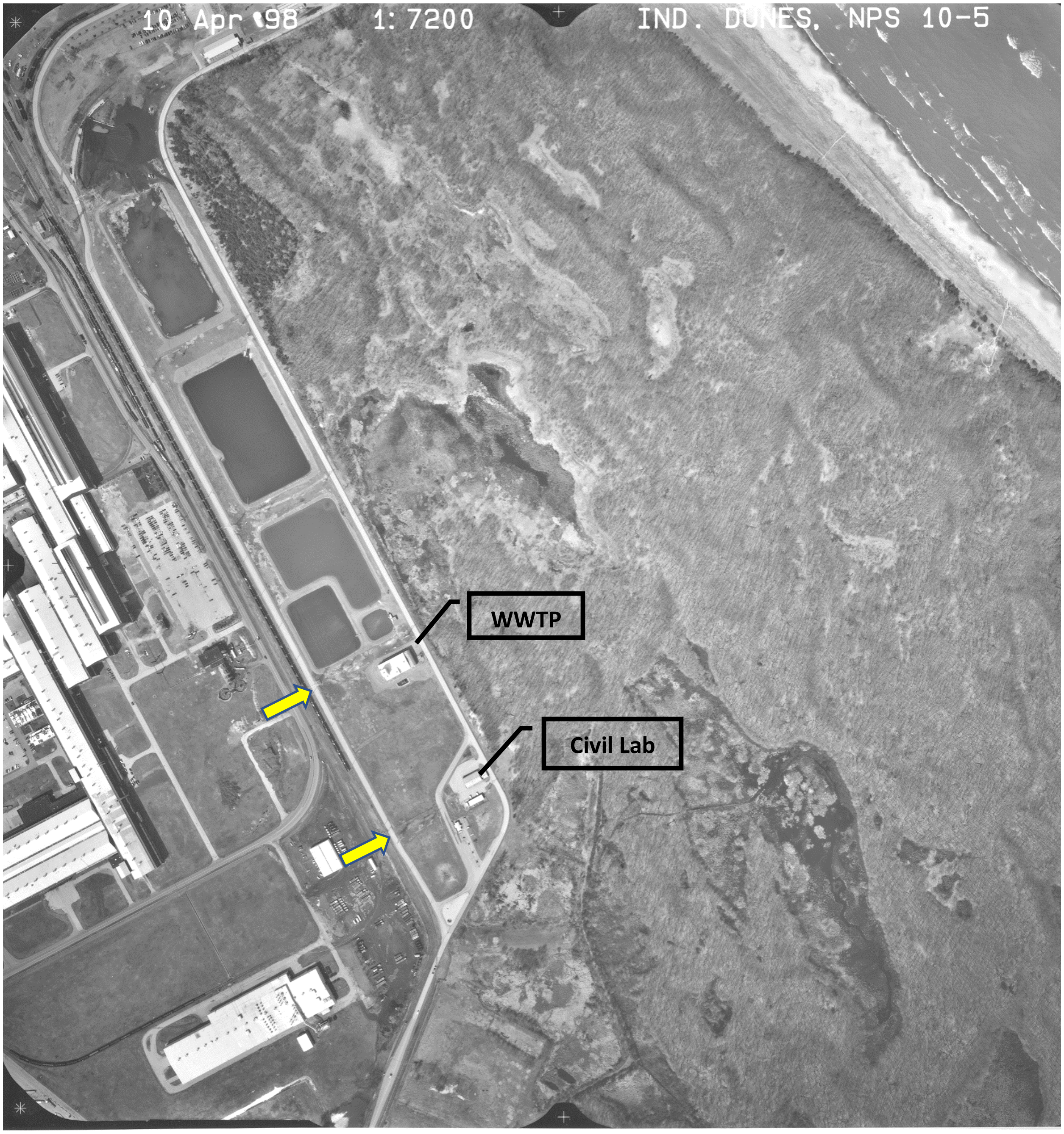
May 3, 1971 - Dark feature in upper northwest portion of SWMU 14 still present, but area appeared to remain dry. Water evident in the impoundments west of SWMU 14.

Photograph 1. Aerial view of the flooded Blag Slough (left) and Little Lake (right in dunes) in the background with the fly-ash ponds and dike in the front half of the photograph. A fly-ash fill area is visible in the lower right corner of the photograph. Taken on September 27, 1977.

Source: Pavlovic, et. al., Great Lakes Legacy Research Report I, Twenty-Three Years of Vegetation Change in a Fly-Ash Leachate Impacted Meadow. February 21, 2009.

September 29, 1977 – Water now evident in the area that eventually became SWMU 14. Structure holding the water appeared to have been built sometime after 1971. Infilling along the southern border appeared to be in progress – see light-colored material. Towers sets now clearly visible.

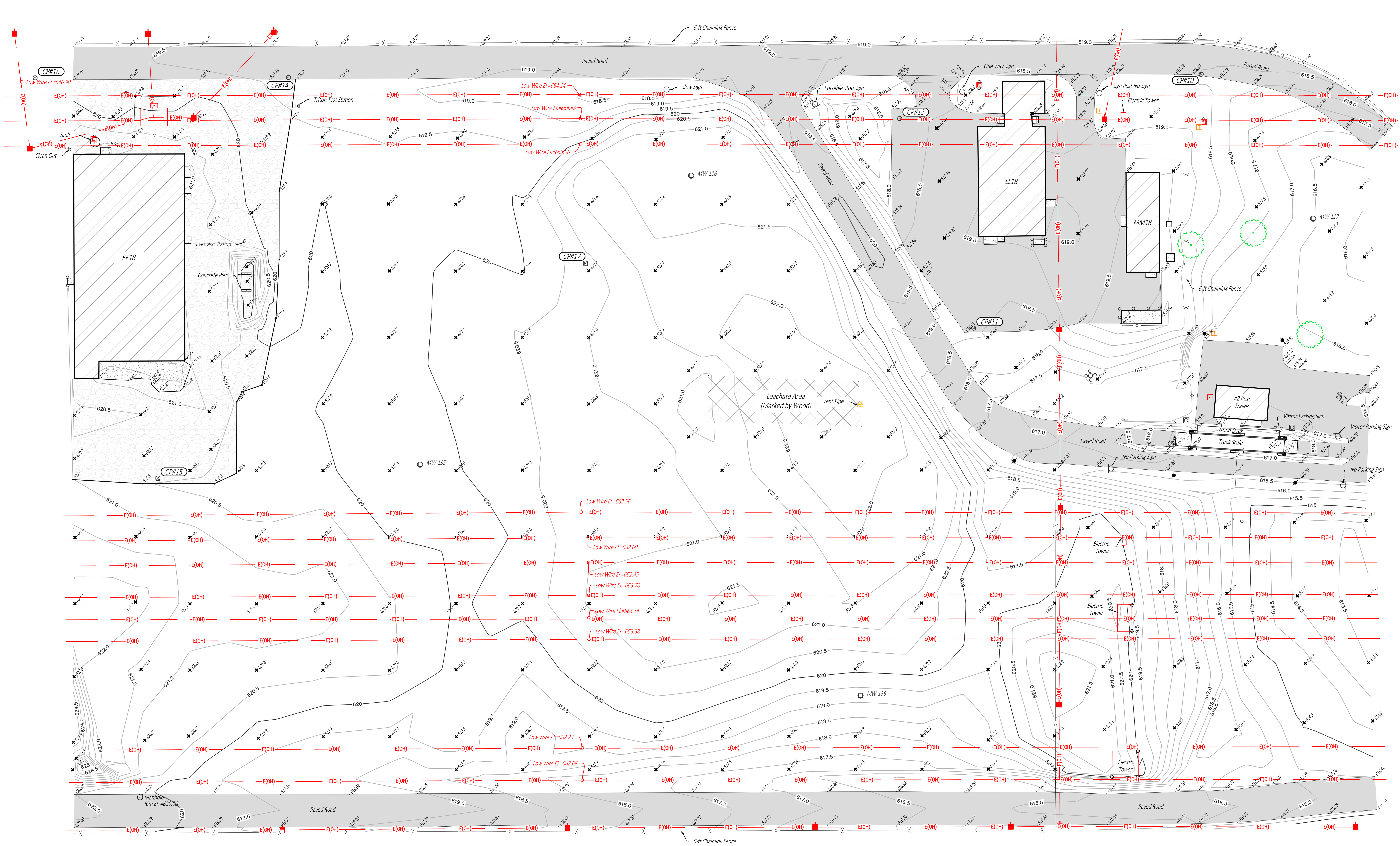
November 4, 1979 – Infilling of the area between tower sets was nearly complete. An L-shaped area to the north appeared to contain water. Impoundments to the west in approximate current configuration. Possible evidence of earth-moving activities in the northwest portion of what is now designated SWMU 14, where the BGS wastewater treatment plant is located currently.

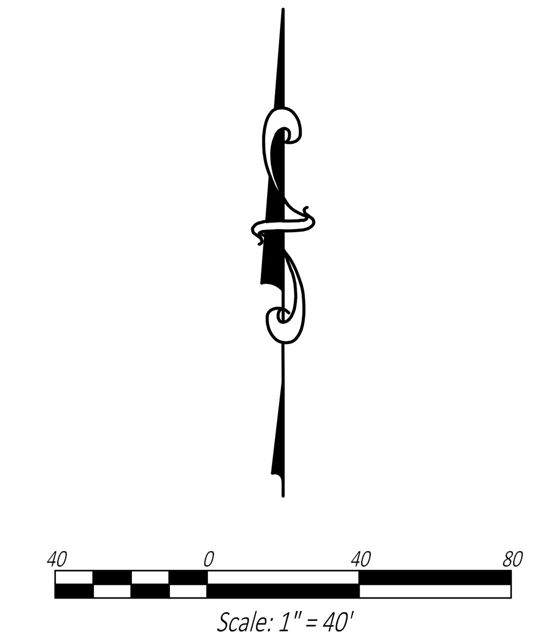


April 10, 1998 – Area now called SWMU 14. The WWTP is seen in the northwest corner, possibly built within the footprint of formerly ponded water. The building referred to as the Civil Lab may also have been built within the footprint of formerly ponded water.

Attachment B

Survey Information





Legend:

- Test Station
- Vent Pipe
- Post
- Steet Sign
- Power Pole
- Light Pole
- Electric Pedestal
- Telephone Pedestal
- Manhole
- Electric Handhold
- Traffic Signal
- 620.00 Pavement Spot Elevation
- 620.0 Ground Elevation
- MW-XXX Monitoring Well
- Gravel
- E(OH) Overhead Power Line
- X Fence
- Pavement
- Concrete
- Building
- 585 Intermediate Contour Line
- 584 Index Contour Line
- Mag Nail
- Rebar
- Tree

Vicinity Map

Not to Scale

Survey Control Information				
Control Point No.	Indiana West NAD83 State Plane		NAVD88	Description
	Northing	Easting	Elevation	
4	2327401.08	2942553.01	619.16	Mag Nail
10	2327845.45	2946051.57	618.57	Mag Nail
11	2327654.52	2945880.41	618.60	Mag Nail
12	2327812.19	2945824.81	618.28	Mag Nail
14	2327843.08	2945365.03	619.40	Mag Nail
15	2327541.58	2945266.95	620.67	Rebar
16	2327842.82	2945174.57	619.62	Mag Nail
17	2327703.36	2945588.43	620.89	Rebar

Notes:

1. The horizontal coordinate system shown is relative to the Indiana State Plane Coordinate System of 1983 (NAD83), West Zone.
2. The vertical datum is relative to North American Vertical Datum of 1988 (NAVD88).
3. Units are in U.S. Survey Feet.
4. Survey control was established for this survey using RTK GNSS GPS with corrections provided by the INDOT CORS reference network.
5. Last date of fieldwork was performed on April 9, 2021.
6. Elevation contours shown are at half-foot intervals.
7. Only utilities observed at time of survey were recorded. Additional utilities may exist in addition to those shown hereon.
8. Low wire elevations were recorded on April 9, 2021 during windy conditions, temperature was recorded at 60deg Fahrenheit .
9. This drawing is not intended to be represented at a retracement or original boundary survey, a route survey, or a surveyor location report.

DLZ
DLZ NATIONAL, INC.
316 TECH DRIVE, BURNS HARBOR, INDIANA 46304
TELEPHONE (219) 764-4700 FAX (219) 764-4156

Chesterton Indiana

Wood Environment & Infrastructure Solutions, Inc.
Northern Indiana Public Service Company

Bailly Generating Station
RCRA Topographic Survey

DRAWN: AMB | CHK'D: CDC
DESIGNED: - | APPRV'D: -
DATE: April 19, 2021
SCALE: 1" = 40'

PROJECT NUMBER
2111-0265-90

NO.	REVISION	BY	DATE
1	Change title block and add monitoring well.	AMB	5/4/21

SHEET 1
OF 1
DRAWING NUMBER
0265TO

X:\PROJECTS\GFL\2021\2111\02659\0 WOOD NIPSCO BAILLY\TOPOGRAPHIC\0265TO.DWG

Native Soil Depths and Elevations
Bailly Generating Station
Chesterton, IN

NIPSCO Bailly Station RCRA Area					Depth to Native Soil (feet)	Native Soil Elevation (NAVD88)
DLZ Pt ID	IN West Zone NAD83 Northing	IN West Zone NAD83 Easting	NAVD88 Ground Elevation	Boring ID		
23000	2327747.69	2945490.94	619.6	SB-10	9.5	610.1
23001	2327747.67	2945540.99	620.1	SB-11	9.5	610.6
23002	2327747.62	2945590.94	621.6	SB-12	9.3	612.3
23003	2327747.63	2945640.98	621.2	SB-13	8.8	612.4
23004	2327747.65	2945691.00	621.3	SB-14	9.7	611.6
23005	2327747.61	2945741.10	621.3	SB-15	10.1	611.2
23006	2327697.42	2945490.89	620.2	SB-16	9.5	610.7
23007	2327697.34	2945540.93	620.0	SB-17	9.3	610.7
23008	2327697.73	2945590.94	620.8	SB-18	9.8	611.0
23009	2327697.77	2945640.97	621.7	SB-19	10.2	611.5
23010	2327697.66	2945691.07	621.9	SB-20	10.7	611.2
23011	2327697.66	2945740.99	621.8	SB-21	9.5	612.3
23012	2327697.66	2945791.12	619.5	SB-22	8.9	610.6
23013	2327647.47	2945490.93	620.2	SB-23	8.9	611.3
23014	2327647.47	2945540.95	620.5	SB-24	9.7	610.8
23015	2327647.43	2945590.92	621.0	SB-25	10.0	611.0
23016	2327647.42	2945640.98	621.4	SB-26	10.6	610.8
23017	2327647.83	2945691.01	622.0	SB-27	10.0	612.0
23018	2327647.76	2945741.08	622.1	SB-28	10.6	611.5
23019	2327647.74	2945791.01	621.1	SB-29	10.3	610.8
23020	2327622.60	2945666.13	621.2	SB-30	9.7	611.5
23021	2327622.59	2945716.18	622.0	SB-31	10.4	611.6
23022	2327622.62	2945766.18	622.4	SB-32	12.6	609.8
23023	2327622.63	2945816.19	620.6	SB-33	10.2	610.4
23024	2327597.58	2945440.85	619.7	SB-34	8.0	611.7
23025	2327597.58	2945490.89	620.1	SB-35	9.0	611.1
23026	2327597.56	2945540.96	620.4	SB-36	9.5	610.9
23027	2327597.46	2945590.99	620.9	SB-37	10.3	610.6
23028	2327597.53	2945640.98	621.1	SB-38	10.1	611.0
23029	2327572.72	2945666.11	621.0	SB-39	10.1	610.9
23030	2327572.66	2945716.09	621.6	SB-40	10.4	611.2
23031	2327572.72	2945766.13	622.5	SB-41	12.2	610.3
23032	2327572.68	2945816.17	622.2	SB-42	12.2	610.0
13033	2327547.33	2945291.10	620.7	SB-43	8.0	612.7
13034	2327547.34	2945341.07	620.3	SB-44	8.3	612.0
13035	2327547.29	2945391.10	620.1	SB-45	8.1	612.0
13036	2327547.26	2945441.16	619.7	SB-46	6.5	613.2

Native Soil Depths and Elevations
Bailly Generating Station
Chesterton, IN

NIPSCO Bailly Station RCRA Area					Depth to Native Soil (feet)	Native Soil Elevation (NAVD88)
DLZ Pt ID	IN West Zone NAD83 Northing	IN West Zone NAD83 Easting	NAVD88 Ground Elevation	Boring ID		
13037	2327547.24	2945491.16	620.0	SB-47	8.6	611.4
13038	2327547.69	2945541.11	620.3	SB-48	9.2	611.1
13039	2327547.56	2945591.17	621.0	SB-49	10.0	611.0
13040	2327547.61	2945641.20	620.9	SB-50	10.3	610.6
13041	2327547.56	2945691.22	621.2	SB-51	10.5	610.7
13042	2327547.53	2945741.30	621.9	SB-52	10.9	611.0
13043	2327547.47	2945791.30	622.1	SB-53	12.0	610.1
13044	2327547.86	2945841.31	621.9	SB-54	5.0	NA
13045	2327547.84	2945891.33	618.2	SB-55	8.3	609.9
13046	2327522.83	2945916.25	619.1	SB-56	9.1	610.0
13047	2327497.01	2945291.08	621.2	SB-57	5.8	615.4
13048	2327497.43	2945341.13	620.6	SB-58	8.7	611.9
13049	2327497.39	2945391.12	620.8	SB-59	8.9	611.9
13050	2327497.38	2945441.12	620.0	SB-60	8.3	611.7
13051	2327497.30	2945491.10	619.8	SB-61	8.2	611.6
13052	2327497.35	2945541.16	620.0	SB-62	9.4	610.6
13053	2327497.68	2945591.14	620.9	SB-63	12.0	608.9
13054	2327497.64	2945641.20	621.0	SB-64	10.1	610.9
13055	2327497.59	2945691.26	621.0	SB-65	10.1	610.9
13056	2327497.62	2945741.20	621.2	SB-66	10.4	610.8
13057	2327497.58	2945791.27	622.0	SB-67	12.4	609.6
13058	2327497.63	2945841.30	621.8	SB-68	12.3	609.5
13059	2327497.98	2945891.32	619.0	SB-69	9.3	609.7
13060	2327497.93	2945941.29	619.4	SB-70	5.2	614.2
13061	2327447.11	2945291.05	621.3	SB-71	8.7	612.6
13062	2327447.10	2945341.09	621.4	SB-72	9.1	612.3
13063	2327447.48	2945391.05	621.3	SB-73	9.2	612.1
13064	2327447.44	2945441.12	620.6	SB-74	9.0	611.6
13065	2327447.40	2945491.12	619.9	SB-75	8.8	611.1
13066	2327447.35	2945541.10	620.2	SB-76	9.7	610.5
13067	2327447.40	2945591.15	621.0	SB-77	11.6	609.4
13068	2327447.36	2945641.15	621.1	SB-78	10.3	610.8
13069	2327447.79	2945691.20	621.6	SB-79	10.4	611.2
13070	2327447.64	2945741.25	621.4	SB-80	10.8	610.6
13071	2327447.75	2945791.27	621.5	SB-81	12.0	609.5
13072	2327447.69	2945841.27	620.8	SB-82	5.0	NA
13073	2327447.70	2945891.28	619.6	SB-83	9.4	610.2

Native Soil Depths and Elevations
Bailly Generating Station
Chesterton, IN

NIPSCO Bailly Station RCRA Area					Depth to Native Soil (feet)	Native Soil Elevation (NAVD88)
DLZ Pt ID	IN West Zone NAD83 Northing	IN West Zone NAD83 Easting	NAVD88 Ground Elevation	Boring ID		
13074	2327447.67	2945941.39	620.1	SB-84	6.0	614.1
13075	2327397.26	2945291.03	620.9	SB-85	13.5	607.4
13076	2327397.19	2945341.11	620.8	SB-86	9.0	611.8
13077	2327397.23	2945391.08	620.6	SB-87	9.1	611.5
13078	2327397.17	2945441.08	620.6	SB-88	9.1	611.5
13079	2327397.55	2945491.15	619.8	SB-89	8.5	611.3
13080	2327397.45	2945541.18	619.6	SB-90	8.9	610.7
13081	2327397.45	2945591.12	620.3	SB-91	10.2	610.1
13082	2327397.50	2945641.13	621.0	SB-92	12.0	609.0
13083	2327397.42	2945691.19	620.8	SB-93	9.9	610.9
13084	2327397.37	2945741.27	620.3	SB-94	8.6	611.7
13085	2327397.78	2945841.24	620.2	SB-95	5.0	NA
13086	2327397.77	2945891.24	619.5	SB-96	9.7	609.8
13087	2327397.76	2945941.22	622.0	SB-97	8.5	613.5
13088	2327347.27	2945391.30	619.4	SB-98	6.2	613.2
13089	2327347.23	2945441.32	619.3	SB-99	8.0	611.3
13090	2327347.21	2945491.35	619.9	SB-100	2.6	617.3
13091	2327347.63	2945541.37	618.7	SB-101	8.0	610.7
13092	2327347.55	2945591.45	619.3	SB-102	4.0	615.3
13093	2327347.47	2945691.40	619.1	SB-103	2.2	616.9
13094	2327347.49	2945741.49	618.2	SB-104	2.2	616.0
13095	2327347.50	2945791.50	617.9	SB-105	1.6	616.3
13096	2327347.82	2945841.58	618.1	SB-106	5.4	612.7
13097	2327347.78	2945941.24	621.3	SB-107	4.0	617.3
13098	2327322.40	2945491.36	619.0	SB-108	1.1	617.9
13099	2327322.41	2945541.36	618.7	SB-109	4.0	614.7
13100	2327322.38	2945591.43	618.4	SB-110	1.1	617.3
13101	2327322.45	2945641.46	617.8	SB-111	0.4	617.4
13102	2327322.32	2945691.46	617.6	SB-112	1.1	616.5
13103	2327322.74	2945741.50	617.4	SB-113	4.0	613.4
13104	2327322.70	2945791.48	617.1	SB-114	1.4	615.7
13105	2327322.71	2945841.56	617.2	SB-115	0.3	616.9
13106	2327322.78	2945891.50	617.7	SB-116	1.4	616.3
13107	2327322.70	2945941.63	619.4	SB-117	1.4	618.0
13109	2327647.70	2945891.14	618.5	SB-118	2.0	NA
13110	2327697.67	2945841.08	618.8	SB-119	2.4	NA

Native Soil Depths and Elevations
Bailly Generating Station
Chesterton, IN

NIPSCO Bailly Station RCRA Area					Depth to Native Soil (feet)	Native Soil Elevation (NAVD88)
DLZ Pt ID	IN West Zone NAD83 Northing	IN West Zone NAD83 Easting	NAVD88 Ground Elevation	Boring ID		
NA	2327747.818	2945815.996	618.0	SB-120	8.1	609.9
NA	2327797.715	2945690.902	621.1	SB-121	9.0	612.1
NA	2327797.619	2945590.866	620.0	SB-122	6.9	613.1
NA	2327797.57	2945540.848	619.4	SB-123	5.2	614.2
NA	2327797.522	2945490.83	619.6	SB-124	6.1	613.5
NA	2327747.455	2945440.86	619.8	SB-125	8.3	611.5
NA	2327696.741	2945391.694	620.1	SB-126	9.2	610.9
NA	2327647.371	2945390.938	620.3	SB-127	8.7	611.6
NA	2327597.212	2945341.945	620.3	SB-128	8.0	612.3
NA	2327497.171	2945241.029	621.4	SB-129	8.7	612.7
NA	2327397.135	2945241.125	621.6	SB-130	13.0	608.6
NA	2327346.933	2945291.127	620.7	SB-131	8.0	612.7
NA	2327346.634	2945341.666	619.8	SB-132	10.3	609.5
				Total:	992.4	
				Average:	8.4	

Notes:

Green shading indicates borings with coordinates generated by Wood in GIS.

Red text indicates borings not included fill volume estimation due to shallow refusal at specified depth.

Soil boring SB-56 was moved due to unknown utilities; elevation estimated from topo map.

Soil boring SB-92 was included in estimation of fill volume (refusal at 12').

Soil borings SB-120 through SB-132 were added during the field program.

Prepared by: LSC 04/23/2021
Checked by: RAJ 04/27/2021

wood.

Attachment C

Boring Logs

SOIL BORING LOG

BORING NUMBER: SB10		Page 1 of 1
Project Name: SWMU 14	Driller/Method: Direct Push / Rammelle	Date/Time Start: 3/22/21 1235
Project Location: BGS	Logged By: L. Capozzi	Date/Time End: 3/22/21 1255
Project Number: 365120011	Water Table: — Total Depth: 12'	Weather: 63° / Sunny

Depth	Sample Interval	Recovery	Subsurface Description and Remarks	Samples	PID (ppm)
1			Grass; silty sandy topsoil, d. brown @0.3' - gravelly sand, brown/gray, some fines, MD, dry, some slag		
2	0-4	2.2/4	@1.4' - f. sand, MD, tan, moist (10YR 6/3)		
3			@2.2-4' - No recovery		
4					
5			f. Sand as above		
6		2.6/4	@5.1' - brown/gray (10YR 4/2) trace coal fragments Slag piece @ 5.5' + 6.7'; coal piece @ 6.2'		
7	4-8		@6.6-8' No recovery		
8					
9			as above, brown/gray, trace coal fragments @8.3' - dk brown / organic sand w/ coal (10YR 3/6) d. brown/black (10YR 2/2) 8.7-8.9' and 9.3-9.5' (more coal)		
10	8-12	3.2/4	@9.5' - f. sand, light tan, MD, moist (10YR 8/3)		
11					
12			11.2-12' - No recovery		
13			End at 12'		
14					
15					
16					
17					
18					
19					
20					

Notes:

wood.

BORING NUMBER: SB-11	SOIL BORING LOG	Page 1 of 1
Project Name: SLOMUM	Driller/Method: Raymond / DP	Date/Time Start: 3/22/21 1257
Project Location: BGS	Logged By: L Caplinger	Date/Time End: 3/22/21 1308
Project Number: 3651200111	Water Table: — Total Depth: 12'	Weather: 63° / p. Sunny

Depth	Sample Interval	Recovery	Subsurface Description and Remarks	Samples	PID (ppm)
1	0-4	3/4	Grass/roots; silty sandy topsoil, d. brown / little gravel @0.4' - gravelly sand, brown/gray, MD @0.6' - f. CCR, brown/d. brown, @0.9' - slag piece, tan f. sand, trace f CCR, tan, MD, moist, trace brick @1.7' - f CCR as above; little f sand @ 1.5' @1.6' - f. sand, tan, MD @2' - f. CCR, d. brown/brown @2.1 - f. sand, tan, MD, moist, trace coal 3-4' - no recovery		
2					
3					
4					
5	4-8	1.5/4	f. sand, trace coal, trace gravel, tan, MD, moist @5.4' - brown/gray @5.5 - 8' - no recovery		
6					
7					
8					
9	8-12	2.9/4	as above, tan @8.2' - brown/gray, some coal @8.8' - tan/ brown @9.3 - 9.5' - gravel/slag @9.5' - f. sand, D, light tan, moist 10.9 - 12' - no recovery		
10					
11					
12			End at 12'		
13					
14					
15					
16					
17					
18					
19					
20					

Notes:

wood

BORING NUMBER: SB-12

SOIL BORING LOG

Page 1 of 1

Project Name: SWMU M
Project Location: BGS
Project Number: 3651200111

Driller/Method: Raimondo
Logged By: L Sigdinger
Water Table: 13.5' Total Depth: 16'

Date/Time Start: 3/22/21 1312
Date/Time End: 3/22/21 1326
Weather: 63°/p. cloudy

Depth	Sample Interval	Recovery	Subsurface Description and Remarks	Samples	PID (ppm)
1			grass/roots; sandy topsoil, trace coal, brown/d brown, loose, dry @0.4'- f sand w/ coal (gravel), brown/d brown, MD, dry, trace slag		
2		2.7/4	@1.3'- f. CCR (coal), then sand w/ gravel + coal, loose, dry, d. brown		
3	0-4		@1.6'- f. CCR, moist, d. brown @2.2'- gravelly sand, some slag, MD, trace f. CCR, trace coal @2.7-4'- no recovery		
4					
5			as above, increase f. CCR at 4.3' @4.6'- f. CCR, M/W		
6		2.1/4	@5.3'- gravelly sand as before, some slag, trace f CCR, trace coal, trace brick		
7	4-8		@6.1-8'- no recovery		
8					
9			@8'- as above @8.4- f. CCR @8.5- f. sand, tan/brown, MD, moist, trace gravel slag piece @ 8.8'		
10		1.9/4	@8.9'- f sand, some coal, trace c. CCR, d brown/gray, MD		
11	8-12		@9.2'- orange (coal?) @9.3'- f. sand, light tan, MD, moist @9.9-12'- no recovery		
12					
13			as above		
14		2.5/4	M/W @ 13.5'		
15	12-16		@14.5-16- no recovery		
16					
17			End at 16'		
18					
19					
20					

Notes:

wood.

BORING NUMBER: SB-13	SOIL BORING LOG	Page 1 of 1
Project Name: SLAM 14	Driller/Method: Raymonde / DP	Date/Time Start: 3/22/21 1331
Project Location: BGS	Logged By: L. Caplinger	Date/Time End: 3/22/21 1344
Project Number: 365200111	Water Table: 13.2' Total Depth: 16'	Weather: 62° / cloudy

Depth	Sample Interval	Recovery	Subsurface Description and Remarks	Samples	PID (ppm)
			Grass/roots, sandy silt topsoil, brown/d brown, loose		
1			@0.7' - f. sand w/ c. CCR, trace slag, MD, moist, d. brown		
2	0-4	2.1/4			
			@2.1-4 - no recovery		
3					
4					
			as above		
5			@4.5' - trace f. CCR, slag piece @4.7'		
			@4.8' - f. sand w/ c. CCR as before; tan f. sand at very bottom		
6	4-8	1.2/4	@5.2 - 8' - no recovery		
7					
8					
			f. sand, trace c. CCR, MD, moist, tan		
9			@8.1' - slag pieces, trace f. CCR, little sand, ...		
			@8.4' - f. sand, trace c. CCR as before		
10	8-12	1.8/4	@8.6 - increase - c. CCR, d. brown		
			@8.8' - f. sand, MD, moist, tan/lt tan		
			@9.8 - 12 - no recovery		
11					
12					
			as above		
13					
		2.9/4	M/W @13.2' m		
14	12-16				
15			@14.9 - 16 - no recovery		
16					
			End at 16'		
17					
18					
19					
20					

Notes:

wood.

BORING NUMBER: SB-14	SOIL BORING LOG	Page 1 of
Project Name: SWMU 14	Driller/Method: Rainbow / DP	Date/Time Start: 3/22/21 1349
Project Location: BGS	Logged By: C. Colinger	Date/Time End: 3/22/21 1402
Project Number: 365120011	Water Table: 13.3' Total Depth: 16'	Weather: 62° / cloudy

Depth	Sample Interval	Recovery	Subsurface Description and Remarks	Samples	PID (ppm)
1			Grass/roots; sandy topsoil, d. brown, loose @ 2'- f.sand w/CCR, d. brown, MD, moist, trace brick		
2	0-4	1.4/4	@1.4-4' - No recovery		
3					
4					
5			as above @4.6' - f.sand, brown/gray, MD, moist, trace f.gravel		
6	4-8	1.5/4	@5.5-8' - No recovery		
7					
8					
9			as above @8.9' - f.CCR, M/W		
10	8-12	2.7/4	@9.4' - f.sand, @ little f. CCR, trace brick, little c.CCR, d.brown/gray, moist @9.7' - f.sand, MD, moist, lt. tan		
11			10.7-12' - No recovery		
12					
13			as above		
14	12-16	3/4	M/W @ 13.3'		
15			15-16' - No recovery		
16					
17			End at 16'		
18					
19					
20					

Notes:

wood.

BORING NUMBER: SB-15	SOIL BORING LOG	Page 1 of 1
Project Name: Soumu 14	Driller/Method: Raimondi / DP	Date/Time Start: 3/22/21 1435
Project Location: BGS	Logged By: C-Caplinger	Date/Time End: 3/22/21 1449
Project Number: 3651200111	Water Table: 13' Total Depth: 16'	Weather: 62° / p.cloudy

Depth	Sample Interval	Recovery	Subsurface Description and Remarks	Samples	PID (ppm)
1			Grass/roots; f.sand w/ c-cor, brown/gray, loose, dry,		
			to @1'		
			@1.3'-1.5' - d. brown, tan brown/gray		
2	0-4	1.7/4	@1.7-4' - NO recovery		
3					
4					
			as above, trace brick + slag		
5			@4.9' - f. sand, light brown/gray, MD, moist, trace slag		
6		2.2/4			
7	4-8		6.2 - 8' - NO recovery		
8					
			as above		
9					
10			@9.2' - coal piece		
			@9.7' - coal piece; @9.6' - little c.cor (co.1'), trace brick, black		
		2.8/4	@10' - little c.coal, black		
11	8-12		@10.1' - f.sand, lt. tan, MD, moist		—
			@10.8 - 12' - No recovery		
12					
			as above		
13			W@13'		
14	12-16	2.9/4			
15			@14.9 - 16' - No recovery		
16					
			Ended at 16'		
17					
18					
19					
20					

Notes:

wood.

SOIL BORING LOG

BORING NUMBER: SB-16	SOIL BORING LOG	Page 1 of 1
Project Name: SWMU 14	Driller/Method: Rainbonde / DO	Date/Time Start: 3/24/21 1005
Project Location: BGS	Logged By: L. Colinger	Date/Time End: 3/24/21 1021
Project Number: 3657200111	Water Table: 12.6' Total Depth: 16'	Weather: 55°/pcloudy, windy

Depth	Sample Interval	Recovery	Subsurface Description and Remarks	Samples	PID (ppm)
1			Grass/ROOTS; silty sandy Topsoil, little c. CCR, d. brown, MO, moist @0.3' - slag piece then fill w/ sand, gravel, slag, silt, c. CCR, d. brown, L/MO, moist		
2	0-4	2.6/4	@0.7' - slag, some f sand		
3			@1.1' - f. sand, lt brown, MO, moist, trace c. CCR, some slag at top @2.6-4 - No recovery		
4			f. sand, brown/gray, MO, moist, trace slag, trace c. CCR		
5					
6	4-8	2.9/4	@6.5' - tan/lt. tan		
7			@6.9-8' - No recovery		
8					
9			f. sand as above @8.1' - f. sand, some coal, d. brown, MO, moist		
10	8-12	3.1/4	some slag after 8.4' @8.6' - Coal, some orange f. sand @ 8.8' + 9' (<0.1')		
11			@9.1' - orange f sand @9.3' - Coal @9.5' - f. sand, lt tan/gray, MO, moist		
12			lt tan after 10' @11.1'-12' - no recovery		
13			as above wet @ 12.6'		
14	12-16	3.3/4			
15					
16			@15.3-16' - no recovery		
17			End at 16'		
18					
19					
20					

Notes:

wood.

BORING NUMBER: SB-17	SOIL BORING LOG	Page 1 of 1
Project Name: SWMU 14	Driller/Method: Raymonde/DP	Date/Time Start: 3/24/21 0919
Project Location: BSS	Logged By: L. Caplinger	Date/Time End: 3/24/21 0939
Project Number: 3651200111	Water Table: 12.3' Total Depth: 16'	Weather: 53°/ p-sunny, windy

Depth	Sample Interval	Recovery	Subsurface Description and Remarks	Samples	PID (ppm)
1			Grass/roots; sandy topsoil @0.1' - gravel @0.3' - fill - sand, gravel, slag, brick pieces, silt, coal, d. brown		
2	0-4	2.7/4	loose/MD, moist @0.9' - f sand, tan, MD, moist, trace c. CCR slag piece @1.5'		
3			@2.7-4' - no recovery		
4					
5			as above, trace f gravel, trace c. CCR		
6	4-8	2.7/4	@5.2-5.4' - brown/gray, then lt tan after 5.4'		
7			@6.6' - coal @6.7-8' - no recovery; f sand on bottom of core @6.7'		
8					
9			coal piece, then loose fill material - sand, gravel, coal, brown/orange @8.1' - f sand w/ coal, d. brown		
10	8-12	2.7/4	@8.5' coal, some f sand @8.9' - orange f sand, some coal laminations		
11			@9.3' - f sand, lt tan, MD, moist		
12			@10.7-12 - No recovery		
13			as above wet @12.3'		
14	12-16	3.3/4	slightly orange 13.5-13.6' & 13.9-14' sat @14'		
15					
16			@15.3-16' - no recovery		
17			End at 16'		
18					
19					
20					

Notes:

wood.

SOIL BORING LOG

BORING NUMBER: SB-18 | Page 1 of 1

Project Name:	SWMU 14	Driller/Method:	Raymond/DP	Date/Time Start:	3/24/24 0733
Project Location:	BGS	Logged By:	C. Coplusir	Date/Time End:	3/24/24 0749
Project Number:	3451200111	Water Table: 12.9	Total Depth: 16'	Weather:	50°/cloudy

Depth	Sample Interval	Recovery	Subsurface Description and Remarks	Samples	PID (ppm)
1			Grass/roots, silty sandy topsoil, d. brown, moist @0.3'- red brick (0.1'), then f. sand w/ C-CCR, d. brown/yellowish		
2	0-4	2/4	@1.3'- f. CCR, d. brown Some f. sand + brick pieces after 1.6' @1.9'- loose fill - sand, silt, coal, brick, black		
3			@2-4- No recovery		
4					
5			loose fill as above @4.4'- f. CCR.		
6		3.2/4	loose fill @4.~~[struck out]~~ f. CCR @ 4.8-4.9', 5' (<0.1'), 5.2-5.3' (rest is loose fill)		
7	4-8		@5.8'- f. CCR, wet; sand thick @ 6.8' (<0.1')		
8			@7.2-8 - No recovery (sand on very bottom of core @ 7.2')		
9			@8'- f. sand, lt tan, MD, moist		
10	8-12	2.8/4	@9'- d. brown @9.1'- slag		
11			@9.2'- orange f. sand @9.3'- coal @9.8'- f. sand, lt. tan, MD, moist		
12			@10.8-12'- no recovery		
13			as above wet @12.9'		
14	12-16	3.1/4			
15			sat @14.4'		
16			@15.1-16'- No recovery		
17			End at 16'		
18					
19					
20					

Notes:

wood.

BORING NUMBER: SB-19	SOIL BORING LOG	Page 1 of
Project Name: SWMU 14	Driller/Method: Raimonde / DP	Date/Time Start: 3/23/21 1406
Project Location: BGS	Logged By: L. Collinger	Date/Time End: 3/23/21 1416
Project Number: 365T200111	Water Table: 13.3' Total Depth: 16'	Weather: 65°/cloudy

Depth	Sample Interval	Recovery	Subsurface Description and Remarks	Samples	PID (ppm)
			Grass/roots; ~~[illegible]~~ sandy topsoil; @ 0.4' - f. sand, w/ c. coal, MD, moist, d. brown		
1			slag pieces @ 0.8' + 1'		
2	0-4	2/4			
			@ 2-4' - No recovery		
3					
4			as above		
5			@ 4.6' - f. sand, MD, moist gray/brown		
6	4-8	1.8/4	@ 5.8-8' - No recovery		
7					
8			as above, trace f. gravel		
9					
10	8-12	2.6/4	@ 9.3' - brown + orange lamination		
			@ 9.4' - lt tan ; @ 9.6' - d. gray		
			@ 9.7' - some coal + slag pieces w/ in		
11			@ 10' - 10.2' - coal		
			@ 10.2' - f. sand, lt tan, MD, moist		
12			@ 10.6-12' - No recovery		
			@ 12' - as above		
13					
14	12-16	2.9/4	wet @ 13.3'		
15			@ 14.9-16' - No recovery		
16					
			End at 16'		
17					
18					
19					
20					

Notes:

wood.

BORING NUMBER: SB-20	SOIL BORING LOG	Page 1 of 1
Project Name: BCMU 14	Driller/Method: Raimonde / DP	Date/Time Start: 3/23/21 0725
Project Location: BGS	Logged By: L. Caplinger	Date/Time End: 3/23/21 0740
Project Number: 3651200111	Water Table: 13.8 Total Depth: 16	Weather: 50° / cloudy

Depth	Sample Interval	Recovery	Subsurface Description and Remarks	Samples	PID (ppm)
1			Grass/roots; f. sand, little C.CCR, brown, moist, MD @0.4 brown/gray		
2	0-4	2.2/4			
3			@2.2-4 - No recovery		
4					
5			as above		
6		2.9/4			
7	4-8		@6.9-8 - No recovery		
8					
9			as above, no C.CCR gravel piece @8.4'		
10		2.8/4			
11	8-12		@10.2'-10.3' - d. brown/gray @10.5' - d. brown/black, Coal @10.7' - f. sand, lt tan, MD, moist		
12			10.8-12 - No recovery		
13			@12' - as above some lt. orange streaks w/i after 12.4'		
14	12-16	2.8/4	@13.8 - wet		
15			@14.8-16' - No recovery		
16					
17			End at 16'		
18					
19					
20					

Notes:

wood.

BORING NUMBER: SB-21	SOIL BORING LOG	Page 1 of 1
Project Name: SWMU-14	Driller/Method: Rainville / DP	Date/Time Start: 3/22/21 1506
Project Location: BGS	Logged By: L. Caplinger	Date/Time End: 3/22/21 1518
Project Number: 3605200111	Water Table: 13.7' Total Depth: 16'	Weather: 60°/ pcloudy

Depth	Sample Interval	Recovery	Subsurface Description and Remarks	Samples	PID (ppm)
			Grass/roots; f. sand, trace c. CCR, mo. moist, brown		
1					
2	0-4	1.9/4	1.9-4 - No recovery		
3					
4					
			as above		
5					
6	4-8	1.8/4	e5.8-8 - no recovery		
7					
8					
			as above		
9			e8.1 - spent coal / slag pieces e8.8' - as before, no c CCR		
10	8-12	1.9/4	e9.4 - Coal e9.5' - f. sand, lt tan, mo. moist		
11			e9.9-12' - no recovery		
12					
			as above		
13					
14	12-16	2.7/4	wet e13.7'		
15			e14.7-16' - no recovery		
16					
			End at 16'		
17					
18					
19					
20					

Notes:

wood.

SOIL BORING LOG

BORING NUMBER: SB-22			Page 1 of 1
Project Name: SWMU 14	Driller/Method: Raimondo / DP		Date/Time Start: 3/22/21 1452
Project Location: BGS	Logged By: L.Capasir		Date/Time End: 3/22/21 1503
Project Number: 3651200111	Water Table: —	Total Depth: 12'	Weather: 62°/P.Sunny

Depth	Sample Interval	Recovery	Subsurface Description and Remarks	Samples	PID (ppm)
			Grass/roots; f.sand, some gravel, loose, moist, lt.brown		
1			@0.5'-large gravel piece (0.1'), thin wood piece		
			@0.9'-large gravel/slag piece, then trace c.coal in sand; lt.brown/gray		
2	0-4	1.7/4	@1.7-4'- no recovery		
3					
4			as above - f.sand		
			@4.2'- no c.coal, lt brown/tan, trace m-f gravel		
5					
6	4-8	2.5/4	@5.8'-large gravel piece		
			@6.5-8'- no recovery		
7					
8			as above		
9			@8.7-coal, black		
			@8.9'-f.sand, MD, moist, lt.tan		
10	8-12	2.7/4			
11			@10.7-12- no recovery		
12			End at 12'		
13					
14					
15					
16					
17					
18					
19					
20					

Notes:

wood.

BORING NUMBER: SB-23	SOIL BORING LOG	Page 1 of 1
Project Name: SWMU 14	Driller/Method: Parmalee / DP	Date/Time Start: 3/24/21 1024
Project Location: BGS	Logged By: L-Caplinger	Date/Time End: 3/24/21 1038
Project Number: 3651200111	Water Table: 12.5' Total Depth: 16'	Weather: 55°/p. cloudy

Depth	Sample Interval	Recovery	Subsurface Description and Remarks	Samples	PID (ppm)
1			Grass/roots; fill w/ sand, silt, slag, gravel, loose, ND, moist @0.5' slag		
2	0-4	2.7/4	@0.9' - f. sand, trace c. CCR, ND, moist, tan; slag piece 1.1-1.2'		
3			@2.7-4 - no recovery		
4					
5			f sand, ND, moist, brown/grey, trace c. CCR		
6	4-8	2.9/4			
7			@6' - lt tan, no c. CCR; @6.7' - slag pieces w/ coal + f. sand, d. brown, loose		
8			@6.9 - 8' - no recovery		
9			as above; @8.1' - coal		
10	8-12	2.9/4	some orange f. sand from 8.3-8.4'; @8.8' - f. sand w/ coal, d brown/orange, ND, moist		
11			@8.9' - f sand, ND, moist, brown/grey then lt tan @9.1'; @10.9-12' - no recovery		
12					
13			as above; wet @12.5'		
14	12-16	3.2/4	some orange streaks @12.7-12.8', 13.4-13.6'		
15					
16			@15.2 - 16' - no recovery		
17			End at 16'		
18					
19					
20					

Notes:

wood.

BORING NUMBER: SB-24	SOIL BORING LOG	Page 1 of 1
Project Name: SWMU 14	Driller/Method: Raymond / DP	Date/Time Start: 3/24/21 0855
Project Location: BGS	Logged By: L-Cap[illegible]	Date/Time End: 3/24/21 0913
Project Number: 3051200111	Water Table: 12.9' Total Depth: 16'	Weather: 53° / P-Sunny

Depth	Sample Interval	Recovery	Subsurface Description and Remarks	Samples	PID (ppm)
1	0-4	3.1/4	Grass/roots; f sand, little c. CCR, MD, moist, d. brown @0.2' - silt (little silt) @0.4' - slag w/ gravel, some f. sand, d. gray, loose/MD		
2			@1.1' - f sand w/ slag, d. brown/gray, some coal @1.6 - f. CCR		
3			@1.8' - f. sand, brown/gray; slag piece @ 2.5' @3.1-4 - No recovery		
4					
5	4-8	2.9/4	f. sand, MD, moist, brown/gray		
6			coal piece @ 5.1'; slag pieces @ 5.4' orange layer @ 5.8' (<0.1'); turn lt. tan		
7			@6.9-8 - No recovery		
8					
9	8-12	3.1/4	as above @8.2' - f sand w/ coal + slag, d. brown @8.5' - orange f sand		
10			@8.6' - coal @9.2' - orange f sand @9.5' - coal		
11			@9.7' - f. sand, MD, moist, lt tan, some orange streaks until 10'		
12			@11.1-12' - No recovery		
13	12-16	3.1/4	as above wet @12.9', slightly coarser 12.9-13.1' + 13.3-13.4'		
14					
15			sat @14.7'		
16			@15.1-16' - No recovery		
17			End at 16'		
18					
19					
20					

Notes:

wood.

BORING NUMBER: SB-25	SOIL BORING LOG	Page 1 of 1
Project Name: SUMCL 14	Driller/Method: Raymond/DP	Date/Time Start: 3/24/21 0754
Project Location: BGS	Logged By: L. Capuzzo	Date/Time End: 3/24/21 0850
Project Number: 3651200111	Water Table: 12.9' Total Depth: 16'	Weather: 51°/p.cloudy

Depth	Sample Interval	Recovery	Subsurface Description and Remarks	Samples	PID (ppm)
1			Grass/roots; f. sand, trace c. CCR, lt. brown, MD, moist more c. CCR @ 0.9' (0.1')		
2	0-4	2.3/4	more c. CCR after 1.6' @1.7' slag piece, then fi CCR, M/W		
3			@2.1' - f. sand, MD, moist, lt brown @2.3-4' - No recovery		
4					
5			as above, trace fi gravel		
6	4-8	2.4/4	@5.5-5.6 - slag pieces @5.9' - coal piece		
7			@6.1' - lt tan @6.4-8' - No recovery		
8					
9			as above, lt tan f. sand, some orange/brown streaks after 8.2' @8.9' - d. brown		
10	8-12	3/4	@9' - slag @9.1' - f. sand, tan @9.2' - slag		
11			@9.3' - Coal, little f. sand @10' - f. sand, MD, moist, lt tan		
12			@11-12' - No recovery		
13			as above wet @12.9'		
14	12-16	3.1/4			
15			sat @14.7'		
16			@15.1-16' - No recovery		
17			End at 16'		
18					
19					
20					

Notes:

wood.

BORING NUMBER: SB-26	SOIL BORING LOG	Page 1 of 1
Project Name: SWMU 14	Driller/Method: Raimondo / DP	Date/Time Start: 3/23/21 1351
Project Location: BGS	Logged By: L Caplinger	Date/Time End: 3/23/21 1402
Project Number: 3651200411	Water Table: 13.5' Total Depth: 16'	Weather: 65° cloudy

Depth	Sample Interval	Recovery	Subsurface Description and Remarks	Samples	PID (ppm)
1	0-4	2.4/4	Grass/roots; f.sand, little c.ccr, trace slag, MD, moist, gray/brown		
2					
3			@2.4-4' - no recovery		
4					
5	4-8	2.7/4	as above trace c.ccr after 4.7', no slag		
6					
7			@6.7-8' - No recovery		
8					
9	8-12	2.8/4	as above, no c.ccr coal pieces @ 8.9' (<0.1') @9.1' - tan/lt tan		
10			@9.9' - d.gray @10' - coal (<0.1'); @ 10.2' - orange sand (<0.1'), then coal		
11			@10.4' - back to sand, d.gray, some orange 10.5-10.6' - coal		
12			@10.6' - f.sand, lt tan, MD, MOIST @ 10.8-12' - No recovery		
13	12-16	2.8/4	@12' - as above		
14			wet @13.5'		
15			@14.8-16' - No recovery		
16					
17			End at 16'		
18					
19					
20					

Notes:

wood.

SOIL BORING LOG

BORING NUMBER: SB-27	SOIL BORING LOG	Page 1 of 1
Project Name: SWMU 14	Driller/Method: Raimondo / DP	Date/Time Start: 3/23/21, 0744
Project Location: BGS	Logged By: L. Carlinger	Date/Time End: 3/23/21 0755
Project Number: 765120911	Water Table: 13.5' Total Depth: 16'	Weather: 51°/cloudy

Depth	Sample Interval	Recovery	Subsurface Description and Remarks	Samples	PID (ppm)
1	0-4	2.4/4	Grass/roots; f. sand, little c. CCR, MD, moist, brown, trace f. gravel; slightly darker 0.4-0.6'; some gravel pieces 0.7-0.9'; @1.1 - brown/gray		
2					
3			@2.4-4 - no recovery		
4					
5	4-8	2.2/4	as above, little c. CCR, no gravel		
6					
7			@6.2-8 - no recovery		
8					
9	8-12	2.4/4	as above, trace to no c. CCR; @8.6-8.7 - slag piece, trace f. gravel after 8.7'		
10			@9.8 - slag piece; @9.9' - coal (<0.1') (2 layers <0.1'); @10' - f. sand, MD, moist, lt. tan		
11			@10.4-12 - no recovery		
12					
13	12-16	2.7/4	as above		
14			wet @13.5'		
15			@14.7-16' no recovery		
16					
17			End at 16'		
18					
19					
20					

Notes:

wood.

SOIL BORING LOG

BORING NUMBER: SB-28 | Page 1 of 1

Project Name: SWH 14 | Driller/Method: Raymonde 10P | Date/Time Start: 3/23/21 0817

Project Location: BGS | Logged By: L. Coplenger | Date/Time End: 3/23/21 0830

Project Number: 365700111 | Water Table: 13.9' | Total Depth: 16' | Weather: 53°/cloudy

Depth	Sample Interval	Recovery	Subsurface Description and Remarks	Samples	PID (ppm)
1			Grass/roots; f.sand, little C.CCR, MD, moist, brown @0.3' - brown/gray		
2	0-4	2/4			
3			@2-4 - No recovery		
4					
5			as above slag piece @ 4.7'		
6	4-8	2.3/4			
7			@6.3-8 - No recovery		
8					
9			as above, trace c.CCR		
10	8-12	2.8/4	@9.8 - slag pieces (<0.1')		
11			@10.3 - coal; @10.4' - orange layer (<0.1') followed by glass/rock pieces @10.6' - f.sand, lt. tan, MD, moist		
12			@10.8-12 - no recovery		
13		2/2	as above		
14	12-14		wet @ 13.9'		
15	14-16	1.6/2	as above		
16			@15.6-16 - No recovery		
17			End at 16'		
18					
19					
20					

Notes:

wood.

BORING NUMBER: SB-29	SOIL BORING LOG	Page 1 of 1
Project Name: BJMU14	Driller/Method: Rainarde / DP	Date/Time Start: 3/23/21 0908
Project Location: BGS	Logged By: L. Collinger	Date/Time End: 3/23/21 0922
Project Number: 365120111	Water Table: 13.1' Total Depth: 16'	Weather: 53°/cloudy

Depth	Sample Interval	Recovery	Subsurface Description and Remarks	Samples	PID (ppm)
1			Grass/roots; f.sand w/ C.CCR, MD, moist, d. brown; some brick pieces @0.5' @0.5' - f. sand, little C.CCR, MD, moist, brown/gray		
2	0-4	2.2/4	coal piece 1" slag piece @ 1.7'		
3			@2.2-4 No recovery		
4					
5	4-8	2.6/4	as above slag - 4.4-4.5' ; 4.6' (<0.1')		
6			slag piece @ 5.1' @5.7' - brown/lt. brown, trace to no C.CCR		
7			@6.6-8' No recovery		
8					
9	8-12	2.5/4	as above, trace to no C.CCR		
10			@9.6'-9.7' coal ; @9.7' - f.sand as before, orange, MD, moist ; coal @ 9.9 & 10' (<0.1')		
11			after 10.1' several clay laminations ; @10.3' - coal (<0.1') Then f.sand, lt. tan, MD, moist		
12			@10.5-12' - No recovery		
13	12-16	2.7/4	as above		
14			wet @13.1'		
15			@14.7-16' - No recovery		
16					
17			End at 16'		
18					
19					
20					

Notes:

wood.

BORING NUMBER: SB-30	SOIL BORING LOG	Page 1 of 1
Project Name: SWMU 14	Driller/Method: Raimonde/DP	Date/Time Start: 3/23/21 1337
Project Location: BGS	Logged By: L. Caplinger	Date/Time End: 3/23/21 1348
Project Number: 3657200111	Water Table: 12.7' Total Depth: 16'	Weather: 65°/cloud

Depth	Sample Interval	Recovery	Subsurface Description and Remarks	Samples	PID (ppm)
			grass/roots; f. sand, little c-CCR, NO, moist		
1					
2	0-4	2/4	slag piece @1.4'		
3			@2-4' - No recovery		
4					
			as above		
5					
			trace c-CCR after 5', trace slag		
6	4-8	2.3/4			
7			@6.3-8' - No recovery		
8					
			as above, trace to no c-CCR		
9		2.7/4			
10	8-12		@9.1-9.3 - several orange laminations @9.4' - dk. gray/brown; @9.5' - coal, little f. sand @9.7' - f. sand, lt. tan, NO, moist		
11			@10.7-12' - No recovery		
12					
			as above		
13			wet @12.7'		
14	12-16	2.9/4			
15			@14.9-16' - No recovery		
16					
			End at 16'		
17					
18					
19					
20					

Notes:

wood.

BORING NUMBER: SB-31	SOIL BORING LOG	Page 1 of 1
Project Name: SWMU 14	Driller/Method: Ramonell/DP	Date/Time Start: 3/23/21 0759
Project Location: BGS	Logged By: L. Caplinger	Date/Time End: 3/23/21 0812
Project Number: 3051200111	Water Table: 13.7' Total Depth: 16'	Weather: 57°/cloudy

Depth	Sample Interval	Recovery	Subsurface Description and Remarks	Samples	PID (ppm)
1			Grass/roots; f. sand, little c. CCR; @0.5' gravel piece, ND, moist, brown, tan brown/gray		
2	0-4	1.9/4	@0.9' slag piece @1.9-4 - No recovery		
3					
4					
5			as above, trace gravel/slag		
6	4-8	2.4/4	slightly lighter after 5.1' @6.1 - some gravel pieces (<0.1')		
7			@6.4-8 - No recovery		
8					
9			as above, trace to no slag		
10	8-12	2.5/4			
11			@10' - coal + slag pieces with sand @10.2 - mostly coal @10.4' - f. sand, lt. tan, ND, moist @10.5-12 - No recovery		
12					
13			as above		
14	12-16	2.4/4	wet @13.7'		
15			@14.4-16 - No recovery		
16					
17			End at 16'		
18					
19					
20					

Notes:

wood.

BORING NUMBER: SB-32	SOIL BORING LOG	Page 1 of 1
Project Name: SWMU 14	Driller/Method: Raimondi / DP	Date/Time Start: 3/23/21 0841
Project Location: BGS	Logged By: L. Caplinger	Date/Time End: 3/23/21 0854
Project Number: 3651200111	Water Table: 13.9' Total Depth: 16'	Weather: 53°/cloudy

Depth	Sample Interval	Recovery	Subsurface Description and Remarks	Samples	PID (ppm)
1			grass/roots; f. sand, little c. CCR, MD, moist, brown/gray, trace slag		
2	0-4	2/4	@1.2 - slag to 1.5'; @1.6-1.7 - slag; @2-4 - no recovery		
3					
4					
5	4-8	1.9/4	as above, slag piece 4.3'		
6			@5.9 - 8 - No recovery		
7					
8					
9	8-12	2.5/4	as above, trace c. CCR, trace slag		
10			@10.2 - coal pieces (<0.1'), thin orange brown layers in f. sand, trace coal + c. CCR, trace brick		
11			@10.5 - 12 - No recovery		
12					
13	12-16	2.6/4	f. sand w/ coal, d. brown, MD, moist; @12.1 - gravel/slag piece (0.1'), thin tan f. sand, trace orange streaks, trace coal		
14			@12.5 - 12.6' - coal; @12.6' - f. sand, lt. tan, MD, moist; wet @13.9'		
15			@14.6 - 16' - no recovery		
16					
17			End at 16'		
18					
19					
20					

Notes:

wood.

SOIL BORING LOG

BORING NUMBER: SB-33

Page 1 of 1

Project Name: SWMU 14
Project Location: BGS
Project Number: 365120011

Driller/Method: Raimonde / DP
Logged By: L. Caplinger
Water Table: 12.6' Total Depth: 16'

Date/Time Start: 3/23/21 0832
Date/Time End: 3/23/21 0947
Weather: 53°/Cloudy, lt rain

Depth	Sample Interval	Recovery	Subsurface Description and Remarks	Samples	PID (ppm)
1			Grass/roots; f. sand, little c. CCR, MD, moist, brown Slag piece @ 0.4', then lighter brown; brown/gray @ 0.6'		
2	0-4	1.6/4	@ 1.6-4' - No recovery		
3					
4					
5			as above, slag piece @ 4.3' slag pieces 4.5-4.6', 4.7-4.9'; some slag after 4.9'		
6	4-8	2.6/4	@ 5.4' - f. sand, tan, MD, moist, trace to no c. CCR		
7			@ 6.6-8' - No recovery		
8					
9			as above		
10	8-12	2.6/4	@ 10-10.2' - wet, followed by orange sand layer (<0.1') Then f. sand, lt. tan, MD, moist		
11			@ 10.6-12' - No recovery		
12					
13			as above, lt tan/orangeish; lt tan after 12.6', wet		
14	12-16	3/4			
15			@ 15-16' - No recovery		
16					
17			End at 16'		
18					
19					
20					

Notes:

wood.

SOIL BORING LOG

BORING NUMBER: SB-34

Project Name: SWMU 14
Project Location: BGS
Project Number: 3651200111
Driller/Method: Raymond / DP
Logged By: L. Cahinger
Water Table: –
Total Depth: 12'
Date/Time Start: 3/24/21 1106
Date/Time End: 3/24/21 1116
Weather: 56° / p. cloudy

Depth	Sample Interval	Recovery	Subsurface Description and Remarks	Samples	PID (ppm)
			Grass/roots; Sand w/ silt, c. CCR		
1			@0.4' - slag		
			@0.9' - f. sand, trace c. CCR, tan, MD, moist		
2	0-4	3/4			
			@2.7' - brown/gray, slag piece @2.9'		
3			@3'-4' - no recovery		
4					
			as above, brown/gray		
5					
6		2.9/4			
			@6' - f. sand w/ slag + coal, lt. brown		
7	4-8		@7' - coal; f. sand layers @ 6.3, 6.5, + 6.6' (<0.1') tan orange		
			@6.9-8' - no recovery, lt tan f. sand on very bottom of core @ 6.9'		
8					
			f. sand, lt tan/orange, MD, moist		
9			lt tan after 9'		
10	8-12	3/4	orange streaks from 10.2-10.5'; brown streaks from 10.7-10.8'		
11			@11-12' - no recovery		
12					
			End at 12'		
13					
14					
15					
16					
17					
18					
19					
20					

Notes:

wood.

SOIL BORING LOG

BORING NUMBER: SB-35	SOIL BORING LOG	Page 1 of 1
Project Name: SWMU 14	Driller/Method: Raimonde/DP	Date/Time Start: 3/24/21 1043
Project Location: BGS	Logged By: L Caplinger	Date/Time End: 3/24/21 1100
Project Number: 3651200111	Water Table: 12.6' Total Depth: 16'	Weather: 56° / cloudy windy

Depth	Sample Interval	Recovery	Subsurface Description and Remarks	Samples	PID (ppm)
			Grass/roots; silty sandy topsoil		
1			@0.2' - some slag + brick pieces		
			@0.5' - slag		
2	0-4	2.6/4	@1' - f.sand, trace c.ccr, tan, ND, moist		
			@2.5' - brown/gray		
3			@2.6-4' - No recovery		
4					
			f.sand, trace c.ccr + brick, brown/gray, ND, moist		
5			slag piece @5.2' + 5.9'		
6	4-8	2.9/4			
			@6.2' - lt tan		
7			@6.4' - d.brown, trace coal		
			@6.5' - tan, some slag		
			@6.7' - slag, f.sand, coal, d.brown/orange		
8			@6.8' - coal		
			@6.9-8' - No recovery		
9			@8' - coal, little orange f.sand		
			@8.4' - orange f.sand		
10		2.9/4	some coal after 8.7', d.brown/orange		
11	8-12		@9' - f.sand, lt tan, ND, moist		
			@10.9-12' - No recovery		
12					
			as above		
13			wet @12.6'		
		3.6/4			
14	12-16				
15					
			sat @15'		
			@15.6-16' - No recovery		
16					
			End at 16'		
17					
18					
19					
20					

Notes:

wood.

BORING NUMBER: SB-36	**SOIL BORING LOG**	Page 1 of 1
Project Name: SWMU 14	Driller/Method: Raymonde / DP	Date/Time Start: 3/24/21 0832
Project Location: BGS	Logged By: L. Caplinger	Date/Time End: 3/24/21 0849
Project Number: 3657200411	Water Table: 12.9' Total Depth: 16'	Weather: 58° P. Cloudy

Depth	Sample Interval	Recovery	Subsurface Description and Remarks	Samples	PID (ppm)
1		1.2/4	Grass/ROOTS, sandy soil; boiler slag piece @ 0.1'; @0.2' - f.sand, lt brown, coal piece @ 0.5', NO moist		
2			@1.4' - brown/gray; slag pieces @1.5'		
3	0-4		@1.7-4' - No recovery		
4					
5			f. sand, trace slag, NO moist, lt tan		
6		2.9/4	orange streak @ 5'		
7	4-8		@6.9-8' - No recovery, coal at very bottom of core @6.9'		
8					
9			Coal w/ f.sand, dk brown/black; @8.3' orange f.sand		
10		2.9/4	@8.6' - coal; @8.7' - f.sand (orange) + slag; @8.8' - coal		
11	8-12		orange f.sand @ 9-9.1' + 9.2-9.3'; rest is coal		
12			@9.5' - f.sand, NO moist, lt tan, some orange streaks until 10.4'; @10.9-12' - No recovery		
13			as above, f.sand, lt tan NO moist; wet @12.9'		
14		3/4			
15	12-16		sat @14.7'; @15-16' - No recovery		
16					
17			End at 16'		
18					
19					
20					

Notes:

wood.

BORING NUMBER: SB-37	SOIL BORING LOG	Page 1 of 1
Project Name: SWMU 14	Driller/Method: Raymond/DP	Date/Time Start: 3/24/21 0813
Project Location: BGS	Logged By: L Cepl-jr	Date/Time End: 3/24/21 0828
Project Number: 3051200111	Water Table: 13.4' Total Depth: 16'	Weather: 57° / pcloudy

Depth	Sample Interval	Recovery	Subsurface Description and Remarks	Samples	PID (ppm)
1			Grass/roots; fsand, little c. CCR, MO. moist. brown/gray, trace slag @0.5'- slag pieces		
2	0-4	1.8/4	@1.8-4- NO recovery		
3					
4					
5			fsand, trace c. CCR, brown/gray, trace f gravel		
6	4-8	2.0/4	@5.4-lt. tan, no c. CCR @5.8-6'-slag		
7			@6.2'- slag pieces (<0.1')		
8			@6.0-8-NO recovery		
9			as above, fsand, lt tan MO. moist		
10	8-12	3/4	@9'-lt. brown @9.3'- brown/gray, trace slag @9.7'- CCR, trace fsand		
11			@10.3'-fsand, MO, moist, lt tan w/some light orange until 10.8'		
12			@11-12-NO recovery		
13			as above		
14	12-16	3.1/4	wet @13.4'		
15			sat @14.9'		
16			@15.1-16'- NO recovery		
17			End at 16'		
18					
19					
20					

Notes:

wood.

BORING NUMBER: SB-30	SOIL BORING LOG	Page 1 of 1
Project Name: SWMU 14	Driller/Method: Raimonde / DP	Date/Time Start: 3/23/21 1303
Project Location: BGS	Logged By: L. Caplinger	Date/Time End: 3/23/21 1317
Project Number: 3651200H1	Water Table: 13' Total Depth: 16'	Weather: 65° / Cloudy

Depth	Sample Interval	Recovery	Subsurface Description and Remarks	Samples	PID (ppm)
1			Grass/roots, f.sand, trace c. CCR, ND, moist, brown/gray		
2	0-4	2/4	@2-4' - No recovery		
3					
4			as above, trace c. CCR, trace slag		
5					
6		2.6/4			
7	4-8		@6-4' - lt tan @6.6-8' - No recovery		
8			as above, no c. CCR or slag		
9					
10	8-12	2.7/4	@9.2' - slag piece @9.3' - coal pieces w/in sand, d. brown 9.4-9.5' - Coal, @9.5' - coal pieces w/in sand as before (@0.1'), Then orange f. sand		
11			@9.7-10' - coal; 10-10.1' - orange f. sand, coal at very bottom		
12			@10.1' - fine sand, lt tan, ND, moist @10.7-12' - No recovery		
13			as above		
14	12-16	2.9/4	wet @13'		
15			@14.9-16' - No recovery		
16			End at 16'		
17					
18					
19					
20					

Notes:

wood.

BORING NUMBER: SB-39	SOIL BORING LOG	Page 1 of 1
Project Name: SWMU 14	Driller/Method: Raimonde / DP	Date/Time Start: 3/23/21 1246
Project Location: BGS	Logged By: L. Coplunjir	Date/Time End: 3/23/21 1258
Project Number: 3651200111	Water Table: 13' Total Depth: 16'	Weather: 64°/Cloudy

Depth	Sample Interval	Recovery	Subsurface Description and Remarks	Samples	PID (ppm)
1			Grass/roots; f.sand, trace c.ccr + f.gravel, MD, moist, gray/brown		
2	0-4	2.2/4			
3			@2.2-4 - No recovery		
4					
5			slag @4.2' f.sand, trace slag, MD, moist, brown/gray		
6	4-8	2.7/4			
7			@6.7-8' - No recovery		
8					
9			as above		
10	8-12	3/4	@9.1' - some slag, d. brown/gray @9.3' - coal; orange sand @9.4' (<0.1'); @9.5' - f.sand (<0.1') @10.1' - f.sand, lt tan, MD, moist, some orange layers		
11					
12			@11-12' - no recovery		
13			as above, tan & orange wet @13'		
14	12-16	3/4			
15					
16			@15-16' - No recovery		
17			End at 16'		
18					
19					
20					

Notes:

wood.

BORING NUMBER: SB-40	SOIL BORING LOG	Page 1 of 1
Project Name: SWMU 14	Driller/Method: Raimonde / DP	Date/Time Start: 3/23/21 / 1200
Project Location: BGS	Logged By: L Caplinger	Date/Time End: 3/23/21 1219
Project Number: 3651200111	Water Table: 13.2' Total Depth: 16'	Weather: 63°/ cloudy

Depth	Sample Interval	Recovery	Subsurface Description and Remarks	Samples	PID (ppm)
1			grass/roots; f. sand, some c. CCR, MD, moist, brown/gray,		
2	0-4	1.4 / 4	slag piece @1.1' @1.4-4' - no recovery		
3					
4					
5			as above, little c. CCR, trace slag		
6	4-8	2.6 / 4	~~little~~ trace to no c. CCR after 5.2', trace f. gravel		
7			@6.6-8' - no recovery		
8					
9			as above		
10	8-12	2.6 / 4	@9.7' - orange layer (<0.1'), tan slag pieces @9.8' - coal to 9.9'		
11			@9.9' - f. sand, orange; @10.1' - coal to 10.4', slag piece @10.2'		
12			@10.4' - f. sand, MD, moist, tan/orange/brown layered (<0.1'), @10.6-12' - no recovery - then lt. tan		
13			as above, f. sand, lt tan, MD, moist		
14	12-16	2.8 / 4	wet @13.2'		
15			@14.8-16' - no recovery		
16					
17			End at 16'		
18					
19					
20					

Notes:

wood.

SOIL BORING LOG

BORING NUMBER: SB-41	SOIL BORING LOG	Page 1 of 1
Project Name: SWMU 14	Driller/Method: Raimonde/DP	Date/Time Start: 3/23/21 0953
Project Location: BGS	Logged By: C. Caplinger	Date/Time End: 3/23/21 1013
Project Number: 36512001.1	Water Table: 13.4' Total Depth: 16'	Weather: 55°/p. cloudy

Depth	Sample Interval	Recovery	Subsurface Description and Remarks	Samples	PID (ppm)
1			Grass/roots; f.sand, some c. CCR, MD, moist, brown/gray, trace f. gravel		
2	0-4	1.9/2	@1.9-4' - no recovery		
3					
4			as above, little c. CCR, trace f. gravel/slag		
5					
6	4-8	2.6/4	@5.5' - slag pieces w/ f.sand, trace possible f. CCR, gray/d.gray, dense, M/W,		
7			@6.2' - f.sand, MD, moist, brown/gray @6.6-8' - no recovery		
8					
9			fine sand as before		
10	8-12	2.8/4			
11			slag piece @10.6', trace coal @10.8-12' - no recovery		
12					
13			f.sand w/coal, MD, moist, d. brown/gray @12.1' - orange f.sand, trace coal + f. gravel @12.2' - f.sand, lt. tan, MD, moist		
14		2.2/4	wet @13.4'		
15	12-16		@14.2-16' - no recovery		
16					
17			End at 16'		
18					
19					
20					

Notes:

wood.

BORING NUMBER: SB42	SOIL BORING LOG	Page 1 of 1
Project Name: SWMU 14	Driller/Method: Raimonde / DP	Date/Time Start: 3/23/21 1020
Project Location: BGS	Logged By: L. Caplinger	Date/Time End: 3/23/21 1049
Project Number: 365720°°11	Water Table: 13.4 Total Depth: 16'	Weather: 58°/M.cloudy

Depth	Sample Interval	Recovery	Subsurface Description and Remarks	Samples	PID (ppm)
1			Grass/roots; f.sand, some c.ccR, MD, moist, brown, gravel piece @ 0.3', brown/gray at 0.4', trace slag @ 0.4'		
2	0-4	1.9/4	@1.9-4' - No recovery		
3					
4					
5			f.sand as above, some slag after 4.1' @4.2' - slag w/ f.sand, little possible f. ccR, d.gray, dense		
6	4-8	3.6/4	5.5-5.7' - all slag		
7			@6.9' - f.sand, brown/gray, MD, moist, 7.1-7.2' + 7.3-7.4' - slag		
8			@7.6-8' - No recovery		
9			@8' - f.sand as above, trace f.gravel,		
10		2.8/4	@9.1 - coal piece @10.6' - f.sand w/ coal, d.brown w/ orange, MD, moist		
11	8-12		@10.8-12' - No recovery		
12					
13			Sand w/ coal as above @12.2' - f.sand, lt tan, MD, moist		
14	12-16	2.5/4	wet @ 13.4'		
15			@14.5-16' - No recovery		
16					
17			End at 16'		
18					
19					
20					

Notes:

wood.

BORING NUMBER: SB-43	SOIL BORING LOG	Page 1 of 1
Project Name: SGMM M Project Location: BGS Project Number: 365120011	Driller/Method: Ramonde / DP Logged By: L. Caplinger Water Table: – Total Depth: 12'	Date/Time Start: 3/24/21 1338 Date/Time End: 3/24/21 1351 Weather: 57° / sunny, windy

Depth	Sample Interval	Recovery	Subsurface Description and Remarks	Samples	PID (ppm)
1	0-4	2.3/4	Gravel, some silt + sand @0.2'- Slag @0.9'- f. sand, brown/gray, ND, moist, trace black streaking slightly darker 1.7-2' @2.3-4'- No recovery		
2					
3					
4					
5	4-8	2.7/4	f. sand as above, trace black + tan streaking, trace coal slightly darker after 6.1', trace coal @6.7-8'- No recovery		
6					
7					
8					
9	8-12	2.6/4	f. sand, lt tan, ND, moist @10.6'- 12'- No recovery		
10					
11					
12					
13			End at 12'		
14					
15					
16					
17					
18					
19					
20					

Notes:

wood.

BORING NUMBER: SB44	SOIL BORING LOG	Page 1 of 1
Project Name: SWMU 14	Driller/Method: Raymonde / DP	Date/Time Start: 3/24/21 1317
Project Location: BGS	Logged By: L Eplinger	Date/Time End: 3/24/21 1332
Project Number: 3651200111	Water Table: — Total Depth: 12'	Weather: 57° / p-sunny, windy

Depth	Sample Interval	Recovery	Subsurface Description and Remarks	Samples	PID (ppm)
			Grass/roots; silty sandy topsoil, some c. CCR		
1			@0.6' - f. sand, trace c-CCR + slag, MD, moist, tan brown/gray @0.9'		
2		2.8/4			
3	0-4		@2.7' - coal @2.8' - 4' - no recovery		
4					
5			f. sand, trace c. CCR, brown/gray, MD, moist, trace slag		
6	4-8	2.6/4	@5.8' - d. brown, @5.9' - f. CCR (<0.1') @6' - brown/gray layer (<0.1'), then trace slag after 6' slag piece @ 6.3'		
7			@6.4' - f. sand, lt tan w/ brown streaking, MD, moist (trace coal/organic material)		
8			@6.6-8' - no recovery		
9			as above, trace coal/organic material @ 8.3' - lt tan, some med. sand until 9'		
10	8-12	2.6/4			
11			@10.6 - 12' - No recovery		
12					
13			End at 12'		
14					
15					
16					
17					
18					
19					
20					

Notes:

wood.

BORING NUMBER: SB-45	SOIL BORING LOG	Page 1 of 1
Project Name: SWMU 14	Driller/Method: Parratt / DP	Date/Time Start: 3/24/21 1258
Project Location: BGS	Logged By: L-Caplinger	Date/Time End: 3/24/21 1310
Project Number: 3652200111	Water Table: – Total Depth: 12'	Weather: 58° / p.sunny, windy

Depth	Sample Interval	Recovery	Subsurface Description and Remarks	Samples	PID (ppm)
1			Grass/roots; silty sandy topsoil w/ c-CCR, d. brown, ND, moist @0.3'-silt w/ gravel, gray, lt, ND, dry, trace brick + coal		
2	0-4	2.9/4	@0.7'- slag, some f sand @1.2'- f sand, trace c-CCR + slag, tan, ND, moist		
3					
4			@2.9-4'- No recovery		
5			f. sand, brown/gray, trace c-CCR + coal, ND, MOIST		
6					
7	4-8	2.9/4	@6.1'- d. brown/gray, trace slag, f. CCR, + coal @6.8'- orange f-sand		
8			@6.9-8'- No recovery		
9			orange f sand, some coal @8.1'- f sand, lt tan, ND, MOIST		
10	8-12	2.9/4			
11			@10.9-12'- NO recovery		
12					
13			End at 12'		
14					
15					
16					
17					
18					
19					
20					

Notes:

wood.

BORING NUMBER: SB-46	SOIL BORING LOG	Page 1 of 1
Project Name: SWMU 14	Driller/Method: Parratt / DP	Date/Time Start: 3/24/21 1230
Project Location: BGS	Logged By: L-Capurso	Date/Time End: 3/24/21 1248
Project Number: 3605200111	Water Table: 11.5' Total Depth: 12'	Weather: 58°/ p.sunny, windy

Depth	Sample Interval	Recovery	Subsurface Description and Remarks	Samples	PID (ppm)
			Grass/roots; silty sandy topsoil		
1			@0.2' - Slag		
			@0.8' - f.sand, trace c-ccr, ND, moist, tan		
2	0-4	2.6/4			
			@2.5' - brown/gray, trace gravel, little c-ccr		
3			@2.6-4' - No recovery		
4					
			as above, trace c-ccr		
5					
			5.4-5.5' - d.brown/gray, brown + tan streaks + d.brown after 5.5'		
6	4-8	2.7/4			
			@6' - coal, some orange f.sand, trace slag		
7			@6.5' - f.sand, ND, moist		
			@6.7-8' - No recovery brown/gray		
8					
			f.sand, lt tan, ND, moist		
9	8-10	2/2			
10					
			as above		
11	10-12	2/2			
			wet @ 11.5'		
12					
			End at 12'		
13					
14					
15					
16					
17					
18					
19					
20					

Notes:

wood.

BORING NUMBER: SB47	SOIL BORING LOG	Page 1 of 1
Project Name: SWMU 14	Driller/Method: Rawnonde / DP	Date/Time Start: 3/24/21 1157
Project Location: RGS	Logged By: L. Caplinger	Date/Time End: 3/24/21 1214
Project Number: 365700111	Water Table: 12.4' Total Depth: 16'	Weather: 56°/cloudy, windy

Depth	Sample Interval	Recovery	Subsurface Description and Remarks	Samples	PID (ppm)
1			Grass/roots; silty sandy topsoil, some slag, brick, c-ccr, d-brown, ND, moist @0.5' - slag		
2	0-4	2.7/4	@0.6' - f. sand, ND, moist, tan, trace c-ccr, trace slag @2.4' - brown/gray		
3			@2.7-4' - no recovery		
4					
5			as above, brown/gray		
6		3.4/4			
7	4-8		@6.7' - d. brown/gray @6.8' - coal, some slag + f. sand		
8			@7.4-8' - no recovery		
9			as above @8.4' - orange f. sand, white slag		
10		2.6/4	@8.6' - f. sand, lt tan, ND, moist		
11	8-12		@10.6-12 - no recovery		
12					
13			as above wet @12.4'		
14	12-16	3.5/4			
15					
16			@15.5-16' - no recovery		
17			End @16'		
18					
19					
20					

Notes:

wood.

SOIL BORING LOG

BORING NUMBER: SB-48	SOIL BORING LOG	Page 1 of 1
Project Name: Swan 14	Driller/Method: Raymond / DP	Date/Time Start: 3/24/21 1115
Project Location: BGS	Logged By: L. Ccplinger	Date/Time End: 3/24/21 1145
Project Number: 3651200111	Water Table: — Total Depth: 12'	Weather: 56° / p.cloudy

Depth	Sample Interval	Recovery	Subsurface Description and Remarks	Samples	PID (ppm)
1			grass/roots; silty sandy topsoil, little c-cgr, d brown, MD, moist @0.3' - f sand, little c. cgr, MD, moist, brown/gray tan @ 0.9'		
2	0-4	2.1/4	slag pieces @ 1.9', brown/gray @2.1-4' - no recovery		
3					
4					
5			f-sand, some m-f gravel, MD, moist, lt. tan brown/gray @ 4.7', coal piece @ 4.9'		
6		2.8/4	lt tan @ 5.5'		
7	4-8		slightly darker 6.1-6.2' @6.6' - slag pieces, brown/gray @6.7' - orange f.sand, some slag		
8			@6.8-8' - no recovery		
9			f.sand, some coal, brown/gray, MD, moist @8.1' - coal w/ f sand, d brown, some orange		
10	8-12	2.9/4	coal 8.3-8.4', thin orange @ 8.5' - coal @ 9.2' - f-sand, lt tan/orange, MD, moist		
11			@10.9-12' - no recovery		
12					
13			End at 12		
14					
15					
16					
17					
18					
19					
20					

Notes: 8-12' sample stuck in rods, had to pull to remove, decided to end at 12' instead of offsetting to drill down to 16'

wood.

SOIL BORING LOG

BORING NUMBER: SB-49			
Project Name: SWMU 14	Driller/Method: Rummel / DP	Date/Time Start: 3/29/21 0913	
Project Location: BGS	Logged By: L. Cyphers	Date/Time End: 3/29/21 0934	
Project Number: 3651200111	Water Table: —	Total Depth: 12'	Weather: 37°/cloudy

Depth	Sample Interval	Recovery	Subsurface Description and Remarks	Samples	PID (ppm)
1			Grass/roots, silty sandy topsoil, d brown, NO, moist @0.2' - f sand, little c. CCR, trace slag, NO, moist, brown/gray more c. CCR 1-1.1'		
2	0-4	2/4	@2-4 - No recovery		
3					
4			f sand, trace c. CCR + slag, brown/gray, NO moist		
5			@4.8' - slag trace f. CCR in slag from 5-5.1'		
6		3/4	@5.3' - f sand, tan, NO, moist		
7	4-8		trace coal @6.7' (<0.1')		
8			@7-8' - no recovery		
9			f sand tan trace coal @8.3' (<0.1)		
10	8-12	2.7/4	brown @8.7' @9.2' - f sand + slag, brown to lt brown @9.7' - f sand, trace slag, brown/gray		
11			@9.5' coal little sand @9.7' - f sand, NO, moist, brown/gray		
12			trace coal @10' (<0.1') @10.3' - lt tan		
13			@10.7-12 no recovery End at 12'		
14					
15					
16					
17					
18					
19					
20					

Notes: 8-12' liner jammed, had to pull rods

wood.

BORING NUMBER: SB-50	SOIL BORING LOG	Page 1 of 1
Project Name: SWMU 14	Driller/Method: [illegible] / DP	Date/Time Start: 3/29/21 1010
Project Location: BGD	Logged By: [illegible]	Date/Time End: 3/29/21 1024
Project Number: 36[illegible]	Water Table: 13.1' Total Depth: 16'	Weather: 37°/Sunny

Depth	Sample Interval	Recovery	Subsurface Description and Remarks	Samples	PID (ppm)
1			Grass/roots; f sand, little C-CCR, trace slag, brown/gray, no, moist; slag piece @ 0.9'		
2		2.2/4	d. brown/gray @ 2.1'		
3	0-4		@2.2-4 - No recovery		
4					
5			as above, d. brown-gray, trace C-CCR; slag piece @ 4.5'		
6		2.7/4	@4.7' - brown/gray		
7	4-8		@6.3' - lt tan f sand, no, moist; @6.7-8 - No recovery		
8					
9			as above; brown/gray @ 8.6'		
10	8-12	3/4	@9.1' - coal, brown/orange; limo f sand @9.4' + 10' (10.1'), orange		
11			@10.3' - f sand, no, moist, brown/gray then lt tan after 10.5'		
12			@11-12 - No recovery		
13			as above; wet @ 13.1'		
14		2.7/4			
15	12-16		@14.7-16 - No recovery		
16					
17			End @ 16'		
18					
19					
20					

Notes:

wood.

SOIL BORING LOG

BORING NUMBER: SB-51 | Page 1 of 1

Project Name: SWHU M | Driller/Method: Raimondo / DP | Date/Time Start: 3/23/21 1225
Project Location: BGS | Logged By: L-Caplinger | Date/Time End: 3/23/21 1242
Project Number: 3057200111 | Water Table: 13' | Total Depth: 16' | Weather: 63°/cloudy

Depth	Sample Interval	Recovery	Subsurface Description and Remarks	Samples	PID (ppm)
1			Grass/roots; f.sand, some c. CCR, MD, moist, brown/gray		
2	0-4	2.4/4	1.8-2' - slag; then f.sand again - 2-2.1'		
			@2.1' - slag w/ f. CCR, d. brown/gray, some f.sand		
3			@2.4-4' - no recovery		
4			slag as above, little f. CCR, little f. gravel, some f.sand		
5					
6	4-8	3/4	@5.3' - f.sand, trace c. CCR, MD, moist, brown/d.brown; slag pieces @ 5.5'; brown/gray @ 5.7'		
7			@7-8' - no recovery		
8			as above, trace to no c. CCR		
9					
10	8-12	2.9/4	@9.5' - dark brown/gray, @9.7' - d. gray w/ coal pieces; @9.8 - orange <0.1'		
			@9.9 - 10.1' - coal		
11			@10.1 - f.sand, orange		
			@10.3' - f.sand w/ coal, d. gray; orange @ 10.4' (<0.1')		
12			@10.5' - f.sand, MD, lt. tan, moist		
			@10.9-12' - No recovery		
13			as above		
14	12-16	3/4	wet @13'		
15			@15-16' no recovery		
16			End at 16'		
17					
18					
19					
20					

Notes:

wood.

SOIL BORING LOG

BORING NUMBER: SB-52	SOIL BORING LOG	Page 1 of 1
Project Name: SWMU 14	Driller/Method: Rainville / DP	Date/Time Start: 3/23/21 1146
Project Location: BGS	Logged By: L. Caplinger	Date/Time End: 3/23/21 1202
Project Number: 3651200111	Water Table: 13 Total Depth: 16	Weather: 63°/Cloudy, lt. rain

Depth	Sample Interval	Recovery	Subsurface Description and Remarks	Samples	PID (ppm)
1			Grass/roots; f. sand, little c. CCR, MD, moist, brown/gray slag pieces @ 0.9' + 1.3'		
2	0-4	1.7/4	@1.7-4' - No recovery		
3					
4					
5			as above @4.2' - f. sand, little f. CCR + c. CCR, MD, d. brown/brown slag piece @ 4.6' + 4.8' @4.9-5.2' - mostly slag, little f. sand		
6	4-8	2.7/4	@5.2' - f. sand, little slag, brown; light brown/gray @5.8'		
7			@6.7-8' - No recovery		
8					
9			as above, trace slag		
10	8-12	3/4	lt brown @ 9' wood piece @ 9.8'		
11			@10.4' - some slag pieces to 10.7' @ 10.7' - coal (<0.1'), then slag @10.9' - f. sand, lt tan, MD, moist		
12			@11-12' - No recovery		
13			as above wet @ 13'		
14	12-16	2.8/4			
15			@14.8'-16' - No recovery		
16					
17			End at 16'		
18					
19					
20					

Notes:

wood.

SOIL BORING LOG

BORING NUMBER: SB-53		Page 1 of 1	
Project Name: Sutill M	Driller/Method: Raimondi / DP	Date/Time Start: 3/23/21 1055	
Project Location: BGS	Logged By: L. Cgauger	Date/Time End: 3/23/21 1155	
Project Number: 3657200111	Water Table: 13.5 Total Depth: 16	Weather: 63°/Cloudy	

Depth	Sample Interval	Recovery	Subsurface Description and Remarks	Samples	PID (ppm)
1			Grass/roots; f. sand, little C. CCR, brown/gray, MD, moist		
2	0-4	2.1/4	slag piece @1.5' + 1.8'		
3			@2.1-4'-No recovery		
4					
5			as above @4.1'- f. CCR, some brick pieces + gravel, d. gray, hard @4.6'- f. sand, some gravel, brick + c. CCR, trace f. CCR, dense, d. gray		
6	4-8	2.2/4	@5.4'- f. sand, MD, little f. gravel + slag, brown to tan		
7			@6.2-8'- No recovery		
8					
9			f. sand, trace f. gravel, lt brown, MD, moist, trace slag		
10	8-12	2.6/4			
11			@10.3'- orange lamination (<0.1') @10.5'- coal, little f. sand, black; fine sand on very bottom of coal @10.8-12'- No recovery		
12					
13			f. sand, lt tan, MD, wet		
14	12-16	2.5/4	wet at 13.5'		
15			@14.5'- 16'- No recovery		
16					
17			End at 16'		
18					
19					
20					

Notes:

wood.

BORING NUMBER: SB-54	SOIL BORING LOG	Page 1 of 1
Project Name: SWMU 14	Driller/Method: Raymond / DP	Date/Time Start: 3/30/21 1252
Project Location: BG3	Logged By: C. Copinger	Date/Time End: 3/30/21 1319
Project Number: 3169200111	Water Table: — Total Depth: 5'	Weather: 63°/sunny, breezy

Depth	Sample Interval	Recovery	Subsurface Description and Remarks	Samples	PID (ppm)
1			Grass/roots; silty sandy topsoil, d brown, MD, moist @0.2'- f sand, some c-c gr, trace slag, d brown/gray, MD, moist		
2	0-4	2.1/4	@1'- f sand + f-c gr w/ slag, dense, d brown, moist		
3			@2.1-4' - No recovery		
4					
5	4-5	1/1	as above		
6			Refusal @5'		
7					
8					
9					
0					
1					
2					
3					
4					
5					
6					
7					
8					
9					
0					

Notes: refusal @5', offset + redrilled; refusal @5' again; offset + re-drilled, refusal @5' again

wood.

SOIL BORING LOG

BORING NUMBER: SB55		Page 1 of 1	
Project Name: SWMU M	Driller/Method: Raymonte / DP	Date/Time Start: 3/30/21 1324	
Project Location: BGS	Logged By: L-Caplinger	Date/Time End: 3/30/21 1340	
Project Number: 3651200111	Water Table: 9'	Total Depth: 16'	Weather: 64° sunny breezy

Depth	Sample Interval	Recovery	Subsurface Description and Remarks	Samples	PID (ppm)
1			Grass/roots; silty sandy topsoil, d brown, mo. moist, @0.3'- f sand, some c-ccr, little c-ccr		
2	0-4	2.4/4	@0.5' - f sand + f-ccr w/ slag, dense, d brown, mo. moist, brown/grey @1.4' - f.sand, trace c.ccr, trace f gravel, brown/grey, mo. moist		
3			@2.4-4' - no recovery		
4					
5			f sand, trace c.ccr + coal, mo. moist, brown/grey		
6	4-8	2.8/4	tan @5.2-6' slag piece @ 6' + 6.2'		
7			@6.8 - 8 - no recovery		
8					
9			as above @8.1'- coal @8.3'- f.sand, lt tan, mo. moist		
10	8-12	2.7/4	wet @ 9', some lt orange from 9 - 9.6' + 10.2-10.5'		
11			@10.7-12' - no recovery		
12					
13			as above, lt tan, wet		
14	12-16'	3.5/4	lt tan/grey @ 13.1'		
15					
16			@15.5-16' - no recovery		
17			End at 16'		
18					
19					
20					

Notes:

wood.

BORING NUMBER: SB56	SOIL BORING LOG	Page 1 of 1
Project Name: SWMU 14	Driller/Method: Raimondi / DP	Date/Time Start: 3/30/21 1344
Project Location: BGS	Logged By: L. Copher	Date/Time End: 3/30/21 1359
Project Number: 3617200111	Water Table: 9.5' Total Depth: 20'	Weather: 65°/ sunny, breezy

Depth	Sample Interval	Recovery	Subsurface Description and Remarks	Samples	PID (ppm)
			grass/roots;		
1			silty sandy topsoil, little c. gravel, NO, moist, dk brown @0.4' - f. sand + f. gravel w/ slag, dense, moist, dk brown		
2	0-4	2.4/4	@1.1' - f sand, trace c. gravel, coal, + slag, NO, moist, brown/gray		
3			@2.4-4' - no recovery		
4					
5			as above		
6	4-8	2.3/4			
7			@6.3-8' - no recovery		
8					
9			as above @8.1' - coal, little f. sand		
10	8-12	2.7/4	@8.8' - f sand, trace coal in top 0.3', lt tan, NO, moist wet @9.5'		
11			@10.7-12' - no recovery		
12					
13			f sand, wet, NO, lt tan/gray @12.6 - 13.3' - organic material/peat		
14	12-16	2.2/4	@13.3' - f sand as before		
15			@14.2 - 16' - no recovery		
16					
17			as above, sat, lt tan/gray (slightly less gray than above)		
18	16-20	4/4			
19					
20					

Notes: Moved SB56 to southwest corner of grid   End at 20'

wood.

BORING NUMBER: SB-57	SOIL BORING LOG	Page 1 of 1
Project Name: SWMU 14	Driller/Method: Raymonde / DP	Date/Time Start: 3/24/21 1357
Project Location: BGS	Logged By: L Caplinger	Date/Time End: 3/24/21 1413
Project Number: 3651200111	Water Table: 13' Total Depth: 16'	Weather: 57°/pcloudy, windy

Depth	Sample Interval	Recovery	Subsurface Description and Remarks	Samples	PID (ppm)
			Grass/roots; silty sandy topsoil some c. CCR		
1			@0.3' - c. CCR		
		2.1/4	@0.4' - f. sand, MD, moist, brown/gray, some tan streaking, trace coal		
2	0-4				
			@2.1-4' - No recovery		
3					
4					
			f. sand as above, trace coal + c. CCR		
5					
			trace orange streaking @ 5.6'		
6	4-8	1.9/4	rusty darker @ 5.7'		
			@5.8' - f. sand, lt tan, MD, moist		
7			@5.9-8' - no recovery		
8					
			as above		
9					
10	8-12	2.9/4			
11			@10.9-12' - No recovery		
12					
			as above		
13			trace orange streaking from 12.8-13.1'		
			wet @ 13'		
14	12-16	2.4/4			
			@14.4-16' - No recovery		
15					
16					
			End at 16'		
17					
18					
19					
20					

Notes:

wood.

SOIL BORING LOG

BORING NUMBER: SB-58 | Page 1 of 1

Project Name: SWMU 14	Driller/Method: Rainwell / DP	Date/Time Start: 3/25/21 0931
Project Location: BGS	Logged By: L. Ceplinger	Date/Time End: 3/25/21 0942
Project Number: 3451200111	Water Table: — Total Depth: 12'	Weather: 47° / P. cloudy

Depth	Sample Interval	Recovery	Subsurface Description and Remarks	Samples	PID (ppm)
			Grass/roots; silty sandy topsoil, d brown		
1			@0.2'- Silt, some gravel + slag, gray, H, NP, moist		
2	0-4	2.7/4	@0.8'- f. sand, tan, MD, moist, little C-CCR lt tan after 1.4'		
3			@2.5'- f. sand w/ C. CCR, d brown/gray, MD, moist		
			@2.7-4'- No recovery		
4					
			f. sand, trace C-CCR, brown/gray, MD, moist, trace slag		
5					
6	4-8	2.8/4			
7			@6.6'- d. brown f. sand, trace f. CCR, MD, moist		
			@6.7- f. sand, little slag, trace CCR		
8			@6.8-8'- No recovery		
			as above, no slag		
9			@8.7'- f. sand, lt tan, MD, moist		
10		2.4/4			
11	8-12		@10.4-12'- No recovery		
12					
			End at 12'		
13					
14					
15					
16					
17					
18					
19					
20					

Notes:

wood.

BORING NUMBER: SB59	SOIL BORING LOG	Page 1 of 1
Project Name: SWMU 14	Driller/Method: Raimonde / DP	Date/Time Start: 3/25/21 0915
Project Location: BGS	Logged By: L. Copunger	Date/Time End: 3/25/21 0920
Project Number: 3651200111	Water Table: 13' Total Depth: 16'	Weather: 47°/ mcloudy

Depth	Sample Interval	Recovery	Subsurface Description and Remarks	Samples	PID (ppm)
1			Grass/roots, silty sandy topsoil, d. brown @0.2' - silt, some gravel + slag, lt, moist, gray/brown		
2	0-4	1.8/4	@1'-f. sand, tan, MD, moist, little c. CCR @1.6'- slag pieces, tan f. sand w/ c. CCR, d. brown/gray, MD, moist		
3			@1.8-4'- No recovery		
4					
5			as above, trace slag @4.9'- f. sand, little c. CCR, brown/gray, MD, moist		
6	4-8	3/4			
7			@6.3'- d. brown, trace c. CCR, trace coal + slag		
8			@7-8'- No recovery		
9			as above @8.2'- orange f. sand @8.5'- d. brown f. sand		
10	8-12	2.8/4	@8.6'- coal @8.9- f. sand, lt tan, MD, moist some orange from 9.5 - 10.5'		
11			@10.8-12'- no recovery		
12					
13			as above wet @13'		
14	12-16	3.2/4			
15					
16			@15.2 - 16'- no recovery		
17			End at 16'		
18					
19					
20					

Notes:

wood.

SOIL BORING LOG

BORING NUMBER: SB-60		Page 1 of 1
Project Name: SWMU 14	Driller/Method: Cascade/DP	Date/Time Start: 3/25/21 1021
Project Location: BGS	Logged By: L. Calager	Date/Time End: 3/25/21 1032
Project Number: 3651200111	Water Table: — Total Depth: 12'	Weather: 48°/cloudy

Depth	Sample Interval	Recovery	Subsurface Description and Remarks	Samples	PID (ppm)
1			Grass/roots; silty sandy topsoil @0.2' - f.sand, little c. CCR, brown, MD, moist		
2	0-4	2.5/4	@0.5' - f.sand w/ c.CCR, d.brown/gray, MD, moist, trace brick + slag		
3			@2.3' - Coal piece, then f. CCR (coal') @2.4' - as before (f sand w c. CCR)		
4			@2.5-4' - No recovery		
5			f.sand, trace c. CCR, brown/gray, MD moist, trace slag		
6		2.1/4	@5.1' - d.brown @5.6' - lt tan		
7	4-8		@5.9' - d.brown, little coal @6' - coal		
8			@6.1-8' - No recovery		
9			Coal as above @8.7' - f.sand, lt tan, MD, moist		
10	8-12	2.8/4			
11			@10.8-12' - No recovery		
12					
13			End at 12'		
14					
15					
16					
17					
18					
19					
20					

Notes:

wood.

BORING NUMBER: SB-61	SOIL BORING LOG	Page 1 of 1
Project Name: SWMU 14	Driller/Method: Raimonde/DP	Date/Time Start: 3/25/21 1300
Project Location: BG	Logged By: C. Caplinger	Date/Time End: 3/25/21 1312
Project Number: 3657200111	Water Table: — Total Depth: 12'	Weather: 47°/cloudy, breezy

Depth	Sample Interval	Recovery	Subsurface Description and Remarks	Samples	PID (ppm)
1	0-4	2.9/4	Grass/roots; silty sandy topsoil, d brown @0.2' - slag + gravel, some sand, brown/gray, loose/MD		
2			@1.2' - f sand, some c. CCR, d brown w/ tan streaking, MD, moist		
3			@1.7' - slag @1.8' - f sand w/ c. CCR, trace slag, d brown, MD, moist		
4			@2.8' - f sand, little c. CCR, MD, moist, brown/gray @2.9-4' - no recovery		
5	4-8	3.1/4	f sand, trace c. CCR + slag, MD, moist, brown/gray		
6			@4.9' - d brown f sand, trace slag + coal, f CCR lens @ 5.2' (coal) trace f CCR lenses after 5.2'		
7			@6.3' - tan + d brown laminations, f sand, trace coal, MD, moist		
8			@6.7' - coal, orange + d brown f sand from 6.8-6.9', then coal again; some f sand @7.1-8' - no recovery		
9	8-12	2.5/4	@8' - coal @8.2' - f sand, lt tan then brown/gray until 8.5', MD, moist		
10					
11			@10.5-12' - no recovery		
12					
13			End at 12'		
14					
15					
16					
17					
18					
19					
20					

Notes:

wood.

BORING NUMBER: SB-62	SOIL BORING LOG	Page 1 of 1
Project Name: SWMU 14	Driller/Method: Cascade/ DP	Date/Time Start: 3/25/21 1316
Project Location: BGS	Logged By: C. Calogero	Date/Time End: 3/25/21 1329
Project Number: 3657200111	Water Table: 12.6' Total Depth: 16'	Weather: 47° cloudy, breezy

Depth	Sample Interval	Recovery	Subsurface Description and Remarks	Samples	PID (ppm)
1			Grass/roots, silty sandy topsoil, d brown, little slag @0.4'-f sand, some c.CCR, trace slag, MD, moist, brown/gray		
2	0-4	1.8/4	@1.8-4 - No recovery		
3					
4					
5			f sand, trace C.CCR, trace coal, MD, moist, brown/gray brown/orange laminations @ 5.3', then tan sand, trace coal, MD, moist		
6	4-8	2.5/4	@6'-d.brown f sand, trace f.CCR lenses, some tan laminations		
7			@6.5-8' - No recovery		
8					
9			f sand, tan + brown streaked, some slag, MD, moist @8.6'- slag, w/ orange + brown f sand		
10	8-12	2.7/4	@8.8'-coal @9.4'- f sand MD, moist, brown/gray then lt tan @ 9.6' trace orange + brown streaks		
11			@10.7-12'- No recovery		
12					
13			as above, some orange from 12.3-12.5' wet @12.6'		
14	12-16	3.3/4	slightly coarser from 13.6-13.7'		
15					
16			@15.3-16'- No recovery		
17			End at 16'		
18					
19					
20					

Notes:

wood.

BORING NUMBER: SB-03		SOIL BORING LOG	Page 1 of 1
Project Name:	SWMU 14	Driller/Method: Remcke/DP	Date/Time Start: 3/29/21 0855
Project Location:	BGS	Logged By: L. Coffey	Date/Time End: 3/29/21 0908
Project Number:	3017200911	Water Table: 13.5' Total Depth: 16'	Weather: 30/Cloudy

Depth	Sample Interval	Recovery	Subsurface Description and Remarks	Samples	PID (ppm)
1			grey/moist; silty/sandy topsoil w/ c.ccr, d brown/black, ND, moist @0.3'- f sand, little c.ccr, brown/grey, ND, moist		
2	0-4	1/4	slag pieces at bottom @1-4'- No recovery		
3					
4					
5			slag @4.1'- f.sand w/ c.ccr, brown/grey, ND, moist		
6	4-8	2.7/4	@4.3'- f sand, trace c.ccr, ND, moist, brown/grey, trace slag slag pieces @ 5.2' + 5.5'		
7			@5.6'- f. sand, tan, ND, moist, trace coal @6.7-8- No recovery		
8					
9			f sand w/ coal, brown/grey f. ccr 8.2-8.3' + 8.6-8.7', sand streaked tan + d brown after 8.7'		
10		3.3/4	same slag @ 8.9' coal @9.5' (<0.1'), then f sand, little coal, brown/orange		
11	8-12		coal @9.7' (<0.1') @9.8'- coal, little f sand		
12			@10.6'- f sand, trace coal, orange at very top, then tan orange 10.9-11', slag piece @11'- tan		
13			@11.3-12- No recovery		
14		2.6/4	@12'- f sand, lt tan, ND, moist wet @ 13.5'		
15	12-16		@14.6-16'- no recovery		
16					
17			TD at 16'		
18					
19					
20					

Notes:

wood.

BORING NUMBER: SB-04	SOIL BORING LOG	Page 1 of 1
Project Name: SWMU 14	Driller/Method: Raimonde / DP	Date/Time Start: 3/29/21 1027
Project Location: BGS	Logged By: C. Cologuir	Date/Time End: 3/29/21 1038
Project Number: 3651200111	Water Table: 12.9' Total Depth: 16'	Weather: 58°/sunny, windy

Depth	Sample Interval	Recovery	Subsurface Description and Remarks	Samples	PID (ppm)
1			Grass/roots; silty sandy topsoil, little c.c.cr, d brown, MD, moist @0.3' - f sand w/ c.c.cr, MD, moist, d. brown then brown/gray after 0.5'		
2	0-4	2.3/4			
3			@2.3-4 - NO recovery		
4					
5			f sand, trace c.c.cr, brown/gray, MD, moist, trace slag		
6	4-8	2.6/4			
7			@6.6-8 - no recovery		
8					
9		2.9/4	as above brown/tan @ 8'		
10	8-12		d brown @ 8.6', trace coal brown + tan streaking @ 9' @ 9.3' - coal, some orange f sand		
11			@9.4-9.5 - orange f sand @9.5 - 9.8' - coal		
12			@9.6 - 9.8' - orange f. sand + slag / some coal @9.8 - 10.1 - coal, some f sand		
13			@10.1 - f sand, lt tan, MD, moist @10.9-12 - No recovery		
14		3.1/4	@12 - as above wet @ 12.9'		
15	12-16				
16			@15.1-16' - No recovery		
17			End @ 16'		
18					
19					
20					

Notes:

wood.

BORING NUMBER: SB-65	SOIL BORING LOG	Page 1 of 1
Project Name: [illegible]	Driller/Method: Raimondi/DP	Date/Time Start: 3/29/21 1013
Project Location: BOS	Logged By: LCGlinger	Date/Time End: 3/29/21 1057
Project Number: 3U5120011	Water Table: 12.8' Total Depth: 16'	Weather: 40°/sunny, breezy

Depth	Sample Interval	Recovery	Subsurface Description and Remarks	Samples	PID (ppm)
1			Grass/roots; f.sand, little c-cerl, d.brown, no, moist		
2	0-4	2/4	@1.1'-Slag @1.3'- f.sand, little c-cerl, d brown, no/moist		
3			slag pieces @ 2.7' (ca.1')		
4			@2-4'- No recovery		
5			as above brown/gray 4.1-4.2'		
6	4-8	2.6/4	@4.7'- f sand, trace c.cerl, trace slag, no, moist, brown/gray		
7			@6.6-8'- No recovery		
8					
9			as above		
10	8-12	2.9/4	@9.1'-coal, little f.sand some f.sand 9.5-9.6' + after 9.8'		
11			@10.1'-f sand, lt tan, no, moist		
12			@10.9-12'- No recovery		
13			as above wet @ 12.8'		
14		3/4			
15	12-16		@15-16'- No recovery		
16					
17			End at 16'		
18					
19					
20					

Notes:

wood.

SOIL BORING LOG

BORING NUMBER: SB-126			Page 1 of 1
Project Name: SWMU 14	Driller/Method: Parratt-Wolff/DP		Date/Time Start: 3/29/21 1257
Project Location: BGS	Logged By: L. Lapliney		Date/Time End: 3/29/21 1305
Project Number: 3651C0011	Water Table: 12.6'	Total Depth: 16'	Weather: 50°/sunny, breezy

Depth	Sample Interval	Recovery	Subsurface Description and Remarks	Samples	PID (ppm)
1			Grass/roots, f sand, little c. CCR, trace slag, NO, moist, brown/gray		
2		2.2/4			
3	0-4		@2.2-4' - No recovery		
4					
5			as above, little slag; silt @ 4.3', gray (<0.1'); brown/gray @ 4.4'-4.6'; brown/gray after 4.8', trace slag		
6		2.5/4	@5.9' - lt brown/gray		
7	4-8		@6.5-8 - No recovery		
8					
9		2.9/4	as above, trace coal, trace slag; @9.7' - orange-brown laminations (<0.1'); dk brown @9.8'		
10	8-12		@9.9' - coal; @10' - orange f sand		
11			@10.1' - orange f. sand + coal; @10.4 - f sand, tan/gray, NO, moist		
12			@10.7-12' - No recovery		
13			f sand, lt tan, NO, moist; wet @ 12.6'		
14		3.1/4			
15	12-16				
16			@15.1-16' - No recovery		
17			End at 16'		
18					
19					
20					

Notes:

wood.

BORING NUMBER: SB-67	SOIL BORING LOG	Page 1 of 1
Project Name: SWMU 14	Driller/Method: Raymond / DP	Date/Time Start: 3/30/21 0945
Project Location: BGS	Logged By: L. Coplinger	Date/Time End: 3/30/21 1004
Project Number: 3651200111	Water Table: 14.1' Total Depth: 16'	Weather: 55° / sunny

Depth	Sample Interval	Recovery	Subsurface Description and Remarks	Samples	PID (ppm)
1			Grass/roots; f sand, little c-CCR, trace slag, MD, moist brown/gray, tan 0.5-0.6', d brown/gray 0.7-0.9'		
2	0-4	2/4			
3			@2-4 No recovery		
4					
5			f sand, some c-CCR, MD, moist, brown/gray		
6	4-8	2.8/4	@5.2' f sand, little slag, trace c-CCR, d brown/gray, MD, moist		
7			@6.4' f sand, trace c-CCR, trace f gravel, MD, moist, tan		
8			@6.8-8' No recovery		
9			as above		
10		2.8/4			
11	8-12		@10.4' f sand, some coal, d brown, MD, moist @10.6' coal @10.7' orange f sand @10.8-12 No recovery		
12					
13			orange f sand @12.1' coal, little orange f sand, little slag at bottom		
14	12-16	2.9/4	@12.4' f sand, MD, moist, lt tan		
15			wet @14.1'		
16			@14.9-16 No recovery		
17			End at 16'		
18					
19					
20					

Notes:

wood.

BORING NUMBER: SB-68	SOIL BORING LOG	Page 1 of 1
Project Name: SWMU 14	Driller/Method: Rawlinsville / DP	Date/Time Start: 3/30/21 1006
Project Location: BGS	Logged By: L. Capuser	Date/Time End: 3/30/21 1032
Project Number: 367200111	Water Table: 12.8' Total Depth: 20'	Weather: 55°/sunny, breezy

Depth	Sample Interval	Recovery	Subsurface Description and Remarks	Samples	PID (ppm)
1			Grass/roots; f sand, some c-ccr, trace slag, no, moist, d brown/gray		
2	0-4	2.6/4	@1.6' - f. ccr + f sand w/ slag, dense, moist, d. brown		
3			@2.6-4 - no recovery		
4					
			as above, M/W		
5					
6	4-8'	3.8/4	increase in slag after 5.3'		
7					
			@7' - f. sand, dark brown/gray, no, moist, trace coal		
8			@7.8-8' - no recovery		
			as above, trace coal + trace fine gravel		
9					
10	8-12	2.8/4			
11			@10.6' - coal, little f sand @10.8 - 12' - no recovery		
12					
			as above - coal, little f sand		
13			@12.3' - f sand, lt tan, no, moist wet @12.8'		
14	12-16	2.8/4	tan/gray 12.7-12.9' + 13.1-13.6'		
15			@14.8 - 16' - no recovery		
16					
			as above		
17					
18	16-20	4/4			
19					
20					

Notes: End at 20'

wood.

BORING NUMBER: SB-69	SOIL BORING LOG	Page 1 of 1
Project Name: SWMU 161	Driller/Method: Raymonte / DP	Date/Time Start: 3/30/21 1228
Project Location: BGS	Logged By: L-Cadnger	Date/Time End: 3/30/21 1240
Project Number: 3600200411	Water Table: 8.5' Total Depth: 20'	Weather: 65°/sunny, breezy

Depth	Sample Interval	Recovery	Subsurface Description and Remarks	Samples	PID (ppm)
			Grass/roots, f sand, some c-ccr, trace slag, MD, moist, d brown/gray		
1			slag piece 0.8-0.9'		
2	0-4	2.7/4	@1.1' - f sand + f ccr, w/ slag, d brown, dense, moist @1.6' - f sand, trace c. ccr, MD, moist, brown/gray		
3			slag piece @ 2.4' @2.7-4' no recovery		
4					
5			f sand, trace c-ccr + slag, trace f gravel, brown/gray, MD, moist		
6	4-8	2.5/4	trace slag 5.8-5.9' and after 6'		
7			@6.5-8' no recovery		
8					
9			as above, tan, water @8.5' @8.6' - coal, little f sand little orange f sand after 8.8'		
10	8-12	2.7/4	@9' - f sand, trace coal, brown/gray, MD, moist		
11			no coal after 9.3'; trace organic specks after 9.3' w/ some tan layers @10.7-12' no recovery		
12					
13			f sand, brown/gray, wet, MD, lt. @12.6-13' - some organic material, d brown		
14	12-16	3.4/4	@13.4-14.1' - some organic material, d brown, roots also		
15			@14.9-15.2' - some organic material + roots, d brown tan after 15.2' @15.4-16' - no recovery		
16					
17			as above, f sand, tan, wet, MD		
18	16-20	3.5/4			
19			tan/gray 18.3-18.4'		
20			@19.5-20 - no recovery		

Notes: TD at 20'.

wood.

BORING NUMBER: SB-70	SOIL BORING LOG	Page 1 of 1
Project Name: SWMU 14	Driller/Method: Cascade / DP	Date/Time Start: 3/30/21 1211
Project Location: BGS	Logged By: L. Capriser	Date/Time End: 3/30/21 1225
Project Number: 3651200111	Water Table: 8.3' Total Depth: 16'	Weather: 61°, sunny, breezy

Depth	Sample Interval	Recovery	Subsurface Description and Remarks	Samples	PID (ppm)
1			Grassroots; silty sandy topsoil, little c. coal + slag, d brown, MD, moist		
2	0-4	2/4	@0.4' - f sand, trace c. coal + f gravel, brown/gray, MD/moist		
3			@2-4' - no recovery		
4					
5			as above @4.5-4.8' coal laminations in sand, again @5'-5.2'		
6	4-8	1.8/4	@5.2' - f sand, lt tan, MD, moist @5.8-8' - no recovery		
7					
8					
9			as above, some brown/gray + tan/orange layers throughout wet @8.3'		
10		2/4	[illegible]		
11	8-12		@10-12' - no recovery		
12					
13			as above, lt tan/tan		
14	12-16	2.4/4	@13.8-14' - organic material, d brown (peat?)		
15			@14.4-16' - no recovery		
16			End at 16'		
17					
18					
19					
20					

Notes:

wood.

SOIL BORING LOG

BORING NUMBER: SB-71		Page 1 of 1
Project Name: SUMM M	Driller/Method: Raymond / DP	Date/Time Start: 3/25/21 0730
Project Location: BSS	Logged By: L. Cooper	Date/Time End: 3/25/21 0741
Project Number: 3057200111	Water Table: — Total Depth: 12'	Weather: 44°/cloudy

Depth	Sample Interval	Recovery	Subsurface Description and Remarks	Samples	PID (ppm)
1			Grass/roots; sandy silty topsoil; @0.3'-f. sand w/c. CCR, trace slag, brown, MD, moist		
2	0-4	2.5/4	more c CCR 0.9-1', d. brown; @1'-f. sand, brown w/ tan streaks, MD, moist		
3			@1.5-1.6'-slag, then f. sand as before; @2.1-2.2'-f. CCR, then f. sand as before		
4			@2.5-4'-No recovery		
5			f. sand, MD, moist, tan; brown/gray from 4.3-4.4' 4.8-5.1'		
6	4-8	2.7/4	@5.1'-lt. brown/gray; lt tan @5.4-5.5' & 5.8-6.1'; @6.1'-f. sand, some coal, v. d. brown, dense, moist		
7			@6.7-8'-No recovery		
8					
9			as above, trace slag also; @8.7'-f. sand, lt tan/orange, MD, moist		
10	8-12	3/4			
11					
12			@11-12-No recovery		
13			End at 12'		
14					
15					
16					
17					
18					
19					
20					

Notes:

wood.

SOIL BORING LOG

BORING NUMBER: SB-72		Page 1 of 1
Project Name: SWMU 14	Driller/Method: Raimonde / DP	Date/Time Start: 3/25/21 1007
Project Location: BGS	Logged By: L Ceplinger	Date/Time End: 3/25/21 1016
Project Number: 3651200111	Water Table: — Total Depth: 12'	Weather: 47° / cloudy

Depth	Sample Interval	Recovery	Subsurface Description and Remarks	Samples	PID (ppm)
			Grass roots, silty sandy topsoil, d-brown, MD, Moist, little		
1			@0.3' - f sand, little c. CCR, MD, moist, brown/gray c. CCR		
2	0-4	2.7/4	@0.6-0.7' - slag @0.7' - f sand as above @1' - silt, little gravel + slag, gray/brown, H, NP, moist		
3			@1.1' - f sand w/ c. CCR, d-brown / gray @2.4' - silt, some gravel, gray / brown, H, NP, moist		
4			@2.6' - f. sand as before @2.7-4' - No recovery		
5			@4' - as above		
6	4-8	2.8/4	@4.1' - f sand, trace c. CCR, trace slag, brown/gray		
7			@6.8-8' - No recovery		
8					
9			as above @8.9' - coal, little slag		
10	8-12	3/4	@9.1' - f sand, lt tan, MD, moist		
11					
12			@11-12' - No recovery		
13			End at 12'		
14					
15					
16					
17					
18					
19					
20					

Notes:

wood.

SOIL BORING LOG

BORING NUMBER: SB-73		Page 1 of 1
Project Name: SWMU 14	Driller/Method: Kaimoski/DP	Date/Time Start: 3/25/21 0851
Project Location: BGS	Logged By: L. Caplinger	Date/Time End: 3/25/21 0903
Project Number: 365200911	Water Table: 12.3' Total Depth: 16'	Weather: ~50°/m. cloudy

Depth	Sample Interval	Recovery	Subsurface Description and Remarks	Samples	PID (ppm)
1	0-4	2.1/4	grass/roots, silty sandy topsoil, d. brown; slag piece @ 0.2', then f. sand, tan, MD, moist		
2			@0.5' - silt, some slg + gravel, brown/grey, lt, MP, moist; @0.9' - f. sand w/ C-CCR, d. brown/grey, MD, moist		
3			@2.1-4' - NO RECOVERY		
4					
5	4-8	2.8/4	as above; @4.8' - f. sand, trace C-CCR, brown/grey, MD moist, trace slag		
6					
7			@6.8-8' - no recovery		
8					
9	8-12	2.8/4	as above; more C CCR from 8.7-8.8'; d. brown @ 8.8', some slag; @9.1' - coal; @9.2' - f. sand, lt tan, MD, moist		
10					
11			@10.8-12' - no recovery		
12					
13	12-16	2.7/4	as above; some orange from 12.1-12.2', wet @ 12.3'		
14					
15			@14.7'-16' - no recovery		
16					
17			End at 16'		
18					
19					
20					

Notes:

wood.

BORING NUMBER: SB-74	SOIL BORING LOG	Page 1 of 1
Project Name: SWMU 14	Driller/Method: Raimondi/DP	Date/Time Start: 3/25/21 1036
Project Location: BGS	Logged By: L. Caplinger	Date/Time End: 3/25/21 1045
Project Number: 3057200111	Water Table: — Total Depth: 12'	Weather: 50° / cloudy

Depth	Sample Interval	Recovery	Subsurface Description and Remarks	Samples	PID (ppm)
1			Grass roots, silty sandy topsoil, d brown @0.2' - f. sand, brown, ND, moist		
2	0-4	1.2/4	@0.3' - slag piece, then f. sand w/ c. ccr, d brown/grey, ND, moist, trace slag		
3			@1.2-4' - No recovery		
4					
5			as above @4.7' - f. sand, trace c. ccr, trace slag, ND, moist, brown/grey		
6	4-8	2.9/4	@5.4' - d. brown, trace lenses of f. ccr @5.8' - lt tan f. sand, ND, moist, brown streaks @5.9-6.2'		
7			@6.1' - slag piece, then 100% fill material - slag, sand, silt, coal, d brown		
8			@6.9-8' - No recovery		
9			as above @8.2' - f. sand, tan w/ brown+orange streaking, ND, moist, trace slag		
10	8-12	2.7/4	@8.6' - Coal @9' - f. sand, lt tan, ND, moist		
11			@10.7-12' - No recovery		
12					
13			End at 12'		
14					
15					
16					
17					
18					
19					
20					

Notes:

wood.

BORING NUMBER: SB-75	SOIL BORING LOG	Page 1 of 1
Project Name: SWMU 14	Driller/Method: Rainmaker/DP	Date/Time Start: 3/15/21 1230
Project Location: BGS	Logged By: L. Caplinger	Date/Time End: 3/15/21 1256
Project Number: 3651200111	Water Table: — Total Depth: 12'	Weather: 50°/cloudy breezy

Depth	Sample Interval	Recovery	Subsurface Description and Remarks	Samples	PID (ppm)
1			Grass roots; silty sandy topsoil, d brown @0.2' - f sand w/ c. CCR, no moist, d brown/gray, trace slag		
2	0-4	2.7/4	increase in slag from 1.2-1.5' @1.5' - more c. CCR, d. brown/black		
3			some coal @2.2' @2.3' - f. sand, trace c. CCR, no moist, brown/gray		
4			@2.7-4' - no recovery		
5			as above d brown/black 4.4-4.5', some coal		
6	4-8	3/4	@4.9' - d. brown/gray, trace slag, some tan streaking throughout tan @6.1'		
7			@6.1' - [illegible] d brown/black w/coal @6.3' - f. sand, tan, some slag		
8			@6.6' - coal, little slag at bottom @6.8' - f sand, tan, some slag		
9			@6.9' - coal @7-8' - no recovery		
10	8-12	3.4/4	@8 - f sand w/coal @8.1' - f. sand, lt tan, no moist, trace streaks (coal) until 8.8'		
11					
12			@11.4-12' - no recovery		
13			End at 12'		
14					
15					
16					
17					
18					
19					
20					

Notes: 8-12' liner jammed in rod, able to retrieve

wood.

BORING NUMBER: SB-76	SOIL BORING LOG	Page 1 of 1
Project Name: SWMU 14	Driller/Method: Parratt/DP	Date/Time Start: 3/25/21 1333
Project Location: BGS	Logged By: L Capwyler	Date/Time End: 3/25/21 1347
Project Number: 3057200111	Water Table: — Total Depth: 12'	Weather: 47° cloudy breezy

Depth	Sample Interval	Recovery	Subsurface Description and Remarks	Samples	PID (ppm)
			Grass/roots; f sand w/ CCR, trace slag, NO, moist, d brown/gray		
1					
		2.5/4	large slag pieces 1-1.5'		
2	0-4				
3			@2.5-4' - No recovery		
4					
			f sand, trace CCR + slag, NO, moist, brown/gray, coal piece @ 4.8'		
5			@5.5-5.6' = lt tan		
6	4-8	2.5/4	@5.6' - f sand, trace f. CCR laminations, little slag, d brown, NO, moist		
7			@6.1' - tan + d brown laminated f sand, f CCR one @ 6.4' (<0.1') NO, moist		
8			@6.5-8' - No recovery		
			f sand, some slag, brown/d brown, tan @ 8.2'		
9			@8.4' - f sand w/ slag + coal, d brown, NO, moist		
		3.2/4	some orange f sand @ 8.6' (<0.1')		
10	8-12		@8.7' - coal		
			brown + orange f sand ~~8.8-8.9'~~ and 9.1-9.3', otherwise coal		
11			@9.7' - f sand, lt brown/gray, tan lt tan @ 9.8', NO, moist		
12			@11.2-12' - No recovery		
			End at 12'		
13					
14					
15					
16					
17					
18					
19					
20					

Notes:

wood.

BORING NUMBER: SB-77	**SOIL BORING LOG**	Page 1 of 1
Project Name: SWMU 14	Driller/Method: Raimondi / DP	Date/Time Start: 3/24/21 0832
Project Location: BGS	Logged By: L Ceplucha	Date/Time End: 3/24/21 0852
Project Number: 3U9200111	Water Table: 12.8' Total Depth: 16'	Weather: 30° / p. cloudy

Depth	Sample Interval	Recovery	Subsurface Description and Remarks	Samples	PID (ppm)
1			Grass/roots, silty sandy topsoil, d brown, ND, moist @0.3' - f sand w/ c. ccr, little sly, ND, moist, d brown/gray		
2	0-4	2.4/4	@1' ccr, some f sand, ND/loose @1.7 - f sand + c. ccr, d brown/gray, ND/loose, moist		
3			@2.4-4 - no recovery		
4					
5			as above @4.7' - f sand, trace c. ccr, + slag, ND, moist, brown/gray		
6	4-8	2.7/4	brown/tan @5.8'		
7			@6.3' - brown/gray, trace f ccr laminations after 6.5', trace slag, ND, moist		
8			@6.7 - 8' no recovery		
9	8-10	2/2	f sand, trace coal, + slag, ND moist, tan then brown/gray @8.4' - brown/orange f sand w/ coal		
10			@8.6' - coal, little f sand @ 8.7 + 1' (<0.1') @9.3', f sand w/ slag, tan, ND, moist		
11	10-12	2/2	@9.5' - coal @9.6' - f. sand, brown/gray, ND, moist, trace coal at very top		
12			@9.9' - f sand + slag, brown/gray, ND/loose		
13			@10.3' - f sand, little slag, ND, moist, brown/gray @11.6' - f. sand, lt tan, ND, moist		
14	12-16	4/4	wet @ 12.8'		
15					
16					
17			End at 16'		
18					
19					
20					

Notes:

wood.

BORING NUMBER: SB-7B	SOIL BORING LOG	Page 1 of 1
Project Name: SWMU 14	Driller/Method: Ramirez/DP	Date/Time Start: 3/29/21 1113
Project Location: BGS	Logged By: L. Cipolyir	Date/Time End: 3/29/21 1125
Project Number: 3657200111	Water Table: 12.8' Total Depth: 16'	Weather: 45°/Sunny, breezy

Depth	Sample Interval	Recovery	Subsurface Description and Remarks	Samples	PID (ppm)
			Grass/roots; silty sandy topsoil, d brown, no, moist		
1			@0.3' - f sand, some slag, trace c. conc, d brown, no, moist		
			Slag 0.5-0.6'		
2	0-4	2.4/4	@2.1' - d. brown/gray		
3			@2.4-4' - no recovery		
4					
			as above		
5			@4.5' - f sand, trace c. conc + slag, brown/gray, no, moist		
6	4-8	2.6/4			
7			@6.6-8' - no recovery		
8					
			as above		
9			@8.6' - trace coal, d brown/gray		
			~~d brown 8.8-8.9', more coal~~		
			brown 8.9-9', tan/brown/gray after 9'		
10	8-12	3/4	@9.5' - coal		
11			@10-10.1' - orange f sand and @10.2' (<0.1')		
			@10.3' - f sand, brown, no, moist, lt tan after 10.5'		
12			@11-12' - no recovery		
			as above		
13			wet @ 12.8'		
14	12-16	3/4			
15			slightly coarser @ 14.6' (<0.1')		
			@15-16 - no recovery		
16					
			End at 16'		
17					
18					
19					
20					

Notes:

wood.

SOIL BORING LOG

BORING NUMBER: SB-79 | Page 1 of 1

Project Name: SWMU 14 | Driller/Method: Raimonde / DP | Date/Time Start: 3/29/21 1057

Project Location: BGS | Logged By: L Caplinger | Date/Time End: 3/29/21 1109

Project Number: [illegible] | Water Table: 12.6' | Total Depth: 16' | Weather: 40°/Sunny, breezy

Depth	Sample Interval	Recovery	Subsurface Description and Remarks	Samples	PID (ppm)
			Grass/roots, silty sandy topsoil, d brown, NO, moist, trace slag		
1			@ 0.5' f sand, some c. coarse, trace slag, NO, moist,		
2	0-4	2/4	slag @ 0.9' (<0.1') + 1.4' (<0.1') d. brown/gray		
3			@2-4' - No recovery		
4					
5			f sand, trace c-coarse, slag, NO, moist, d brown/gray		
			brown/gray @ 4.7'		
6	4-8	2.7/4			
7			@6.7-8' - No recovery		
8					
9			as above		
10	8-12	2.5/4	@9.4' - d brown laminations (<0.1') [illegible] tan		
			@9.6' - brown/gray, trace coal		
11			@9.9' - coal		
			little f sand @ 7.1' (<0.1')		
12			@10.4 - f sand, lt tan, NO, moist		
			@10.5-12' - No recovery		
13			as above		
			wet @ 12.6'		
14	12-16	2.6/4	@14.1' - staining cover (<0.1')		
15			@14.6-16' - No recovery		
16					
17			End at 16'		
18					
19					
20					

Notes:

wood.

BORING NUMBER: SB-80	SOIL BORING LOG	Page 1 of 1
Project Name: SUMM 14	Driller/Method: [illegible] / DP	Date/Time Start: 3/25/21 1310
Project Location: BGS	Logged By: L Colyer	Date/Time End: 3/25/21 1323
Project Number: 365720011	Water Table: 13.1' Total Depth: 16'	Weather: 51°/sunny, breezy

Depth	Sample Interval	Recovery	Subsurface Description and Remarks	Samples	PID (ppm)
			grass/roots; silty sandy topsoil, little c. CCR, no. moist.		
1			@0.3'-f sand, trace c. CCR, trace slag, d. brown/lt. brown/gray,		
2	0-4	2/4	trace lenses f. CCR, mo. moist		
			@2-4'-No recovery		
3					
4					
			f sand as above, trace lenses f. CCR, trace slag + c. CCR		
5					
			@5.2'-f sand, trace c. CCR, mo. moist, brown/gray		
6		2.3/4			
7	4-8		@6.3-8'-No recovery		
8					
			as above, trace coal, trace slag + c. CCR still		
9					
			lt tan 9.2-9.3'		
10	8-12	2.9/4	@9.8' to brown, some coal, and c. sand @10.1'		
			@10.2' - coal + f. orange sand layers, some slag		
11			all coal 10.5-10.7'; f. orange sand @10.7', little coal		
			@10.8'-f sand, lt tan, mo. moist		
12			@10.9'-12'-No recovery		
			as above		
13					
		2.8/4	wet @13.1'		
14	12-16				
15			@14.8-16'- no recovery		
16					
			EOB at 16'		
17					
18					
19					
20					

Notes:

wood.

SOIL BORING LOG

BORING NUMBER: SB81			Page 1 of 1
Project Name: SWMU 14	Driller/Method: [illegible] / DP		Date/Time Start: 3/30/21 0932
Project Location: [illegible]	Logged By: [illegible]		Date/Time End: 3/30/21 0944
Project Number: 345207111	Water Table: 13.5'	Total Depth: 16'	Weather: 54° sunny, breezy

Depth	Sample Interval	Recovery	Subsurface Description and Remarks	Samples	PID (ppm)
1			Grass/roots; f sand, little c. CCR, ND, moist, d brown, trace slag; brown/gray @ 0.3'; tan @ 0.9-1.1'		
2	0-4	2/4	@1.1' - f sand, w/ some slag + c. CCR, ND, moist, d brown/gray		
3			@1.7' - f sand w/ silt, little c. CCR + slag, D, moist, d brown-gray; @2.4' - No recovery; possible trace f. CCR		
4					
5			f sand, some slag + c. CCR, ND, moist, d brown/gray; @4.4' - f sand w/ c. CCR, trace slag, brown/gray, ND, moist		
6	4-8	2.9/4	@5.4' - f sand, little slag + c. CCR, ND, moist, d brown/gray		
7			@6.2' - f sand, trace slag + c. CCR, tan, ND, moist, trace f gravel; @6.9-8' - No recovery		
8					
9			f sand, ND, moist, tan		
10	8-12	2.8/4	@10.3' - f sand, some coal + slag, ND, moist, d brown		
11			@10.6' - coal, little f sand; @10.8-12 - No recovery, orange f sand on very bottom of core		
12					
13			f sand, lt tan, ND, moist		
14	12-16	2.8/4	wet @13.5'		
15			@14.8-16 - No recovery		
16					
17			End at 16		
18					
19					
20					

Notes:

wood.

SOIL BORING LOG

BORING NUMBER: SB 82			Page 1 of 1
Project Name: Swmu M	Driller/Method: Parratt Wolff / DP	Date/Time Start: 3/30/21 1045	
Project Location: BGS	Logged By: L Coplinger	Date/Time End: 3/30/21 1114	
Project Number: 3U5172001111	Water Table: — Total Depth: 5'	Weather: 55° / sunny	

Depth	Sample Interval	Recovery	Subsurface Description and Remarks	Samples	PID (ppm)
1			Grass (roots), silty sandy topsoil, d. brown, NO, Moist		
2	0-4	2.1 / 4	@0.4' - f sand, little c. gravel, little c. cert slag, d brown/grey, NO, MOIST		
3			[illegible] @2-4' - No recovery		
4					
5	4-5	1/1	f. sand + f. c. gravel w/ slag, Dense, MOIST, d brown		
6			Refusal @5'		
7					
8					
9					
0					
1					
2					
3					
4					
5					
6					
7					
8					
9					
0					

Notes: Refusal @5', offset + re-drilled; refusal again @5', offset + re-drilled, refusal @5'

wood.

SOIL BORING LOG

BORING NUMBER: SB-83		Page 1 of 1
Project Name: SWMU 14	Driller/Method: Rammate/DP	Date/Time Start: 3/30/21 1117
Project Location: BGS	Logged By: L Calluger	Date/Time End: 3/30/21 1133
Project Number: 3651200011	Water Table: 10' Total Depth: 16'	Weather: 60°, m.sunny

Depth	Sample Interval	Recovery	Subsurface Description and Remarks	Samples	PID (ppm)
1			Grass/roots, f sand, some c. CCR, MD, MOIST, d brown/gray, trace slag		
2	0-4	3.1/4	@1.4' - f sand + f. CCR w/ slag, d brown, Dense, moist		
3			@2.6' - f. sand, trace c. CCR, brown/gray, MD, MOIST		
4			@3.1-4' - No recovery		
5			as above, trace f gravel + coal as well		
6	4-8	2.7/4			
7			@7-8' - No recovery		
8					
9			as above @8.8' - f sand w/ coal, little c. CCR + slag; MD, moist, d brown / gray		
10	8-12	2.6/4	@9.2' - coal, little orange f. sand		
11			@9.4' - f sand, lt tan, MD, moist wet @10' @10.6 - 12' - No recovery		
12					
13			as above		
14	12-16	3.5/4	trace organic material @13.1' (coal?)		
15					
16			@15.5 - 16' - No recovery		
17			End at 16'		
18					
19					
20					

Notes:

wood.

BORING NUMBER: SB-84	SOIL BORING LOG	Page 1 of 1
Project Name: Swpu 14	Driller/Method: Lawrence / DP	Date/Time Start: 3/30/21 1158
Project Location: BGS	Logged By: L-Coplazer	Date/Time End: 3/30/21 1259
Project Number: 3051200111	Water Table: 8.4' Total Depth: 12'	Weather: 61° / sunny windy

Depth	Sample Interval	Recovery	Subsurface Description and Remarks	Samples	PID (ppm)
1			Grass/roots, little C-CCR, d brown/grey, ND, silty sandy topsoil, moist		
2	0-4	2.1/4	@0.6' - f sand, little C-CCR, ND, moist, brown/grey, trace slag + f gravel		
3			@2.1-4' - No recovery		
4					
5			as above @4.4' - f sand, trace C-CCR + coal, brown/orange thin tan @ 4.6',		
6		2.3/4	d brown laminations @ 4.9', 5.2', 5.4' (<0.1') ND, moist		
7	4-8		@5.5' - f sand, little coal, brown, ND, moist		
8			@5.9' - coal, some f sand, gravel piece laminations @6' - f sand, lt tan, ND, moist		
9			@6.3-8' - no recovery @8' - as above		
10	8-12	2.4/4	lt tan/orange @8.4', wet		
11			@10.4-12' - No recovery		
12					
13			End at 12'		
14					
15					
16					
17					
18					
19					
20					

Notes:

wood.

SOIL BORING LOG

BORING NUMBER: SB-05	Page 1 of 1
Project Name: SWMU 14	Driller/Method: Raymond / DP	Date/Time Start: 3/25/21 0745
Project Location: SWMU 14	Logged By: L. Caplinger	Date/Time End: 3/25/21 0801
Project Number: 3651200111	Water Table: 12.8 Total Depth: 20'	Weather: 45° / cloudy

Depth	Sample Interval	Recovery	Subsurface Description and Remarks	Samples	PID (ppm)
1			Grass/roots; silty sandy topsoil, d.brown/brown slag piece @0.3'		
2		2.5/4	@0.5' - f. sand, trace c. CCR, MD, moist, brown tan streaks after 1'		
3	0-4		brown/gray @2.2' @2.5-4' - no recovery		
4					
5			f. sand, brown/gray, MD, moist, trace c. CCR		
6	4-8	3/4	@5.2' - d.brown/gray @5.5-5.7' - coal pieces in sand, trace slag after 5.7'		
7			@5.9' - brown/gray w/ tan streaks, trace coal pieces after 5.9', no c. CCR		
8			@7-8' - no recovery		
9			f. sand, little coal, d.brown/gray w/ tan streaks/laminations throughout MD, moist		
10		2.7/4			
11	8-12		@10.9-12' - no recovery		
12					
13		2.8/4	f. sand, brown/gray, MD, moist, trace coal, wet @12.8 increase in coal from 12.8-12.9', 13-13.1', + 13.3-13.4'		
14			slag piece at 12.9' orange + d.brown laminations @13.4'		
15	12-16		@13.5' - f. sand, tan/lt tan, MD, wet lt tan after 14.3'		
16			@14.8-16' - no recovery		
17			as above, saturated		
18	16-20	3.8/4			
19			Slightly darker 18.7-18.8'		
20			@19.8-20' - no recovery		

Notes: EOB at 20'

wood.

SOIL BORING LOG

BORING NUMBER: SB-06

Project Name: SWMU M	Driller/Method: Raymonde/DP	Date/Time Start: 3/25/21 0805
Project Location: BGS	Logged By: C Caplinger	Date/Time End: 3/25/21 0817
Project Number: 345720011	Water Table: 12.5' Total Depth: 16'	Weather: 45°/cloudy

Depth	Sample Interval	Recovery	Subsurface Description and Remarks	Samples	PID (ppm)
			Grass/ROB; silty sandy topsoil, d brown, ND, moist, some slag		
1			@0.6'- f. sand w/ c. CCR, d brown/gray, ND moist, trace brick		
			some slag from 0.8-0.9' + 1.4-1.5'		
2	0-4	2.6/4	@1.7'- f.sand, little c. CCR, brown/gray w/ d brown + tan laminations/streaking		
			ND, moist		
3			@2.6-4'- No recovery		
4					
			f.sand, trace c. CCR, brown/gray, ND, moist		
5			light orange 4.2-4.3' + 4.9' (coal), 5.1-5.2', 5.3-5.4'		
			some slag 4.6-4.7', 5.2' (coal)		
6	4-8	2.1/4			
			@6.1-8- No recovery		
7					
8					
			as above, f.sand, trace c. CCR, brown/gray, ND, moist		
9			@8.7'- coal, some orange f.sand after 8.9'		
			@9'- f.sand, ND, moist, lt tan		
10	8-12	2.9/4			
11			@10.9-12'- No recovery		
12					
			as above		
13			wet @12.5'		
14	12-16	2/4	@14-16'- No recovery		
15					
16			End at 16'		
17					
18					
19					
20					

Notes:

wood.

BORING NUMBER: SB-07	SOIL BORING LOG	Page 1 of 1
Project Name: SWMU 14	Driller/Method: Raimondi / DP	Date/Time Start: 3/25/21 0835
Project Location: BGS	Logged By: L. Granger	Date/Time End: 3/25/21 0847
Project Number: 3051200111	Water Table: 12.5' Total Depth: 16'	Weather: 45°/cloudy

Depth	Sample Interval	Recovery	Subsurface Description and Remarks	Samples	PID (ppm)
1			Grass/roots; silty sandy topsoil, d. brown, NO, moist fine slag after 0.3'		
2		2.7/4	@0.5' - f. sand w/ c. CCR, NO, moist, d. brown/grey, trace slag slag 0.9-1' slag 1.9-2.1'		
3	0-4		2.7-4' - no recovery		
4					
5			f. sand as above @4.2' - f. sand, tan, trace c. CCR, NO, moist		
6	4-8	2.7/4			
7			brown/grey @ 6', trace coal specks @ 6.8'		
8			@6.7-8' - no recovery		
9			f. sand, trace slag, NO, moist, tan @8.5' - coal w/ f. sand, d. brown/black, m/w		
10	8-12	2.9/4	@9.1 - f. sand, tan/gray, NO, moist, lt tan after 9.5'		
11			@10.9-12 - no recovery		
12					
13			as above wet @12.5' lt tan/orange from 13-13.3'		
14		1.9/4	@13.9-16' - no recovery		
15	12-16				
16					
17			End at 16'		
18					
19					
20					

Notes:

wood.

BORING NUMBER: SB-88

SOIL BORING LOG

Page 1 of 1

Project Name: SWMU 14
Project Location: BGS
Project Number: D6612C0111
Driller/Method: Cascade / DP
Logged By: L. Ceplugh
Water Table: 12.8' Total Depth: 16'
Date/Time Start: 3/25/21 1049
Date/Time End: 3/25/21 1101
Weather: 50° / cloudy

Depth	Sample Interval	Recovery	Subsurface Description and Remarks	Samples	PID (ppm)
1	0-4	1.8/4	Grass/root, silty sandy topsoil, MD, moist, d. brown @0.3' - f. sand w/ c. CCR, d. brown/grey, trace slag @1.8'-4' - No recovery		
2					
3					
4					
5	4-8	2.5/4	as above @4.1' - f. sand, little c. CCR, MD, moist, brown/grey slag piece at 4.2' tan from 4-4.5', some tan streaking after 4.5' slag piece @ 5.7' @5.8' - f. sand, trace c. CCR, tan + brown streaked, trace slag, MD, moist @6.5-8' - No recovery		
6					
7					
8					
9	8-12	3/4	as above @8.4' - f. sand w/ coal, d. brown + orange, MD, moist, trace slag @8.7' - f. sand, trace coal, brown/grey @8.9' - coal @9.1' - f. sand, lt. tan, MD, moist @11-12' - No recovery		
10					
11					
12					
13	12-16	3.4/4	as above WT @12.8'		
14					
15					
16			@15.4-16' - No recovery		
17			End at 16'		
18					
19					
20					

Notes:

wood.

BORING NUMBER: SB-89	SOIL BORING LOG	Page 1 of 1
Project Name: SWMU 14	Driller/Method: Raymond / DP	Date/Time Start: 3/25/21 1213
Project Location: BGS	Logged By: L. Caplusic	Date/Time End: 3/25/21 1225
Project Number: 3687200111	Water Table: 12.3' Total Depth: 16'	Weather: 50°, cloudy breezy

Depth	Sample Interval	Recovery	Subsurface Description and Remarks	Samples	PID (ppm)
1			Grass/roots; f sand w/ c. CCR, trace slag, MD, moist, d brown/gray		
2		2.5/4	@1.9' - f. sand, little c. CCR, brown/gray, MD, moist		
3	0-4		@2.5-4' - No recovery		
4					
5			loose fill material - c. CCR, sand, gravel, slag @4.7' - f sand, brown/gray, MD, moist, trace c. CCR		
6	4-8	3.2/4	@4.9-5' - f. CCR @5' - f sand, brown/gray, MD moist, trace c. CCR little f CCR 5.3-5.4'		
7			@5.9 slag w/ f sand @6.1' - Coal (<0.1'), then f. sand, lt tan		
8			slag piece @ 6.3'		
9			@6.4' - coal, little f sand f sand 6.8-6.9', then coal again		
10	8-12	2.6/4	some orange f sand after 7' @7.2-8' - No recovery		
11			@8' - Coal some brown + orange f sand after 8.3'		
12			@8.5' - f. sand, lt tan, MD, moist, orange streaking throughout @10.6-12 - No recovery		
13			as above		
14		3.1/4	wet @12.3' no orange after 12.9'		
15	12-16				
16			@15.1-16' - No recovery		
17			End at 16'		
18					
19					
20					

Notes:

wood.

BORING NUMBER: SB-90	SOIL BORING LOG	Page 1 of 1
Project Name: SWMU 14	Driller/Method: Parratt [illegible] / DP	Date/Time Start: 3/25/21 1352
Project Location: BGS	Logged By: C Colvig [illegible]	Date/Time End: 3/25/21 1427
Project Number: 3657200911	Water Table: — Total Depth: 12'	Weather: 47°/Cloudy, breezy

Depth	Sample Interval	Recovery	Subsurface Description and Remarks	Samples	PID (ppm)
1			gravel/roots, f. sand w/ c-ccr, d brown, no, moist slag 0.3-0.5'		
2	0-4	1.5/4	@0.5'- f sand, little c-ccr, no, moist, brown/gray slag 0.7-0.8', then as before slag 1.3-1.4', then as before, d brown/gray		
3			@1.5-4' - No recovery		
4					
5			f sand, trace c ccr, trace slag, d brown/gray, no, moist		
6	4-8	2.9/4	@5.1' - f sand, some slag, trace coal, tan + d brown, no, moist		
7			@7- orange f sand @8'- coal + f sand		
8			@6.5'- f sand, trace coal + slag, tan + brown streaked, no, moist ~~d brown @ 6.8'~~ @6.9-8' - no recovery		
9					
10	8-12	2.4/4	@8' - ~~[illegible]~~ as above, brown/gray, trace coal + slag		
11			~~[illegible]~~ @ 8.2-8.4' - tan, then brown/gray again		
12			@8.9' - f sand, tan/gray, tan, lt tan @ 9.1', no, moist 10.4-12 - no recovery		
13			End at 12'		
14	[illegible]				
15					
16					
17					
18					
19					
20					

Notes: 8-12' liner jammed, offset to try + get deeper, but 8-12 jammed again, ended at 12'

wood.

SOIL BORING LOG

BORING NUMBER: SB-91		Date/Time Start: 3/24/21 0816	
Project Name: SWMU 14	Driller/Method: Raimondi/DP	Date/Time End: 3/24/21 0829	
Project Location: BG	Logged By: L Keplinger	Weather: 29°/sunny	
Project Number: 3165200111	Water Table: –	Total Depth: 12'	

Depth	Sample Interval	Recovery	Subsurface Description and Remarks	Samples	PID (ppm)
			Grass/roots, f. sand + c. ccr, d brown/gray, no, moist, trace slag		
1			@0.7' - f sand, trace c. ccr, tan/brown, no, moist		
2	0-4	2.5/4	@1.7' - f sand + c. ccr, d brown/gray, no, moist		
			@2.2' - slag, little f. sand + c. ccr		
3			~~@2.5-4 - no recovery~~		
4			f sand, trace slag + c. ccr, brown/gray, no, moist; more slag 4.3-4.4'		
5			@4.4' - f sand, trace pockets/lenses of f. ccr, brown/gray w/ trace slag; tan/red brown streaking		
6	4-8	2.8/4	mostly tan w/ brown/gray streaking after 5.4', still trace lenses f. ccr		
7			@6.7' - slag		
			@6.8-8 - no recovery		
8			f sand, some ~~[illegible]~~ slag, brown/gray, no, moist; trace slag after 8.2'		
9	8-10	2/2	@8.7' - coal + f sand		
			@8.9' - f sand, trace coal, brown/gray		
10			~~@9.1' - coal + sand (@0.1'); then f. sand, trace coal + slag,~~ no, moist, tan/brown		
11	10-12	1.8/2	@10.2' - f sand, lt tan, no, moist		
12			@11.8-12' no recovery		
			End at 12'		
13					
14					
15					
16					
17					
18					
19					
20					

Notes:

wood.

SOIL BORING LOG

BORING NUMBER: SB-92			Page 1 of 1
Project Name: JWMU 14	Driller/Method: Raimondo/DP		Date/Time Start: 3/29/21 1130
Project Location: BGS	Logged By: C-Caplinger		Date/Time End: 3/29/21 1153
Project Number: 3657 [illegible]	Water Table: –	Total Depth: 12'	Weather: 45°/sunny, breezy

Depth	Sample Interval	Recovery	Subsurface Description and Remarks	Samples	PID (ppm)
1			Grass/roots; f sand w/ c. CCR, no moist, d brown/gray		
2	0-4	2.4/4	brick pieces @1.1'; little CCR after 1.4', d brown		
3			slag @1.6' (<0.1'), trace slag after 1.6'; tan sand @1.8' (<0.1')		
4			@2.4-4' - no recovery		
5	4-8	2.8/4	f sand, trace slag + c. CCR, brown/gray, no moist; tan @4.6', trace to no c. CCR, trace gravel, no moist; some orange after 5.2'		
6			coal piece 5.6'; @5.9' - brown/gray, trace coal		
7			@6.8-8' - no recovery		
8					
9	8-12	2.3/4	as above; d brown/gray @8.6', little c. CCR + slag		
10			lt tan @9.3'; some slag 9.6-9.7', little coal, brown/gray; lt tan @9.8'		
11			@10.3-12' - no recovery		
12			End at 12'		
13					
14					
15					
16					
17					
18					
19					
20					

Notes: No recovery 8-12' due to piece of slag stuck in liner, offset + redrilled 0-4' interval very similar in both; 8-12' liner jammed again, ended at 12'

wood.

BORING NUMBER: SB-93	SOIL BORING LOG	Page 1 of 1
Project Name: SWMU 14	Driller/Method: Diamonde / DP	Date/Time Start: 3/29/21 1230
Project Location: BGS	Logged By: C. Calhoun	Date/Time End: 3/29/21 1244
Project Number: 3651200ul	Water Table: 13.1' Total Depth: 16'	Weather: 48°/sunny, breezy

Depth	Sample Interval	Recovery	Subsurface Description and Remarks	Samples	PID (ppm)
1	0-4	2.3/4	grass/roots; f. sand, some c. ccr, little slag, no, moist, d brown/gray; more slag @ 0.6', 0.8', + 0.9', trace slag after 1'		
2					
3			@ 2.3-4 - No recovery		
4					
5	4-8	2.8/4	large slag piece; f. sand, little c. ccr, gray/brown, no, moist; @ 4.3' - f sand, trace c. ccr, no, moist, brown/tan, trace coal		
6			brown/gray after 5.6'		
7			@ 6.8-8 - No recovery		
8					
9	8-12	2.5/4	as above; increasing coal after 8.5'; d brown @ 8.7-8.8', more coal, little slag		
10			@ 8.8' f. sand, some slag, little coal, tan, no, moist, some brown/gray layers		
11			@ 9.7' - coal; @ 9.9' - f. sand, no, moist, tan/gray		
12			@ 10.5-12' - No recovery		
13	12-16	3.3/4	f sand as above; lt. tan @ 12.3'		
14			wet @ 13.1'		
15					
16			@ 15.3-16' - No recovery		
17			End of 16'		
18					
19					
20					

Notes:

wood.

BORING NUMBER: SB-94	SOIL BORING LOG	Page 1 of 1
Project Name: SWMU 14	Driller/Method: Raimonde / DP	Date/Time Start: 3/29/21 1330
Project Location: BGS	Logged By: L Copley	Date/Time End: 3/29/21 1350
Project Number: 365720011	Water Table: 12.2' Total Depth: 16'	Weather: 51°/sunny, breezy

Depth	Sample Interval	Recovery	Subsurface Description and Remarks	Samples	PID (ppm)
1			grass/roots; f sand, some c. ccr, d brown/gray, ND, moist, trace slag more slag from ~0.9 - 1.1'		
2	0-4	2.9/4	trace c. ccr after 1.1'		
3			@2.4' - f. ccr @2.9 - 4' - No recovery		
4					
5			f. sand, trace slag + coal, tc. ccr, ND, moist, brown/gray		
6		2.7/4			
7	4-8		@6.7-8' - No recovery		
8					
9			as above d brown + orange laminations @ 8.3'		
10	8-12	2.8/4	@8.4-8.6' coal, some sand @8.6' - f sand, lt tan, ND, moist d brown @10.1' (<0.1')		
11			@10.8-12' - No recovery		
12					
13			as above wet @12.2'		
14	12-16	3.8/4			
15			sloughy cover 14.9-15.1'		
16			@15.8 - 16' - No recovery		
17			End at 16'		
18					
19					
20					

Notes: 4-8' liner came up empty, went back down to try + retrieve sample, moved to set, offset + redrilled

wood.

BORING NUMBER: SB-95	SOIL BORING LOG	Page 1 of 1
Project Name: SWMU 14	Driller/Method: Rammed / DP	Date/Time Start: 3/30/21 0855
Project Location: BGS	Logged By: C. Caplinger	Date/Time End: 3/30/21 0929
Project Number: 3657200111	Water Table: — Total Depth: 5'	Weather: 52° / rainy

Depth	Sample Interval	Recovery	Subsurface Description and Remarks	Samples	PID (ppm)
1			Grass/roots; silty sandy topsoil, little c. CCR, d. brown, moist, no @ 0.4' - f sand w/ c. CCR, little slag, d. brown/grey, ND, moist		
2	0-4	2.3/4	@ 1.6' - silt pocket (<0.1'), grey/brown, little gravel, H, NC, NP, moist then f sand as before		
3			silt [illegible] @ 2' (same as at 1.6'), <0.1", Then slag piece, then f sand as before; slag piece @ 2.2'		
4			@ 2.3-4 - no recovery		
5	4-5	1/1	slag w/ f sand + c. CCR, d. grey/brown, ND, moist, possible trace f. CCR		
6			Refusal @ 5'		
7					
8					
9					
0					
1					
2					
3					
4					
5					
6					
7					
8					
9					
0					

Notes: 4.8' liner stalled/jammed; re-drilled (offset), jammed again @ 4.8', refusal @ 5' (slag); offset one more time + re-drilled, refusal again @ 4.7'

wood.

BORING NUMBER: SB-96	SOIL BORING LOG	Page 1 of 1
Project Name: SWMU 14	Driller/Method: Parratt-Wolff/DP	Date/Time Start: 3/30/21 0836
Project Location: BGS	Logged By: L Caplinger	Date/Time End: 3/30/21 0852
Project Number: 3057200011	Water Table: 12' Total Depth: 16'	Weather: 57°/sunny

Depth	Sample Interval	Recovery	Subsurface Description and Remarks	Samples	PID (ppm)
1			grass/roots; silty sandy topsoil, d brown, NO, moist @0.4'- f sand, some c.c.c.r + slag, NO, moist, d brown/grey		
2	0-4	2.3/4	more slag after 1.6', trace f. CCR?, d brown slag 1.7-1.8' slag 2.1-2.2'		
3			@2.5'- f sand, trace c.ccr + slag, tan, NO, moist		
4			@2.3-4' no recovery		
5			as above, trace coal also		
6	4-8	2.7/4			
7			@6.7-8' no recovery		
8					
9			as above d brown laminations @8.9'		
10	8-12	2.8/4	@9.2'- f sand w/ coal laminations, tan + d brown/black @9.4'- coal, little f sand		
11			@9.7'- f sand, NO, moist, lt tan @10.8-12- no recovery		
12					
13			as above, wet		
14	12-16	3.5/4			
15					
16			tan/grey 15.1-15.3' @15.5-16'- no recovery		
17			End at 16'		
18					
19					
20					

Notes:

wood.

SOIL BORING LOG

BORING NUMBER: SB-97		Page 1 of 1
Project Name: SWMU M	Driller/Method: Parratt-Wolff / DP	Date/Time Start: 3/30/21 0821
Project Location: BGS	Logged By: C. Cephyer	Date/Time End: 3/30/21
Project Number: 3092200111	Water Table: — Total Depth: 12'	Weather: 50°/sunny

Depth	Sample Interval	Recovery	Subsurface Description and Remarks	Samples	PID (ppm)
1			Grass/roots; f sand, trace gravel, trace c.ccR, MD moist, d brown tan tan @ 0.2'		
2	0-4	1.8/4	@1.8-4 - No recovery		
3					
4					
5			f sand, trace c.ccR + slag, MD, moist, tan/lt tan		
6	4-8	1.9/4	@5.9-8 - No recovery		
7					
8					
9			@ above @8.5' - f sand, lt tan, MD, moist		
10	8-12	2.2/4			
11			@10.2-12 - No recovery		
12					
13			End at 12'		
14					
15					
16					
17					
18					
19					
20					

Notes:

wood.

SOIL BORING LOG

BORING NUMBER: SB-98	**SOIL BORING LOG**	Page 1 of 1
Project Name: SWMU M	Driller/Method: Raimond 100	Date/Time Start: 3/25/21 0822
Project Location: BGS	Logged By: C. Caplinger	Date/Time End: 3/25/21 0831
Project Number: 305120911	Water Table: 10.7' Total Depth: 12'	Weather: 45°/cloudy

Depth	Sample Interval	Recovery	Subsurface Description and Remarks	Samples	PID (ppm)
			Grass/NOB; silty sandy topsoil		
1			@0.1' - f sand w/ c.CCR, brown/gray, trace slag, ND, moist		
2	0-4	1.9/4	slag pieces 1.5-1.6, then layer of silt (<0.1')		
3			@1.9-4' - no recovery		
4					
5			f sand, trace c.CCR, brown/gray w/ tan to brown laminations) ND, moist		
6	4-8	2.8/4	@4.6' - f sand w/ f CCR, d. brown, moist; more f sand after 5.3', tan w/ d. brown laminations mostly d brown from 5.8-6.2'		
7			@6.2' - f sand, lt tan, ND, moist, some d brown laminations until 6.3'		
8			@6.5-8' - no recovery		
9			f sand as above, lt tan, ND, moist; brown/gray @ 8.6'; tan/orange @ 8.8'; lt tan @ 9.6'		
10		2.9/4			
11	8-12		wet @ 10.7'		
12			@10.9-12 - no recovery		
13			End at 12'		
14					
15					
16					
17					
18					
19					
20					

Notes:

wood.

BORING NUMBER: SB-99	SOIL BORING LOG	Page 1 of 1
Project Name: SWMU 14	Driller/Method: Raimonde / DP	Date/Time Start: 3/25/24 1107
Project Location: BGS	Logged By: L. Caplinger	Date/Time End: 3/25/24 1117
Project Number: 3U5120011	Water Table: — Total Depth: 12'	Weather: 50° / Cloudy

Depth	Sample Interval	Recovery	Subsurface Description and Remarks	Samples	PID (ppm)
1			grass roots, f sand w/ CCR, d brown/gray, MD, moist silt @0.8' (coal)		
2	0-4	1.7/4	lrg slag piece 1.3-1.41 @1.4' - f sand tan, MD, moist, trace slag		
3			brown/gray @1.5' @1.7-4' - No recovery		
4					
5			as above, trace slag @4.2' - d. brown, trace coal + slag, trace f CCR lenses		
6		1.9/4	@4.8' - ~~brown~~ tan, no ~~f CCR lenses~~, trace coal @5.4 - brown /gray		
7	4-8		@5.8 - d. gray/brown @5.9 - 8' - No recovery		
8					
9			wood pieces @8.1' - f.sand, MD, moist, brown/gray tan talc/rock @8.2'		
10	8-12	2.2/4	lt tan @9.3'		
11			@10.2 - 12' - No recovery		
12					
13			End at 12'		
14					
15					
16					
17					
18					
19					
20					

Notes:

wood.

BORING NUMBER: SB-100	SOIL BORING LOG	Page 1 of 1
Project Name: SWMU 14	Driller/Method: Raimondi / DP	Date/Time Start: 3/25/21 1139
Project Location: BGS	Logged By: L-Caplinger	Date/Time End: 3/25/21 1149
Project Number: 2657200111	Water Table: — Total Depth: 12'	Weather: 50°, cloudy, breezy

Depth	Sample Interval	Recovery	Subsurface Description and Remarks	Samples	PID (ppm)
1			Grass/roots; silty sandy topsoil, d. brown, MD, moist @0.3' - slag		
2	0-4	2.8 / 4	@0.6' - f sand w/ c-CCR, d. brown/gray, MD, moist; trace slag		
3			@1.1-1.2' - slag, then as above trace c. CCR after 1.8'		
4			@2.4' - sand w/ coal, d. brown/black @2.6' - f. sand, MD, moist, tan @2.8-4' - no recovery		
5			@4' - f. sand, MD, moist, tan + brown/gray streaked		
6	4-8	3.2 / 4	d. brown 4.6-4.9', then brown/gray after 4.9' @5.7' - tan/orange		
7			@6.3' - lt tan/orange		
8			@7.2-8' - no recovery		
9			as above lt tan after 8.8'		
10	8-12	2.8 / 4			
11			@10.8-12' - no recovery		
12					
13			End at 12		
14					
15					
16					
17					
18					
19					
20					

Notes:

wood.

BORING NUMBER: SB-101	SOIL BORING LOG	Page 1 of 1
Project Name: SWMU-14	Driller/Method: Raymond/DP	Date/Time Start: 3/29/21 0742
Project Location: BOS	Logged By: L. Caplinger	Date/Time End: 3/29/21 0752
Project Number: 3653200111	Water Table: 10.2' Total Depth: 12'	Weather: 28°/sunny

Depth	Sample Interval	Recovery	Subsurface Description and Remarks	Samples	PID (ppm)
1			grass/roots; silty sandy topsoil, d brown, MD, moist @0.3' - f sand, some c. cgr + slag, d brown/gray, MD, moist		
2		2.4/4	@1.2' - f sand, trace c. cgr, tan/brown, moist; tan after 1.7', trace coal specks		
3	0-4		@2.4-4 - No recovery		
4					
5			As above, trace coal specks		
6		2.4/4			
7	4-8		@6.4-8 - No recovery		
8					
9			as above, no coal, lt tan		
10		2.4/4			
11			wet @ 10.2' @10.4-12 - No recovery		
12					
13			End at 12'		
14					
15					
16					
17					
18					
19					
20					

Notes:

wood.

SOIL BORING LOG

BORING NUMBER: SB/102 | Page 1 of 1

Project Name:	SWMU 14	Driller/Method:	Rapmuse / DP	Date/Time Start:	3/29/21 0805
Project Location:	BGS	Logged By:	L Caplinger	Date/Time End:	3/29/21 0812
Project Number:	3651200011	Water Table:	— Total Depth: 12'	Weather:	29°/sunny

Depth	Sample Interval	Recovery	Subsurface Description and Remarks	Samples	PID (ppm)
1			Grass/roots, silty sandy topsoil, d brown, MD, moist; @0.2'- f sand, trace rock, brown/gray, MD, moist		
2	0-4	2.2/4	@0.7- f sand and c. rock, brown/gray, MD, moist, trace brick		
3			@1.9'- f. sand, MD, moist, brown/gray, trace slag; lt tan @ 2'		
4			@2.2-4 - no recovery		
5			as above, no slag		
6	4-8	2.6/4			
7			@6.6-8 - No recovery		
8					
9			as above		
10	8-12	2.1/4			
11			@10.1-12 - No recovery		
12					
13			End at 12'		
14					
15					
16					
17					
18					
19					
20					

Notes:

wood.

SOIL BORING LOG

BORING NUMBER: SB-103

Project Name: SWMU 14
Project Location: BGS
Project Number: 3657200111

Driller/Method: Parnassio/DP
Logged By: L. Caplinger
Water Table: –
Total Depth: 8'

Date/Time Start: 3/29/21 1215
Date/Time End: 3/29/21 1226
Weather: 48°/sunny, breezy

Depth	Sample Interval	Recovery	Subsurface Description and Remarks	Samples	PID (ppm)
			Grass/roots; f.sand, little c.clk, MD, moist, d brown		
1			@0.5' - f.sand + c.clk, MD/loose, d brown/black, moist		
2	0-4	2.4/4	@1.8' - f.sand, trace c.clk, brown/gray, MD, moist		
3			@2.2' - f.sand, tan, MD, moist @2.4-4 - no recovery		
4					
5			as above, lt tan		
6	4-8	2.9/4			
7			@6.9-8' - no recovery		
8					
9			End at 8'		
0					
1					
2					
3					
4					
5					
6					
7					
8					
9					
0					

Notes:

wood.

BORING NUMBER: SB-104	SOIL BORING LOG	Page 1 of 1
Project Name: SWMU 14	Driller/Method: Raymond/DP	Date/Time Start: 3/29/21 1357
Project Location: BGS	Logged By: US	Date/Time End: 3/29/21 1501
Project Number: 3657200111	Water Table: — Total Depth: 8'	Weather: 57°/sunny, breezy

Depth	Sample Interval	Recovery	Subsurface Description and Remarks	Samples	PID (ppm)
			grass/roots, f-sand, some c-CCR, d brown, MD, moist		
1			@0.4' - f.sand + C-CCR, hollow, moist, d brown/black		
			@1.4' - f sand, trace C-CCR, MD, moist, brown/grey, some d. brown laminations		
2		2.9			
3	0-4	4	@2.2' - f sand, lt tan, MD, moist		
			@2.9-4' - no recovery		
4					
			as above		
5					
6		2.5			
7	4-8	4	@6.5-8' - no recovery		
8					
9			End at 8'		
0					
1					
2					
3					
4					
5					
6					
7					
8					
9					
0					

Notes:

wood.

BORING NUMBER: SB-105	SOIL BORING LOG	Page 1 of 1
Project Name: SCAHU 14	Driller/Method: Raymonde / DP	Date/Time Start: 3/30/21 0719
Project Location: [illegible]	Logged By: L. Caplinger	Date/Time End: 3/30/21 0726
Project Number: 3651 00111	Water Table: — Total Depth: 8'	Weather: 46° Sunny

Depth	Sample Interval	Recovery	Subsurface Description and Remarks	Samples	PID (ppm)
1			Grass/[illegible]; Sandy silt, some slag, d brown, [illegible], moist, moist @0.4' - f sand, trace silt + slag, brown/gray		
2	0-4	2/4	@1.6' - f sand, lt tan, [illegible], moist		
3			@2-4 - no recovery		
4					
5			as above		
6	4-8	2.7/4	brown @ 6.2' (<0.1')		
7			@6.7-8 - no recovery		
8					
9			End at 8'		
0					
1					
2					
3					
4					
5					
6					
7					
8					
9					
0					

Notes:

wood.

BORING NUMBER: SB106	SOIL BORING LOG	Page 1 of 1
Project Name: SWMU 14	Driller/Method: Rainbow/DP	Date/Time Start: 3/10/24 0742
Project Location: BGS	Logged By: Lccphy	Date/Time End: 3/10/24 0751
Project Number: 3657ZOOD11	Water Table: 9.6' Total Depth: 12'	Weather: 46°/sunny

Depth	Sample Interval	Recovery	Subsurface Description and Remarks	Samples	PID (ppm)
1			Grass mat, silty sandy topsoil, d brown, MD, moist; some gravel + slag @ 0.2'		
2	0-4	2.5/4	@0.4' - f sand, trace c. CCR + slag, brown/gray, MD, moist; @1' - f sand w/ c. CCR, MD, moist, d brown		
3			some slag; more slag 1.4-1.6'; @1.8' - f sand, trace c. CCR + slag, MD, moist, brown/gray		
4			lt tan 2.2 - 2.3, then some tan + d brown streaks after 2.3'		
			@2.5' - no recovery		
5			@4 - as above; @4.3' - f sand w/ c. CCR + slag, MD, moist, d brown		
6		2.7/4	@4.7' - f sand, trace c. CCR + slag, MD, moist, tan + brown layered		
7	4-8		@5.4' - f sand, lt tan, MD, moist; @6.7-8 - no recovery		
8					
9			as above		
10	8-12	2.8/4	wet @ 9.6'		
11			@10.8-12 - no recovery		
12					
13			End at 12'		
14					
15					
16					
17					
18					
19					
20					

Notes:

wood.

BORING NUMBER: SB-107	**SOIL BORING LOG**	Page 1 of 1

Project Name:	SWMU 14	Driller/Method:	Ramundo/DP	Date/Time Start:	3/30/21 0812
Project Location:	BGS	Logged By:	LCaluyer	Date/Time End:	3/30/21 0818
Project Number:	3651200111	Water Table:	— Total Depth: 8'	Weather:	50°/sunny

Depth	Sample Interval	Recovery	Subsurface Description and Remarks	Samples	PID (ppm)
1			Grass/roots; f. sand, trace c. sand + slag, trace coal, d brown, MD, moist to @ 0.3'		
2	0-4	2.2/4			
3			@ 2.2-4 - No recovery		
4					
5			f. sand, lt tan, MD, moist		
6	4-8	2.4/4			
7			@ 6.4-8 - No recovery		
8					
9			End at 8'		
0					
1					
2					
3					
4					
5					
6					
7					
8					
9					
0					

Notes:

wood.

BORING NUMBER: SB-108	SOIL BORING LOG	Page 1 of 1
Project Name: SWMU 14	Driller/Method: Raymonde / DP	Date/Time Start: 3/25/21 1123
Project Location: BGS	Logged By: L. Cooper	Date/Time End: 3/25/21 1134
Project Number: 3651200111	Water Table: 10.3' Total Depth: 12'	Weather: 50° cloudy windy

Depth	Sample Interval	Recovery	Subsurface Description and Remarks	Samples	PID (ppm)
1			Grass roots; f sand, some c-sand, dk brown, no moist, trace slag		
2	0-4	2.1/4	@1.1' - f sand, lt tan, NO, moist @1.9' - brown @2.1-4' - No recovery		
3					
4					
5			f sand as before, brown/tan brown/gray 4.1-4.2' and after 4.4'		
6	4-8	2.3/4	@4.7' - d. brown lamination (<0.1') + @5' (<0.1') brown 5.1-5.3'		
7			@5.3' - d. brown lamination (<0.1'), tan brown/gray @5.6' d brown lamination (<0.1')		
8			@5.9' - brown/orange/tan @6.3-8 - no recovery		
9			as above, f. sand, tan/orange, NO, moist lt tan @ 8.9'		
10	8-12	2.7/4			
11			wet @10.3' @10.7-12' - No recovery		
12					
13			End at 12'		
14					
15					
16					
17					
18					
19					
20					

Notes:

wood.

BORING NUMBER: SB-109	SOIL BORING LOG	Page 1 of 1
Project Name: SWMU 14	Driller/Method: Ramonde / DP	Date/Time Start: 3/25/21 0730
Project Location: BGS	Logged By: L. Kaplinski	Date/Time End: 3/25/21 0740
Project Number: 3605720011	Water Table: 10' Total Depth: 12'	Weather: 28°/Sunny

Depth	Sample Interval	Recovery	Subsurface Description and Remarks	Samples	PID (ppm)
1			grass/rob, silty sandy topsoil, d brown, MD. moist @0.4'- f sand, trace gravel(s), tan/brown, MD. moist		
2	0-4	2.3/4	d.brown/gray @ 1.3', some d.brown/black streaks @2.2'- brown trace coal(s)		
3			@2.3-4'- No recovery		
4					
5			f. sand, MD, moist, tan/orange @4.7'- lt tan		
6	4-8	1.8/4			
7			@5.8-8'- No recovery		
8					
9			as above		
10	8-12	2.6/4			
11			wet @ 10' @10.6-12'- No recovery		
12					
13			End at 12'		
14					
15					
16					
17					
18					
19					
20					

Notes:

wood.

BORING NUMBER: SB-110	SOIL BORING LOG	Page 1 of 1
Project Name: SWMU 14	Driller/Method: Parratt-Wolff/DP	Date/Time Start: 3/24/21 0756
Project Location: BGS	Logged By: C. Collinger	Date/Time End: 3/24/21 0803
Project Number: 3657200111	Water Table: — Total Depth: 8'	Weather: 29°/sunny

Depth	Sample Interval	Recovery	Subsurface Description and Remarks	Samples	PID (ppm)
1			0-0.4' GRASS/ROOTS, sandy topsoil, d. brown, NP, moist, some slag + gravel @0.4' - f sand, brown/gray, trace c. rock, coal, + slag		
2	0-4	2/4	@1' - f sand, lt tan, NP, moist		
3			@2-4 - No recovery		
4					
5			as above		
6	4-8	2.6/4			
7			@6.6-8 - No recovery		
8					
9			End at 8'		
0					
1					
2					
3					
4					
5					
6					
7					
8					
9					
0					

Notes:

wood.

SOIL BORING LOG

BORING NUMBER: SB-111

Page 1 of 1

Project Name: SWMU 14
Project Location: BGS
Project Number: 3651200111

Driller/Method: Raimondi/DP
Logged By: L-Cagnuzzi
Water Table: – Total Depth: 8'

Date/Time Start: 3/29/21 1157
Date/Time End: 3/29/21 1202
Weather: 45°/sunny, breezy

Depth	Sample Interval	Recovery	Subsurface Description and Remarks	Samples	PID (ppm)
			grass roots; silty sandy topsoil, little clay, no moist, d brown		
1			@.4'- f sand, no. moist, tan/lt tan		
2		2.9/4			
3	0-4		@2.9-4'- No recovery		
4					
			as above		
5			slightly coarser 4.8-5'		
6		2.5/4			
7	4-8		@6.5-8'- No recovery		
8					
9			End at 8'		
0					
1					
2					
3					
4					
5					
6					
7					
8					
9					
0					

Notes:

wood.

BORING NUMBER: SB-112	SOIL BORING LOG	Page 1 of 1
Project Name: SWMU 14	Driller/Method: Parratt-Wolff / DP	Date/Time Start: 3/25/21 1200
Project Location: BGS	Logged By: L. Caplinger	Date/Time End: 3/25/21 1214
Project Number: 3657200111	Water Table: — Total Depth: 8'	Weather: 48° / sunny, breezy

Depth	Sample Interval	Recovery	Subsurface Description and Remarks	Samples	PID (ppm)
1			Grass/roots, silty sandy topsoil, ND, moist, d brown, trace @ 0.5' - f sand, trace gravel + slag, ND, [illegible]		
2	0-4	2.5 / 4	@ 1.1' moist, tan/brown f sand, lt tan, ND, moist		
3			@ 2.5-4' - No recovery		
4					
5			as above		
6	4-8	2.7 / 4			
7			@ 6.7-8' - No recovery		
8					
9			End at 8'		
0					
1					
2					
3					
4					
5					
6					
7					
8					
9					
0					

Notes:

wood.

BORING NUMBER: SB-113	SOIL BORING LOG	Page 1 of 1
Project Name: SWMU 14	Driller/Method: Rannonite / DP	Date/Time Start: 3/29/21 1405
Project Location: Bldg	Logged By: L Coplinger	Date/Time End: 3/29/21 1410
Project Number: 3651200911	Water Table: — Total Depth: 8'	Weather: 53° / Sunny, breezy

Depth	Sample Interval	Recovery	Subsurface Description and Remarks	Samples	PID (ppm)
1			grass/roots; fsand, trace slag, c-ccrk, dk brown, NO, moist; @0.5' - fsand, trace c.cck, brown/gray, NO, moist		
2	0-4	2.1/4	tan @ 1.4', trace coal after 1.4', lt tan @ 1.8'		
3			@2.1-4' - no recovery		
4					
5			F sand, lt tan, NO, moist		
6	4-8	2/4			
7			@6-8' - no recovery		
8					
9			End at 8'		
0					
1					
2					
3					
4					
5					
6					
7					
8					
9					
0					

Notes:

wood.

SOIL BORING LOG

BORING NUMBER: SB-114		Page 1 of 1
Project Name: JWHU 14	Driller/Method: Rainvarde/DP	Date/Time Start: 3/29/21 1416
Project Location: BGS	Logged By: L. Copinger	Date/Time End: 3/29/21 1422
Project Number: 3652200111	Water Table: — Total Depth: 8'	Weather: 53°/sunny, breezy

Depth	Sample Interval	Recovery	Subsurface Description and Remarks	Samples	PID (ppm)
1			Grass/roots; silty sandy topsoil, brown/dk brown, NO, moist @0.3'-f sand, brown, NO, moist		
2	0-4	2.6/4	@0.5'-f sand, little slag, dk brown, NO, moist @0.6'-f sand, trace c. CCR, brown/grey, some tan, NO, moist		
3			@1.4'-f sand, NO, moist, tan, eff tan after 1.7'		
4			@2.6-4'-no recovery		
5			as above		
6	4-8	2.6/4			
7			@6.6-8'-no recovery		
8					
9			End at 8'		
0					
1					
2					
3					
4					
5					
6					
7					
8					
9					
0					

Notes:

wood.

SOIL BORING LOG

BORING NUMBER: SB-115

Page 1 of 1

Project Name: SWMU 14
Project Location: BGS
Project Number: 3657200?1
Driller/Method: Rainmaker/PP
Logged By: L. Caphyi
Water Table: —
Total Depth: 8'
Date/Time Start: 3/15/21 0735
Date/Time End: 3/15/21 0740
Weather: 46°/sunny

Depth	Sample Interval	Recovery	Subsurface Description and Remarks	Samples	PID (ppm)
1			grass/roots; silty sandy topsoil @0.2' slag		
2	0-4	0.5/4	@0.3' f sand, lt tan, no moist @0.5-4 - no recovery		
3					
4					
5			as above		
6	4-8	2.6/4			
7			@2.6-8' - no recovery		
8					
9			End at 8'		
0					
1					
2					
3					
4					
5					
6					
7					
8					
9					
0					

Notes:

wood.

BORING NUMBER: SB-116	SOIL BORING LOG	Page 1 of 1
Project Name: Hutch M	Driller/Method: Raimonde / DP	Date/Time Start: 3/30/21 0755
Project Location: 13(3	Logged By: L. Coplinger	Date/Time End: 3/30/21 0840
Project Number: 765120011	Water Table: — Total Depth: 8	Weather: 48°/sunny

Depth	Sample Interval	Recovery	Subsurface Description and Remarks	Samples	PID (ppm)
1			Grass/roots; silty sandy topsoil, d brown, MD, moist @0.4' - f. sand, trace c. CCR + slag, brown/gray, MD, moist		
2	0-4	2.4/4	d brown 1.3-1.4', some slag, trace coal @1.4' - f. sand, lt tan, MD, moist		
3			@2.4-4 - no recovery		
4					
5			as above		
6	4-8	2.2/4	d. brown laminations 5.5-5.7', trace organics		
7			@6.2-8 - no recovery		
8					
9			End at 8'		
0					
1					
2					
3					
4					
5					
6					
7					
8					
9					
0					

Notes:

wood.

BORING NUMBER: SB-117	SOIL BORING LOG	Page 1 of 1
Project Name: SWMU 14	Driller/Method: Rainbow DE/DP	Date/Time Start: 3/30/21 0804
Project Location: BGS	Logged By: L Capizzi	Date/Time End: 3/30/21 0809
Project Number: 3459200111	Water Table: – Total Depth: 8'	Weather: 48°/Sunny

Depth	Sample Interval	Recovery	Subsurface Description and Remarks	Samples	PID (ppm)
1			Grass/roots; fi sand, NP, moist, brown, trace coal		
2	0-4	2.2/4	tan @ 0.3' d brown @ 0.7' (<0.1'), coal piece		
3			slag pieces @ 1' lt tan @ 1.4', no coal		
4			@ 2.2-4 - No recovery		
5			as above		
6	4-8	2.4/4			
7			@ 6.4-8 - No recovery		
8					
9			End at 8'		
0					
1					
2					
3					
4					
5					
6					
7					
8					
9					
0					

Notes:

wood.

BORING NUMBER: SB-118	SOIL BORING LOG	Page 1 of 1
Project Name: SWMU 14	Driller/Method: Raymond/PP	Date/Time Start: 3/30/21 1405
Project Location: BGS	Logged By: C. Caplinger	Date/Time End: 3/30/21
Project Number: 3057200111	Water Table: — Total Depth: 2'	Weather: 65°/sunny, breezy

Depth	Sample Interval	Recovery	Subsurface Description and Remarks	Samples	PID (ppm)
1	0-2	1.8/2	Grass/roots; silty sandy topsoil, trace c. conc, d brown, moist; @0.2' - f sand, some c. conc + slag, d brown/gray, moist		
2			@0.9' - f. sand + slag, some possible f conc, d brown, dense, moist; no moist (0.9-1.1' in 2nd boring - black sparkly rock)		
3			Refusal @2'; pulled/dug out large chunk of rock/debris (0.7' diameter)		
4					
5					
6					
7					
8					
9					
0					
1					
2					
3					
4					
5					
6					
7					
8					
9					
0					

Notes: refusal @ ~2', offset + re-drilled; refusal @ 2' again

wood.

SOIL BORING LOG

BORING NUMBER: SB-119

Project Name:	SWMU 14	Driller/Method:	Raymond / PP	Date/Time Start:	3/30/21 1425
Project Location:	BGS	Logged By:	L. Caplinger	Date/Time End:	3/30/21 1430
Project Number:	3057200041	Water Table:	– Total Depth: 2.4'	Weather:	68°/sunny, breezy

Depth	Sample Interval	Recovery	Subsurface Description and Remarks	Samples	PID (ppm)
1	0-2.4	2.4/2.4	Gravel, little sand + CCR, d. gray, dense, moist; mostly gravel/slag after 0.4'; 0.4'-f sand w/slag, little c. CCR + gravel, possible little f CCR, d. brown, dense, moist		
2					
3			Refusal @ 2.4'		
4					
5					
6					
7					
8					
9					
0					
1					
2					
3					
4					
5					
6					
7					
8					
9					
0					

Notes:

wood.

BORING NUMBER: SB120	SOIL BORING LOG	Page 1 of 1
Project Name: SWMU 14	Driller/Method: Raimonde/DP	Date/Time Start: 3/30/21 1438
Project Location: BGS	Logged By: L-Colpier	Date/Time End: 3/30/21 1449
Project Number: 3651 00111	Water Table: 9.1' Total Depth: 12'	Weather: 68°/Sunny, breezy

Depth	Sample Interval	Recovery	Subsurface Description and Remarks	Samples	PID (ppm)
1			Gravel + slag w/ f sand, little c CCR + coal, dense, moist @0.8' - f sand, some coal, d brown/gray, d brown possible trace f CCR		
2	0-4	1/4	@1-4' - no recovery		
3					
4					
5		2/4	f sand, trace coal + f gravel, NO, moist brown/gray w/ tan + d brown layers throughout		
6	4-8		mostly brown/gray after 5.1' coal in bottom 0.05' of core, little orange f sand		
7			@6-8' - no recovery		
8					
9		@8.1'	coal, little orange f sand f sand, lt tan, NO, moist		
10	8-12	2.3/4	wet @ 9.1'		
11			@10.3-12' - No recovery		
12					
13			End at 12'		
14					
15					
16					
17					
18					
19					
20					

Notes:

wood.

BORING NUMBER: SB-121	SOIL BORING LOG	Page 1 of 1
Project Name: [illegible]	Driller/Method: [illegible] / DP	Date/Time Start: 3/31/21 0745
Project Location: BGS	Logged By: [illegible]	Date/Time End: 3/31/21 0815
Project Number: [illegible]	Water Table: 12.7 Total Depth: 20'	Weather: 34° / sunny, breezy

Depth	Sample Interval	Recovery	Subsurface Description and Remarks	Samples	PID (ppm)
1			Grass/roots, f sand w/ CCR, MD, moist, d brown/gray		
2		2.2/4	@1.2'- f sand, trace c. CCR + slag, MD, moist, d brown/gray @2'- f sand w/ CCR, some slag, MD, moist, d brown/gray, some tan layers		
3	0-4		@2.2-4 - No recovery		
4					
5			f sand, little c. CCR, trace slag, MD, moist, d brown/gray		
6	4-8	2.6/4	@4.5'- f sand w/ c. CCR, trace slag, MD, moist, d brown to 4.8' [illegible] as before		
7			[illegible] slag, [illegible] coal @6.1-8 - No recovery		
8					
9			f sand w/ c. CCR + coal, MD, moist, d brown/black @8.6' - coal, little f sand		
10	8-12	2.4/4	@8.8 - f. sand, MD, moist, brown/orange, then lt tan after 8.9'; trace coal in top 0.2'		
11			@10.4-12 - No recovery		
12					
13			As above wet @12.7'		
14	12-16	1.5/4	@13.5-16' - No recovery		
15					
16					
17			As above, sat.		
18	16-20	2.2/4			
19			@18.2 - 20 - No recovery		
20			EOB @ 20'		

Notes: [illegible] after 8-12 interval due to [illegible] stuck in liner, [illegible]

wood.

BORING NUMBER: SB-122	SOIL BORING LOG	Page 1 of 1
Project Name: [illegible] 144	Driller/Method: [illegible] / DP	Date/Time Start: 3/31/21 0818
Project Location: [illegible]	Logged By: [illegible]	Date/Time End: 3/31/21 0932
Project Number: [illegible]	Water Table: 12.3' Total Depth: 16'	Weather: 35°/Sunny, breezy

Depth	Sample Interval	Recovery	Subsurface Description and Remarks	Samples	PID (ppm)
1			Grass/roots, f sand w/ c.cer, trace coal, MD, Moist, d. brown/gray; slag @ 0.8		
2		2.6/4	~~Brown~~, f. cer, d brown @ 0.9-1'; slag @ 1'		
3	0-4		@1.1' f. sand w/ c-cer, MD, moist, d. brown/gray; @2.6-4 - No recovery		
4					
5			f. sand w/ c.cer, trace coal, MD, moist, d brown/black; @4.4' - Coal, little f sand		
6	4-8	3.5/4	f sand, little coal 5-5.1', [illegible]		
7			@6' - f sand, trace coal, MD moist, tan/orange/brown layers; silt lens @ 6.6' (<0.1')		
8			@6.9' - f sand, Lt tan, MD, moist; @ 7.5-8 - No recovery		
9			as above		
10	8-12	2.7/4			
11			@10.7-12 - No recovery		
12					
13			as above; wet @ 12.3'		
14	12-16	2.7/4	Lt tan/orange 12.8-13' and 13.5-13.7'; slightly coarser @ 13.4' (<0.1') + 14.1' (<0.1')		
15			@14.7-16 - No recovery		
16					
17			End at 16'		
18					
19					
20					

Notes:

wood.

BORING NUMBER: SB-123	SOIL BORING LOG	Page 1 of 1
Project Name: BWMU 14	Driller/Method: Parratt/DP	Date/Time Start: 3/31/21, 0835
Project Location: BGS	Logged By: L. Caplinger	Date/Time End: 3/31/21, 0844
Project Number: 3651210111	Water Table: — Total Depth: 12'	Weather: 35°/Sunny, breezy

Depth	Sample Interval	Recovery	Subsurface Description and Remarks	Samples	PID (ppm)
			Grassroots; f sand, some c ccr slag, MD, moist, d brown		
1			@0.4' - Gravel, some sand + slag		
2	0-4	3.1/4	@1' - f sand w/ c ccr + coal, MD, moist, d brown/gray		
3			@1.8' coal, little f. sand, trace slag		
4			@3.1-4 - No recovery		
5			As above @4.7' - f sand, trace coal, MD, moist, orange + tan layers		
6	4-8	2.9/4	@5.2' - lt tan, no coal lt tan/brown 5.5-6.5', then little lt tan/brown layers after 6.5' (organic or coal fines)		
7			@6.9-8 - No recovery		
8					
9			As above, lt tan/brown layers 8.4-8.5', 8.8-8.9', 9.2' (<0.1'), 9.3' (<0.1'), and 9.8' (<0.1')		
10	8-12	2.5/4			
11			@10.5-12 - No recovery		
12					
13			End at 12'		
14					
15					
16					
17					
18					
19					
20					

Notes:

wood.

BORING NUMBER: SB-124	SOIL BORING LOG	Page 1 of 1
Project Name: SWMU 14	Driller/Method: Ramonley/DP	Date/Time Start: 3/31/21 0849
Project Location: BGS	Logged By: L. Gallagher	Date/Time End: 3/31/21 0850
Project Number: 3419120311	Water Table: — Total Depth: 12'	Weather: 35°/sunny, breezy

Depth	Sample Interval	Recovery	Subsurface Description and Remarks	Samples	PID (ppm)
1			Grass/roots; sand w/ slag + gravel, d brown; @0.3' - gravel + slag, little sand		
2	0-4	3/4	@1' - f. sand, brown/gray, MD, moist; coal 1.1' (<0.1')		
3			tan w/ d brown streaking after 1.3'; @2.1' - coal, little f. sand		
4			@3-4 - no recovery		
5			as above		
6	4-8	2.8/4	@5.6' - f sand, MD, moist, tan/orange turn lt tan after 6.1'; trace coal in top 0.3'		
7			@6.8 - 8 no recovery		
8					
9			as above; lt tan/brown layers @ 8.5' (<0.1'), @ 8-9.1', 9.3' (<0.1'), 9.6 (<0.1'), 9.7-9.9'		
10	8-12	2.5/4			
11			@10.5-12 - no recovery		
12					
13			Terminated at 12'		
14					
15					
16					
17					
18					
19					
20					

Notes:

wood.

SOIL BORING LOG

BORING NUMBER: SB-125	Page 1 of 1

Project Name: SWMU M	Driller/Method: Rammond/DP	Date/Time Start: 3/31/21 0902
Project Location: BG	Logged By: L Conyo	Date/Time End: 3/31/21 0914
Project Number: 3651200111	Water Table: 12.4' Total Depth: 16'	Weather: 35°/Sunny breezy

Depth	Sample Interval	Recovery	Subsurface Description and Remarks	Samples	PID (ppm)
1	0-4	2.9/4	Grass/roots; silty sandy topsoil, some slag + c.ccr, mo, moist @0.4' - f sand w/slag, trace c.ccr, brown/gray d brown, mo, moist @0.9 - slag + gravel, some f sand @1.2' - f sand, trace c. ccr + coal, tan, mo, moist		
2					
3			@2.9-4 - No recovery		
4	4-8	2.8/4	As above @4.4' - f sand w/coal + c.ccr, some slag, mo, moist, d brown/gray @4.9' - f. sand, little coal + c.ccr, brown/gray, mo, moist @5.7' - f sand w/ coal + c.ccr, trace slag, mo, moist, d brown/gray @5.5' - f sand, trace coal + c.ccr, mo, moist brown/gray @6.3' - f sand w/ coal, some slag, mo, moist, possible trace f.ccr d brown/gray		
5					
6					
7					
8	8-12	2.5/4	@6.8 - 8 - No recovery @8 - as above @8.1' - coal, little f sand @8.3' - f sand, mo, moist, lt tan, little brown staining in top 0.2' @10.5-12 No recovery		
9					
10					
11					
12	12-16	3.4/4	As above wet @12.4' slightly coarser @ 13.1', 14.1' (~0.1') and 14.3-14.4'		
13					
14					
15					
16			@15.4-16' - no recovery End at 16'		
17					
18					
19					
20					

Notes:

wood.

BORING NUMBER: SB-126	SOIL BORING LOG	Page 1 of 1
Project Name: SWMU 14	Driller/Method: Parratt Wolff/DP	Date/Time Start: 3/31/21 0940
Project Location: BOS	Logged By: L. Collings	Date/Time End: 3/31/21 0950
Project Number: 3652200111	Water Table: — Total Depth: 12'	Weather: 35°/sunny breezy

Depth	Sample Interval	Recovery	Subsurface Description and Remarks	Samples	PID (ppm)
1			grass/roots; f sand, little c. cse, no. moist, brown/dk brown gray		
			slag + gravel @0.6-0.7', rest same as above		
2			@0.8' slag + gravel		
			@1.3'- f sand, trace c. cse + coal, no. moist, tan		
3	0-4	2.9/4	@2.9-4- no recovery		
4					
			hs casual		
5					
6		2.6/4	little slag @5.0', tan little coal after 5.6'		
			@5.1'- f sand, some coal, little slag, no. moist, dk brown/gray some tan layers		
7	4-8		@6.6-8- no recovery		
8					
			f sand, trace coal, no. moist, tan		
9			[illegible] f sand, some coal, no. moist,		
		3.2/4	@8.3-8.5', 8.7-8.8', + 8.9-9.2' dk brown/gray		
10	8-12		rest is f sand as at 8'		
11			@9.2'- f sand, tan, no. moist, 2+ tan after 9.8'		
12			@11.2-12- no recovery		
13			End at 12'		
14					
15					
16					
17					
18					
19					
20					

Notes: Had to offset due to large slag chunk in shallow fill

wood.

BORING NUMBER: SB-127	SOIL BORING LOG	Page 1 of 1
Project Name: SWMU 14	Driller/Method: Ramanase / DP	Date/Time Start: 3/31/21 0952
Project Location: BGS	Logged By: L Coplinger	Date/Time End: 3/31/21 1057
Project Number: 3612200111	Water Table: 12.7' Total Depth: 16'	Weather: 35° sunny, breezy

Depth	Sample Interval	Recovery	Subsurface Description and Remarks	Samples	PID (ppm)
1	0-4	2.7/4	Grass (MOB), silty sandy topsoil, d brown, NO, moist; @0.3' f sand, some c-c GR		
2			@0.7' - slag, some c + f GR, some f sand, d brown, dense, moist; @0.9' - slag + gravel, little f sand, dense		
3			@1.1' - f sand, trace c-c GR + coal, trace slag, NO, moist, tan		
4			@2.7-4' - no recovery		
5	4-8	2.8/4	as above		
6			brown/gray layers from 5.0-5.9' (slag, maybe coal), red brown/gray streaking after 5.9'		
7			@6.8-8' no recovery		
8	8-11	2.3/3			
9			f sand, some coal + c-c GR, NO, moist, brown/gray, tan from 8.7-8.8'		
10			@8.8' - fines - d brown w/ orange streaking, possibly f-c GR; @9.0' - f sand, some coal; @9.1' - f sand, NO, moist, lt tan		
11			@10.3-12 - no recovery		
12	12-16	3/4			
13			as above; wet @12.7'		
14			slightly coarser 13.8-13.9', 14.1'(<0.1'), 14.2-14.3'		
15			@15-16' no recovery		
16					
17			End at 16'		
18					
19					
20					

Notes: Had to offset due to large slag or concrete in ground

wood.

SOIL BORING LOG

BORING NUMBER: SB-12B			
Project Name: SWMU 14	Driller/Method: Raimonde/DP		Date/Time Start: 3/31/21 1010
Project Location: BGS	Logged By: L Cooper		Date/Time End: 3/31/21 1020
Project Number: 3657200111	Water Table: —	Total Depth: 12'	Weather: 35°/snow, breezy

Depth	Sample Interval	Recovery	Subsurface Description and Remarks	Samples	PID (ppm)
1			Grass roots, silty sandy topsoil, little c. cur, MD, moist, @ 0.3'- f sand, little c. cur, trace slag, MD, moist, brown brown/gray		
2	0-4	2.2/4	tan 0.7-1.1'		
3			@1.3-1.4'-slag, then f. sand, trace c. cur, trace coal, MD, moist, brown/gray; brick pieces @ 2' (~0.1')		
4			@2.2-4' no recovery		
5			As above; slag @4.7-4.9', coarse f sand, then f sand as before		
6	4-8	2.6/4			
7			@6.5' slightly more coal		
			@6.6'-8'-no recovery		
8					
9			f sand, little tan, MD, moist		
10	8-12	2.8/4			
11			@10.8-12-no recovery		
12					
			End at 12'		
13					
14					
15					
16					
17					
18					
19					
20					

Notes:

wood.

BORING NUMBER: SB 129	SOIL BORING LOG	Page 1 of 1
Project Name: SWMU 14	Driller/Method: Raimondi / DP	Date/Time Start: 3/31/21 1030
Project Location: BGS	Logged By: L. Collinger	Date/Time End: 3/31/21 1042
Project Number: 3057200911	Water Table: 13.4' Total Depth: 16'	Weather: 37°/sunny, breezy

Depth	Sample Interval	Recovery	Subsurface Description and Remarks	Samples	PID (ppm)
			grass/roots, f sand, little c-ccr, MO, moist, d brown		
1			@0.8' - f sand, trace c-ccr, coal, + slag, MO moist, tan		
2	0-4	2.3/4			
3			@2.3-4 - NO recovery		
4					
			f sand, some coal, trace c-ccr, MO, moist, tan w/ multiple coal laminations d brown streaking throughout, trace roots		
5		2.2/4			
6	4-8		@6.1' - f-ccr		
7			@6.2 - 8 - NO recovery		
8					
			f.ccr @8.1' - orange f sand, some f. ccr laminations throughout, trace roots		
9			@8.7' - f sand, MO moist, tan/orange then lt tan after orange 8.9'		
10	8-12	2.3/4			
11			@10.3-12 - NO recovery		
12					
			as above, lt tan/orange		
13			lt tan/brown layer @ 12.2-12.4' + 13-13.3'		
14	12-16	2.6/4	wet @13.4'		
15			@14.6-16 - NO recovery		
16			End at 16'		
17					
18					
19					
20					

Notes:

wood.

BORING NUMBER: SB-130	SOIL BORING LOG	Page 1 of 1
Project Name: SWMU 14	Driller/Method: [illegible] / DP	Date/Time Start: 3/31/21 1045
Project Location: BGS	Logged By: [illegible]	Date/Time End: 3/31/21 1103
Project Number: 3057[illegible]11	Water Table: 13.3' Total Depth: 20'	Weather: 37° / sunny, breezy

Depth	Sample Interval	Recovery	Subsurface Description and Remarks	Samples	PID (ppm)
1			grass/roots, f.sand trace c. [illegible] + coal, trace silt, no, moist. d.brown tan [illegible] 0.6'		
2	0-4	1.9/4	@1.9-4 - No recovery		
3					
4					
5			as above @4.4' - f.sand, little coal, no, moist, brown/gray w/ tan + d.brown streaking		
6	4-8	1.5/4	tan @5.3', less coal		
7			@5.5-8' - no recovery		
8					
9			as above, tan @8.1' - f.sand, little coal, no, moist, brown/gray w/ d.brown streaking		
10	8-12	3.2/4	tan @8.4', less coal @8.6' - coal w/ f.sand/organic material, black ? coal or organic ? weathered coal ?		
11			f.sand 9.6-9.7' @10' - f.sand, no, moist, tan, organic/coal layer @ 10.1' (<0.1')		
12			@11.2 - 12 - NO recovery		
13			as above d.brown 12.6-13', possible trace coal/organic		
14		3.1/4	wet @ 13.3' d.brown/gray @ 14.5-14.7'		
15	12-16		@14.7' - peat, black/d.brown @14.8' - f.sand, brown/orange, no, wet		
16			@15.1-16' - NO recovery		
17			f.sand as above, color gradually lightens w/ depth		
18	16-20	3.5/4			
19			@18.4-18.7' - d.brown/gray, plant/organic material w/ fibers trace plant/organic specks after 18.7'		
20			@19.5 - 20 - No recovery		

Notes: End at 20'

wood.

BORING NUMBER: SB-131	SOIL BORING LOG	Page 1 of 1
Project Name: SWMU 14	Driller/Method: Raymond / DP	Date/Time Start: 3/31/21 1107
Project Location: BGS	Logged By: C Caplinger	Date/Time End: 3/31/21 1124
Project Number: 3457200111	Water Table: 12.9' Total Depth: 16'	Weather: 37° sunny breezy

Depth	Sample Interval	Recovery	Subsurface Description and Remarks	Samples	PID (ppm)
1			Grass/roots, silty sandy topsoil, trace c. CCR, MD, moist, d brown @0.6' - f. sand, some c. CCR, trace slag/coal, MD, moist		
2	0-4	2.8/4	d brown/gray; some tan 1.3-1.4'; d brown 1.4-1.6', little coal		
3			brown/gray w/ tan and d brown streaking after 1.6'		
4			@2.8-4 - no recovery		
5			f sand w/ coal, some c CCR, trace slag, MD, moist, d brown/gray w/ tan layers		
6	4-8	2.9/4	@5' - coal; @5.2' - orange f sand w/ coal + slag		
7			@5.3' - f sand, some coal, MD, moist, d brown/gray w/ mostly tan from 5.5-5.7' + 5.8-6.1', tan streaking, little coal		
8			@6.1' - f sand w/ coal/organic material, d brown/black		
9			@6.6' - f sand, MD, moist, tan/orange, trace coal; @6.9-8' - no recovery		
10	8-12	3/4	@8' - f. sand, lt tan/orange then lt tan after 8.4', MD, moist		
11			@11-12 - no recovery		
12					
13			as above; wet @ 12.9'		
14	12-16	3.2/4	slightly coarser 13.9', 14', 14.2' (<0.1')		
15					
16			@15.2-16' - no recovery		
17			End at 16'		
18					
19					
20					

Notes:

wood.

BORING NUMBER: SB-132	SOIL BORING LOG	Page 1 of 1
Project Name: SWMU 14	Driller/Method: [illegible] / DP	Date/Time Start: 3/31/21 1128
Project Location: BGS	Logged By: L. Ca[illegible]	Date/Time End: 3/31/21 1143
Project Number: 3619 20011	Water Table: 12.3' Total Depth: 16'	Weather: 37°/sunny, breezy

Depth	Sample Interval	Recovery	Subsurface Description and Remarks	Samples	PID (ppm)
1			Grass/roots; silty sandy topsoil, little coal, mo, moist; @0-2' - f sand, some c. coal, MD, moist, brown/gray		
2	0-4	2.3/4	@1.2' - f sand, trace c. coal, coal + slag, MD, moist, brown/gray, some d. brown streaking		
3			@2.3-4' - No recovery		
4					
5			as above; @4.5-4.7' - coal, some f sand		
6	4-8	2.3/4	@4.7' - f sand, trace coal, MD, moist, tan, some abundant orange streaking		
7			@6.3-8' - No recovery		
8					
9		2.8/4	Coal, little fine sand; @8.3' - f sand, trace coal, MD, moist, tan/brown		
10	8-12		d. brown/gray 8.4-8.6' (little coal), 9.3' (coal), + 9.4-9.5' (coal); brown/gray @ 9.5', f sand, MD, moist		
11			brown/orange @ 9.6'; tan/orange @ 9.7'; trace coal streaks until 10.3'; lt tan after 10.3'		
12			@10.8-12' - No recovery		
13			as above, wet @ 12.3'		
14	12-16	3.4/4			
15					
16			@15.4-16' - No recovery; End at 16'		
17					
18					
19					
20					

Notes:

wood.

Wood Environment & Infrastructure Solutions, Inc.
271 Mill Road
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Chelmsford, MA 01824
USA
T: 978-692-9090

Memo

To: Michelle Kaysen / EPA

From: Russ Johnson / Wood
Dan Sullivan / NIPSCO

Reviewer: Julie Scott / Wood

cc: Marc Okin

Wood File No.: 3651200111.2800.****

Date: 25 June 2021

Re: **NIPSCO Bailly Generating Station**
Targeted CCR Excavation at SWMU 14

Wood Environment & Infrastructure Solutions, Inc. (Wood) has prepared this memorandum on behalf of Northern Indiana Public Service Company, LLC (NIPSCO) in support of a targeted removal effort at Solid Waste Management Unit (SWMU) 14 at the Bailly Generating Station (BGS). In a letter dated January 21, 2021, the Environmental Protection Agency (EPA) summarized comments received from the public regarding SWMU 14. The public expressed concern that future water-table rise might possibly inundate the buried coal combustion residuals (CCR) at SWMU 14. In the January 21, 2021 letter, EPA provided lines of evidence that it thought might be substantive enough to recommend a presumptive remedy of excavation and offsite disposal in the Final Decision/Response to Comments.

To better understand the nature and distribution of fill at SWMU 14, a subsurface investigation was performed in March 2021 that included the advancement of 123 borings through the fill, most of which were advanced into native sand. The 2021 subsurface investigation revealed that the vast majority (almost 90%) of fill within the area designated SWMU 14 was sand, with lesser amounts of silt, slag, brick, coal, and gravel. Coarse CCR, or boiler slag (8.4%), and fine CCR, or fly ash (2.1%), were interspersed within the sandy matrix. No fill containing coarse or fine CCR was encountered below the water table. Findings were reported in a memo to EPA dated May 25, 2021. Comments were received from EPA in an e-mail dated May 26, 2021. Findings and potential options were discussed in a call with EPA on June 1, 2021, and additional details were presented to EPA on June 16, 2021. A response to comments memo was forwarded to EPA on June 25, 2021.

The volume of fill investigated in March 2021 amounts to 87,000 cubic yards (CY). Based on the investigation findings NIPSCO has determined that full excavation and off-site disposal of fill materials within the limits of the area investigated is not warranted. Instead, NIPSCO proposes a targeted removal effort for areas where the aggregate thickness of fine CCR is greater than 0.5 foot based on the March 25, 2021 memo – see **Figure 1**. Note that aggregate thickness is calculated by adding up the individual thickness(es) of each layer of fill containing fine CCR mixed with sand or other components of fill (e.g., slag, gravel, coarse CCR), accounting for the percent fine CCR present in that interval, ranging from pure fine CCR (100%) to as low as 5%. For example, if a layer is pure fine CCR, then the full thickness of that interval is added into the aggregate thickness. If an interval contains only 50% fine CCR, then only one-half the interval thickness is added into the aggregate thickness. Three examples are provided in Table 1, Page 1 of 28 (**Attachment A**), taken from the May 25, 2021 memo to EPA.

The three example boring locations presented below are shown in **Figure 1**:

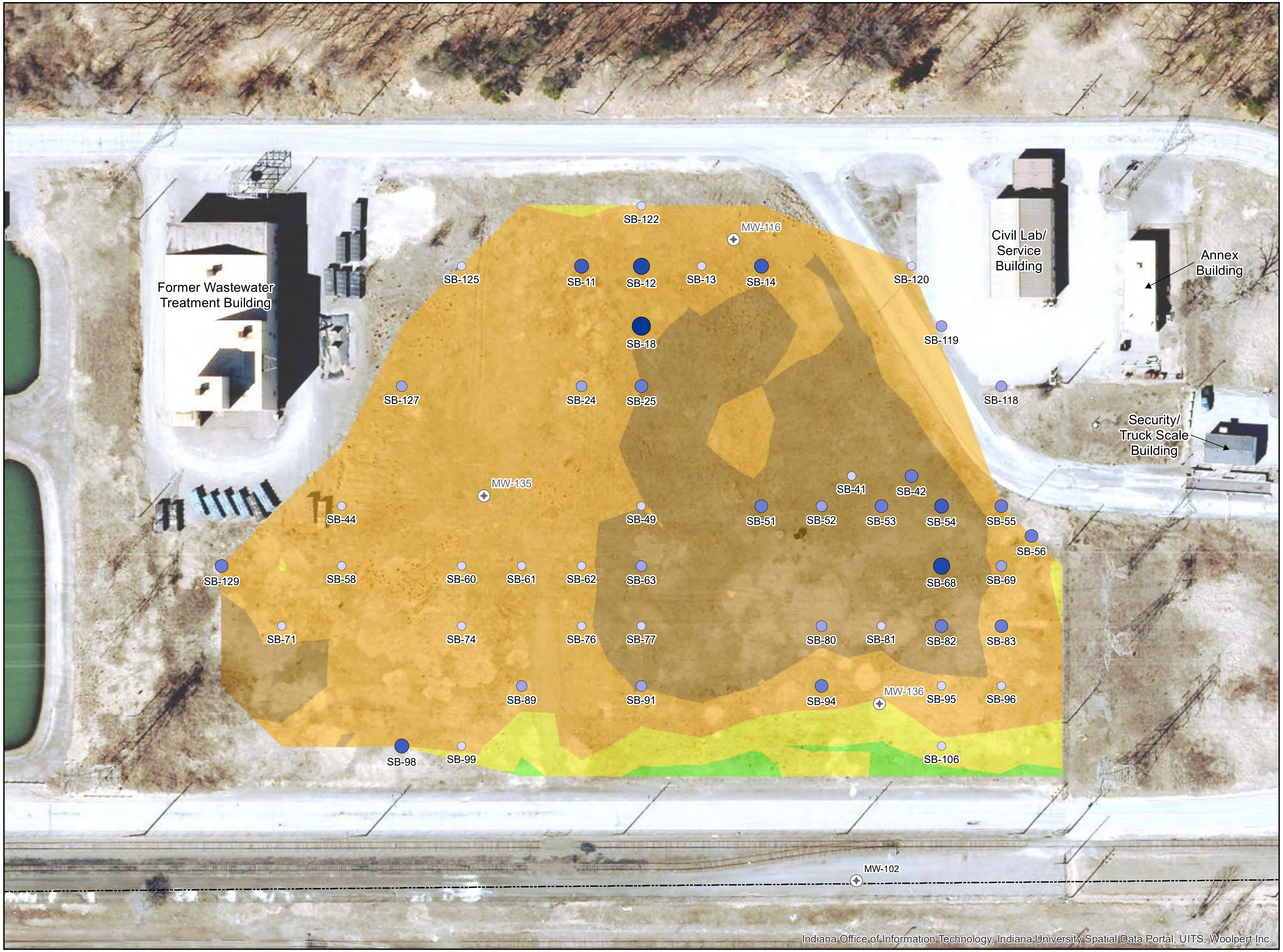
- Boring SB-11 has an aggregate thickness of 0.7 foot, with the deepest interval ending at 2.1 feet
- Boring SB-12 has an aggregate thickness of 1.6 feet, with the deepest interval ending at 8.5 feet.
- Boring SB-13 has an aggregate thickness of 0.03 foot, with the deepest interval ending at 8.4 feet.

Figure 2 presents the four areas proposed for targeted remediation where the aggregate thickness of fine CCR is >0.5 foot. The four areas combined cover approximately 0.7 acre. The base of the four excavations is defined by the deepest interval of fine CCR observed during the March 2021 subsurface investigation, with a maximum excavation depth of 10 feet at SB-14. The combined volume of fill from the four areas is estimated to be 4,100 CY. Fill containing CCR will be excavated to the pre-defined limits and depths shown on **Figure 2**, with the following key elements and assumptions:

- No confirmation sampling is proposed.
- Groundwater will not be encountered during excavation.
- Segregation of CCR from the excavated fill is deemed infeasible.
- Excavated materials will be disposed off-site.
- The excavation will be backfilled to previous grades using native sand from a local source.
- Plantings will be consistent with native dune species.

Consistent with EPA's recommendation in their letter dated January 21, 2021, the proposed excavation and offsite disposal of fill containing CCR will be performed as a Presumptive Remedy.

FIGURES



2021
Investigation Findings

Northern Indiana Public
Service Company

Bailly Generating Station
Chesterton, Indiana

Legend

- Bailly Generating Station Property Line
- Monitoring Well Location

Fill Thickness (Feet)
- 0-2
- 2-6
- 6-10
- 10-14

2021 Soil Boring Aggregate Fly Ash Thickness (Feet)
- ≤ 0.1
- ≤ 0.25
- ≤ 0.5
- ≤ 1
- ≤ 2
- ≤ 3

Location of Site

Notes and Sources

FIGURE 1

Aerial Imagery: Orthophotography of Indiana, (2018) obtained through ArcGIS Online.

N

0 80 Feet

wood.

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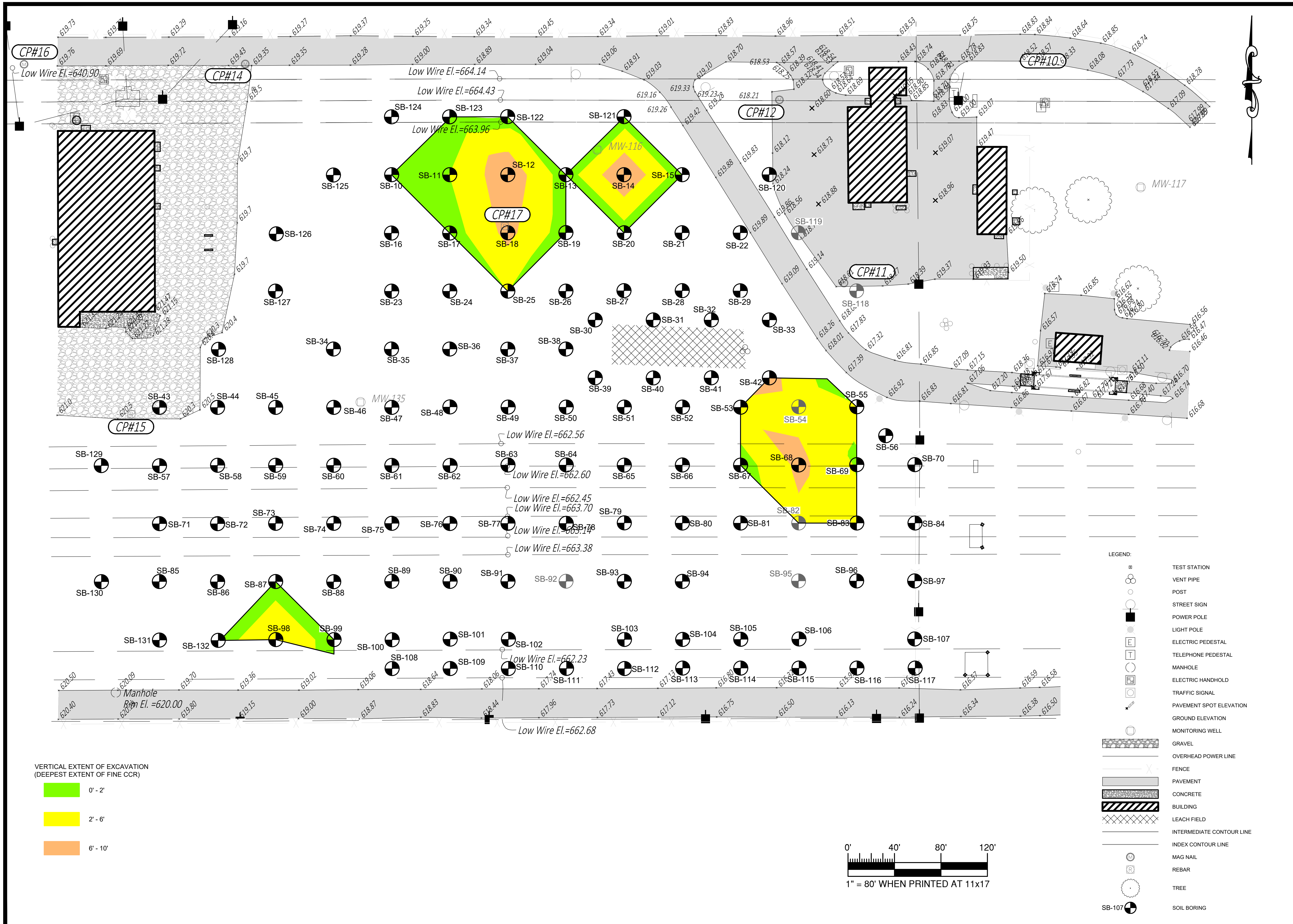
H:\NiSource\BaillyGenerating\Task81\MXD\Fig3_SWMU14SoilBorings_Flyash_SpatialDist.mxd June 21, 2021 DWN: emily.gardiner CHKD: LC



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NORTHERN INDIANA PUBLIC SERVICE COMPANY

PROJECT:

BAILLY GENERATING STATION

REV	DATE	DESCRIPTION

ISSUE / REVISION:

DESIGNED BY: LC	DRAWN BY: DED
CHECKED BY: RJ	DATE: JUNE 2021
SCALE: AS SHOWN	ISSUE / REVISION: 0

PROJECT NUMBER:
3651200111

TITLE:

EXCAVATION FOOTPRINT AND DEPTH TO REMOVE FINE CCR WITH AGGREGATE THICKNESS ≥0.50 FEET

FIGURE NUMBER:
2

FILE: C:\Users\dana.dempsey\Documents_Projects\Work from Home Starting 2020-03-18\BaillyGeneratingStation\CAD\2021-04-26\7.0 CAD\7.1 Design - Permitting\Sheets\Figure 2.dwg BY: dana.dempsey DATE: 17 Jun 2021 - 11:49am

ATTACHMENT A

PAGE 1 OF TABLE 1

SOURCE: MAY 25, 2021 MEMO TO EPA

Table 1. Composition of Fill at SWMU 14
Bailly Generating Station
Chesterton, IN

Boring	Fill (feet)	Native (feet)	No Recovery (feet)	Log Percentages						
				sand (includes silt)	slag (includes brick)	coal	gravel	peat	Coarse CCR	Fine CCR
SB-10	0.3			100%						
	1.1			50%	25%		25%			
	0.8			100%						
			1.8							
	1.1			100%						
	1.7			90%	5%	5%				
			1.2							
	0.3			95%		5%				
	1.2			60%		40%				
		1.7		100%						
			0.8							
12	6.5	1.7	3.8	81%	6%	9%	4%	0%	0%	0%
SB-11	0.4			85%			15%			
	0.2			60%			40%			
	0.3			0%						100%
	0.4			90%	5%					5%
	0.3			5%						95%
	0.4			100%						
	0.1			0%						100%
	0.9			95%		5%				
			1							
	1.5			90%		5%	5%			
			2.5							
	0.2			90%		5%	5%			
	1.1			70%		25%	5%			
	0.2			0%	50%		50%			
		1.4		100%						
			1.1							
12	6	1.4	4.6	73%	2%	7%	6%	0%	0%	12%
SB-12	0.4			95%		5%				
	0.9			55%	5%	20%			20%	
	0.3			55%		20%	20%			5%
	0.6			0%						100%
	0.5			40%	20%	5%	30%			5%
			1.3							
	0.3			40%	20%	5%	30%			5%
	0.3			30%	20%	5%	30%			15%
	0.7			0%						100%
	0.8			35%	25%	5%	30%			5%
			1.9							
	0.4			35%	25%	5%	30%			5%
	0.1			0%						100%
	0.4			90%	5%		5%			
	0.4			70%		25%			5%	
		0.6		100%						
			2.1							
		2.5		100%						
			1.5							
16	6.1	3.1	6.8	41%	10%	8%	13%	0%	3%	26%
SB-13	0.3			100%						
	1.8			55%	5%				40%	
			1.9							
	0.5			55%	5%				40%	
	0.3			50%	5%				40%	5%
	0.4			60%					40%	
			2.8							
	0.1			95%					5%	
	0.3			15%	80%					5%
	0.2			95%					5%	
	0.2			85%					15%	
		1		100%						
			2.2							
		2.9		100%						
			1.1							
16	4.1	3.9	8	60%	9%	0%	0%	0%	30%	1%

Example page taken from Table 1 of a Memo to EPA dated May 25, 2021, RE: SWMU 14 Investigation Findings