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April 28, 2010

Mr. Roy Crossland
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U.S. Environmental Protection Agency, Region 7
901 North 5th Street
Kansas City, Kansas 66101

Subject: **Phase II Targeted Brownfields Assessment**
Burlington Northern and Santa Fe Property Site, Lincoln, Nebraska
EPA Region 7, Mini-START, Contract No. EP-S7-09-01, Task Order No. 0015
Task Monitor: Ron King, Site Assessment Team Leader

Dear Mr. Crossland:

Seagull Environmental Technologies Inc. (Seagull) is submitting the attached Phase II Targeted Brownfields Assessment (TBA) report for the Burlington Northern and Santa Fe Property site located in Lincoln, Nebraska. If you have any questions or comments, please contact the project manager at (913) 220-5887.

Sincerely,

Jeff Pritchard, CHMM
Mini-START Project Manager

Hieu Q. Vu, PE
Mini-START Program Manager

Enclosures

EPS70901.0015

PHASE II TARGETED BROWNFIELDS ASSESSMENT REPORT

BURLINGTON NORTHERN AND SANTA FE PROPERTY SITE, LINCOLN, NEBRASKA

Mini-Superfund Technical Assessment and Response Team (Mini-START)

Contract No. EP-S7-09-01, Task Order No. 0015

Prepared For:

U.S. Environmental Protection Agency
Region 7
901 North 5th Street
Kansas City, Kansas 66101

April 28, 2010

Prepared By:

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EXECUTIVE SUMMARY

Seagull Environmental Technologies Inc. (Seagull) was tasked by the U.S. Environmental Protection Agency (EPA), under the Mini-Superfund Technical Assessment and Response Team (Mini-START) contract, to conduct a Phase II Targeted Brownfields Assessment (TBA) of the Burlington Northern and Santa Fe (BNSF) Property site. The site, which is approximately 67 acres in size, is located west of the downtown business district of the City of Lincoln, Lancaster County, Nebraska. The site is currently owned by BNSF and operated as a railroad yard. The City of Lincoln applied for a Brownfields grant from EPA Region 7 for assessment of the site, which has been targeted as part of a redevelopment area by the City of Lincoln. It should be noted that the BNSF Property site includes several small parcels of land currently owned by the Lower Platte South Natural Resources District (LPSNRD), as well as platted right-of-ways owned by the City of Lincoln. For the purposes of this investigation, the LPSNRD and City of Lincoln properties are considered part of the BNSF Property site. The purpose of this Phase II TBA was to confirm or eliminate recognized environmental conditions (REC) specified in the Phase I TBA report for the site, further investigate the extent of soil and groundwater contamination identified during previous environmental assessments of the site, and assess risks to human health and the environment posed by any contamination.

Phase II TBA activities were conducted on March 8 through 10, 2010, and included the collection of soil (subsurface and surface soil) and groundwater samples from locations geographically placed across the site. Specifically, 18 subsurface soil, nine surface soil, and 13 groundwater samples were collected for laboratory analysis of site-related contaminants (volatile organic compounds [VOC], semi-volatile organic compounds [SVOC], total extractable hydrocarbons [TEH], metals regulated under the Resource Conservation and Recovery Act [RCRA], and polychlorinated biphenyls [PCB] [for select surface soil sample locations only]). A summary of the Phase II TBA sample results follows:

<u>Subsurface Soil</u>

Ten of the 18 subsurface soil samples contained VOCs at concentrations that ranged from 1.6 J to 1,060 micrograms per kilogram (µg/kg). A J-coded result indicates the concentration was estimated. None of the VOCs were detected at concentrations that exceeded their respective Nebraska Voluntary Cleanup Program Remediation Goals (NVCP-RG), which were the health-based standard used for comparison with the sample results. The highest concentrations of VOCs, which were commonly associated with petroleum products, were detected in the samples collected from SB-8, SB-10, SB-12, and SB-14. Those sample locations are located in the east portion of the site, either north or south of a diesel-contaminated groundwater plume that is currently being remediated by BNSF. The VOCs detected in the samples from SB-8, SB-10, SB-12, and SB-14 are likely attributable to the known groundwater plume. Four of the 18

subsurface soil samples contained SVOCs (primarily polynuclear aromatic hydrocarbons [PAH]) at concentrations that ranged from 59.7 J to 10,000 µg/kg. Those four samples were collected from SB-1, SB-4, SB-12, and SB-14. SVOCs were only detected at two of the sample locations (SB-1 and SB-4) at concentrations that exceeded NVCP-RGs. The sample collected from SB-1 (from 10 to 12 feet below ground surface [bgs]) contained six SVOCs at concentrations that ranged from 68.6 J to 105 J µg/kg. Benzo(a)pyrene (detected at 99.2 J µg/kg) was the only SVOC detected at a concentration that exceeded its NVCP-RG established for residential soil, which is 62 ug/kg. SB-1 was located in the northwest corner of the site in an area of currently (and historically) undeveloped land. The detected concentration of benzo(a)pyrene in the sample from SB-1 (99.2 J µg/kg) was well below its NVCP-RG established for industrial soil, which is 21,000 µg/kg. The sample collected from SB-4 contained 20 SVOCs at concentrations that ranged from 59.7 J to 8,380 µg/kg. This sample was collected from the north portion of the site where fill (including buried railroad ties) was encountered at subsurface depths. SVOCs (PAHs in particular) are commonly associated with wood treatment chemicals (creosote) associated with railroad ties; therefore, the SVOCs detected in the sample from SB-4 could be attributed to the buried railroad ties (and other fill materials). Six SVOCs were detected in the sample collected from SB-4 at concentrations that exceeded their respective NVCP-RGs established for residential soils. Those SVOCs were benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, dibenzo(a,h)anthracene, dibenzofuran, and indeno(1,2,3-cd)pyrene; however, only benzo(a)pyrene, which was detected at 4,400 µg/kg, was detected at a concentration that exceeded its NVCP-RG for industrial soils, which is 2,100 µg/kg. In addition, petroleum-related SVOCs were detected at concentrations below their respective NVCP-RGs in the samples collected from SB-12 and SB-14. Those sample locations are just north and south of the known diesel-contaminated groundwater plume and are likely attributable to that source.

Seven of the 18 subsurface soil samples contained reportable concentrations of TEH that ranged from 4.9 J to 1,170 milligrams per kilogram (mg/kg). TEH as diesel and TEH as motor oil were the only TEH analytes detected in those samples. Low concentrations (ranging from 4.67 J to 15.1 mg/kg) of TEH as motor oil were detected in the samples collected from SB-1, SB-2, SB-7, and SB-13. TEH as diesel was detected in three samples (SB-4, SB-10, and SB-12) at concentrations that ranged from 35.4 to 1,170 mg/kg. Sample SB-12 (collected from 6 to 8 feet bgs) contained the highest concentration of TEH as diesel, which was 1,170 mg/kg. SB-10 and SB-12 were located in the east-central portion of the site, just north of the known diesel-contaminated groundwater plume; therefore, it is likely the detected concentrations of TEH are attributable to that source. Currently, no NVCP-RGs for TEH have been established. However, regulatory limits for TEH as diesel and waste oil (comparable to motor oil) have been established for several exposure scenarios by NDEQ for petroleum release sites. The detected concentrations of TEH were compared to NDEQ regulatory limits established for the vapor intrusion

pathway; all results were below regulatory limits for the most conservative scenario (residential exposure).

All 18 of the subsurface soil samples contained RCRA metals. In those samples, the following RCRA metals were detected: arsenic, barium, cadmium, chromium, lead, mercury, and silver (only selenium was not detected). All 18 of the samples contained levels of arsenic that exceeded its NVCP-RG established for residential soil, which is 0.39 mg/kg (cancer endpoint concentration). Concentrations of arsenic ranged from 1.6 to 10.8 mg/kg in those samples. None of the detected concentrations of arsenic exceeded its NVCP-RG established for industrial soil, which is 16 mg/kg. The average concentration for arsenic in Lancaster County is 9.04 mg/kg. Only one sample (SB-4) contained arsenic above the background concentration established by United States Geological Survey (USGS); therefore, the detected arsenic concentrations in all the samples collected across the site are likely naturally occurring. Lead was detected in sample SB-2 (collected from 8 to 10 feet bgs) at 601 mg/kg, which exceeded its NVCP-RG of 400 mg/kg established for residential soil. That detected concentration of lead was below its NVCP-RG for industrial soil, which is 750 mg/kg. Sample SB-2 was collected from the north portion of the site, just northwest of the former roundhouse facility. The source for the elevated lead concentration is unknown; however, based on sample results from previous investigations and surface soil XRF screening/sampling conducted during the Phase II TBA (discussed below), it does not appear that a widespread area of lead-contaminated soil exists. None of the other metals were detected at concentrations that exceeded their respective NVCP-RGs.

Surface Soil

All five of the surface soil samples contained reportable concentrations of RCRA metals. In those samples, the following RCRA metals were detected: arsenic, barium, cadmium, chromium, lead, and mercury (selenium and silver were not detected). Arsenic was the only RCRA metal detected above its NVCP-RGs. Concentrations of arsenic ranged from 3.8 to 50.2 mg/kg in those samples. All of the samples contained levels of arsenic that exceeded its NVCP-RG established for residential soil, which is 0.39 mg/kg (cancer endpoint concentration). The samples collected from SB-8 and SB-13 contained arsenic at 37.6 and 50.2 mg/kg, respectively. Those concentrations exceed the NVCP-RG established for arsenic in industrial soil (cancer endpoint concentration), which is 16 mg/kg. It should be noted that none of the detected concentrations of arsenic exceeded its NVCP-RG non-caner endpoint concentration for industrial soil, which is 260 mg/kg. SB-8 is located in the east-central portion of the site, and SB-13 is located in the southwestern portion of the site. There are many potential anthropogenic sources of arsenic, including treated lumber (railroad ties). No other metals were detected at concentrations that exceeded their established NVCP-RGs. A surface soil x-ray fluorescence (XRF) spectrometer survey completed at the site (primarily for lead) determined XRF results for lead in the screened samples ranged

from 36 to 326 mg/kg. XRF screening indicated that none of the surface soil samples contained lead at concentrations greater than 400 mg/kg, the NVCP-RG established for lead in residential soil. For confirmation purposes, five surface soil samples were submitted for laboratory analysis. Comparison of the XRF data with laboratory results determined the data correlated well.

Four surface soil samples, which were collected from BNSF property is adjacent to Alter Scrap Yard's North Yard, were submitted for analysis of PCBs. All four of the samples contained reportable concentrations of PCBs that ranged from 15.3 to 852 µg/kg. Sample SS-1 contained Aroclor 1248 and Arochlor 1254 at 852 and 604 mg/kg, respectively. Both of those concentrations exceeded the NVCP-RG established for residential soil, which is 220 µg/kg (for Arochlors 1248 and 1254). The detected concentrations of those PCBs were well below the NVCP-RG established for industrial soil, which is 7,400 µg/kg (for Arochlors 1248 and 1254). Sample SS-1 was collected from BNSF property that was adjacent to the southwest corner of Alter's North Yard. A remedial action was conducted in 1999 in the North Yard, which involved the excavation of PCB-contaminated soil. Based on the sample results from SS-1, it appears PCBs have migrated from Alter Scrap Yard's North Yard and impacted surface soils in the vicinity of sample SS-1. None of the other surface soil samples contained PCBs above their respective NVCP-RGs.

Groundwater

Five of the groundwater samples contained reportable concentrations of VOCs. Those groundwater samples were SB-1-GW, SB-6-GW, SB-10-GW, SB-12-GW, and SB-18-GW. In those five samples, 16 VOCs were detected at concentrations that ranged from 0.24 J to 36.7 micrograms per liter (µg/L). Two of the samples (SB-6-GW and SB-18-GW) contained VOCs at concentrations that exceeded their respective NVCP-RGs. SB-6-GW contained chloroform (a common laboratory contaminant) at 0.25 J µg/L, which exceeds its established NVCP-RG of 0.21 µg/L. SB-18-GW contained nine VOCs, one of which (1,2-dichloroethane [1,2-DCA]) was detected at a concentration above its respective NVCP-RG established for the groundwater exposure pathway. 1,2-DCA was detected at 36.7 µg/L, well above its NVCP-RG of 5.0 µg/L. No other VOCs were detected at concentrations that exceeded their respective NVCP-RGs. Sample SB-18-GW collected from the southwest corner of the site. Industrial and commercial facilities (including Alter Scrap Yard) are located east (upgradient) of this sample location. The source for the contaminants detected in SB-18-GW is unknown. VOCs were also detected in SB-1-GW, SB-10-GW, and SB-12-GW; however, the detected concentrations were below their respective NVCP-RGs. The VOCs detected in those samples are historically associated with historical activities and known sources of contamination, which are the former roundhouse upgradient of SB-1-GW and the diesel-contaminated groundwater plume just south of SB-10-GW and SB-12-GW.

Five of the groundwater samples contained reportable concentrations of SVOCs. Those samples were SB-1-GW, SB-3-GW, SB-12-GW, SB-14-GW, and SB-16-GW. In those samples, 17 SVOCs were detected at concentrations that ranged from 1.5 J to 195 µg/L. Two of the samples contained SVOCs at concentrations that exceeded their respective NVCP-RGs established for the groundwater exposure pathway. SB-3-GW contained naphthalene at 4.1 J µg/L, which exceeded its NVCP-RG of 1.5 µg/L. SB-3-GW was collected within the boundary of the former roundhouse facility. Naphthalene is commonly associated with petroleum products, which were likely historically used during operation of the roundhouse. SB-16-GW contained 10 SVOCs at concentrations that ranged from 2.5 to 7.3 J µg/L. Six of those 10 SVOCs were detected at concentrations that exceeded their respective NVCP-RGs for the groundwater exposure pathway. Those SVOCs were benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, chrysene, and indeno(1,2,3-cd)pyrene. SB-16-GW was collected from the southeast corner of the site, between two railroad lines. The SVOCs detected in the sample are commonly associated with petroleum products, as well as other sources. Petroleum-related SVOCs were detected in SB-12-GW and SB-14-GW, which are likely attributable to the diesel-contaminated groundwater plume.

Two of the groundwater samples contained reportable concentrations of TEH as diesel. TEH as diesel was detected in SB-10-GW and SB-12-GW at 3.09 and 32.9 milligrams per liter (mg/L), respectively. The detected concentrations of TEH are below regulatory limits established by the Nebraska Department of Environmental Quality (NDEQ). The levels of TEH detected in SB-10-GW and SB-12-GW are likely attributable to the diesel-contaminated groundwater plume. None of the other samples contained any detections of TEH.

All of the groundwater samples contained reportable concentrations of RCRA metals. Total arsenic, barium, cadmium, chromium, lead, and selenium were detected at concentrations that exceeded their respective NVCP-RGs for the groundwater exposure pathway. The groundwater samples analyzed for dissolved metals contained concentrations of arsenic, barium, and selenium; however, only arsenic was detected at concentrations that exceeded its established NVCP-RG for the groundwater exposure pathway, which is 50 µg/L (cancer endpoint concentration). Samples SB-10-GW and SB-12-GW (both collected from 16 to 20 feet bgs) contained dissolved arsenic at 425 µg/L and 376 µg/L, respectively. The source of the elevated arsenic concentrations is not known. SB-10-GW and SB-12-GW were collected just north of the diesel-contaminated groundwater plume; however, arsenic is not generally associated with diesel fuel. The elevated concentrations of metals detected in the unfiltered samples (total metals) are likely attributable to suspended sediment in the samples and are not likely representative of groundwater quality in the site area.

Evaluation of the groundwater sample results should consider that groundwater at the site and in the near site vicinity is not currently used for domestic purposes. Although groundwater contaminants were detected in several of the samples at elevated concentrations, the groundwater exposure pathway presents minimal risk for current and proposed future use, because groundwater is not currently used. Currently, there are no standards established by the NVCP for evaluating the vapor intrusion exposure pathway (for contaminated soil and groundwater); those standards are currently under development. Once vapor intrusion standards are established, sample results from this Phase II TBA should be reevaluated to determine risks presented for future development at the site.

Based on the Phase II TBA sample results, the contaminants detected in the environmental samples pose RECs to the site. Evaluation of risks posed to human health and the environment by contaminants identified in soil and groundwater at the site should be evaluated based on current site use, as well as future site use and redevelopment plans.

1.0 INTRODUCTION

Seagull Environmental Technologies Inc. (Seagull) was tasked by the U.S. Environmental Protection Agency (EPA), under the Mini-Superfund Technical Assessment and Response Team (Mini-START) contract to conduct a Phase II Targeted Brownfields Assessment (TBA) of the Burlington Northern and Santa Fe (BNSF) Property site. The site, which is approximately 67 acres in size, is located west of the downtown business district of the City of Lincoln, Lancaster County, Nebraska. The site is currently owned by BNSF and operated as a railroad yard. The BNSF Property site will hereafter be referred to as the "subject property" or "site". The City of Lincoln applied for a Brownfields grant from EPA Region 7 for assessment of the site, which has been targeted as part of a redevelopment area by the City of Lincoln. The following sections address the background and site history, Phase II TBA activities, presentation and evaluation of analytical results, and a discussion of findings and recommendations.

1.1 PURPOSE

The purpose of this Phase II TBA was to confirm or eliminate recognized environmental conditions (REC) specified in the Phase I TBA report for the site (Seagull 2010), further investigate the extent of soil and groundwater contamination identified during previous environmental assessments completed for the site, and assess risks to human health and the environment posed by any contamination. RECs specified in the Phase I TBA report were primarily related to the historical use of the site as a railroad yard.

1.2 SPECIAL TERMS AND CONDITIONS

No special terms or conditions were identified during the Phase II TBA.

2.0 BACKGROUND AND SITE HISTORY

This section provides a brief description of the site: the physical setting; site history and land use; adjacent land use; and a summary of the Phase I TBA previously completed for the site.

2.1 SITE DESCRIPTION AND FEATURES

The subject property is an active railroad yard with numerous railroad tracks running north and south across the site. The surrounding area consists of a mix of industrial, commercial, and retail properties. Currently, two metal buildings, a communication tower, and several small outbuildings are located on the site property. Several dirt/gravel access roads are located on the property. The north portion of the site is primarily undeveloped land. Access to the site is from a gravel road off N Street.

2.2 PHYSICAL SETTING

The site, which is approximately 67 acres in size, is located west of the downtown business district of the City of Lincoln, Lancaster County, Nebraska (see Appendix A, Figures 1 and 2). The BNSF Property site covers the southwest quarter of Section 23 and the northwest quarter of Section 26 in Township 10 North, Range 6 East (U.S. Geological Survey [USGS] 1980). The geographic coordinates for the approximate center of the site are 40.815254 degrees north latitude and 96.712556 degrees west longitude. It should be noted that the BNSF Property site includes several small parcels of land currently owned by the Lower Platte South Natural Resources District (LPSNRD), as well as platted right-of-ways owned by the City of Lincoln. For the purposes of this investigation, the LPSNRD and City of Lincoln properties are considered part of the BNSF Property site.

2.2.1 Geologic Setting

The site is located in Lincoln, Lancaster County, Nebraska, in the Central Lowland province of the Interior Plains physiographic region (Lobeck 1948). Soils at the site belong to the Wymore-Pawnee-Burchard Association. These soils are very deep, nearly level to strongly sloping, moderately well drained to well drained, silty or loamy soils with clayey subsoils on uplands (University of Nebraska-Lincoln [UNL] 2010).

The site is underlain by the Cretaceous Dakota Group (Gosselin 1996). The general sequence for this group includes a lower sandstone-dominated Nishnabotna Member and an upper mudstone-dominated Woodbury Member. The thickness of the Dakota Group ranges from 45 to 210 feet in eastern Nebraska to about 394 feet in western Nebraska. The thickness of the Nishnabotna in Nebraska is highly variable and probably less than 210 feet. Although Woodbury strata are dominated by mudstones, shales, and siltstones, very fine to fine-grained, channel-shaped sandstone bodies are also present, ranging in thickness from less than 3 feet up to 75 feet. In east-central Nebraska, the Woodbury Member is not recognizable. The Dakota Group in Nebraska is completely or partially overlain by Upper Cretaceous marine shales or Quaternary deposits consisting of glacial till and loess (Gosselin, Harvey, and Flowerday 2003).

2.2.2 Hydrogeology

The site is located in Groundwater Region 11, which occupies the glacial drift area of southeastern Nebraska. The base of the principal groundwater-bearing units in the northern and western parts (including the Lincoln area) of Groundwater Region 11 is the Dakota Formation (Gosselin 1996).

The primary units from which groundwater is obtained are Pleistocene sand and gravel deposits associated with paleovalleys and along some modern stream valleys; however, they are usually of limited extent. Nearly all major water supplies in this region come from the paleovalleys.

The Dakota Formation serves as a secondary source of groundwater where the primary Pleistocene sources are insufficient to meet water-supply needs (Gosselin 1996). The continuous sandstone bodies of the Nishnabotna Member are the primary water-bearing units in east-central Nebraska (Weeks and Gutentag 1988).

The Dakota Group consists of variable amounts of interbedded sandstone and shale (Gosselin 1996). Because of its geologic variability, the Dakota Group's capacity to yield groundwater can differ over short distances; consequently, well yields can be difficult to predict. The thickness of the saturated groundwater-bearing units is generally less than 300 feet. Depth to the regional water table varies as a function of topographic location. In upland areas, depth to water may be greater than 200 feet, while it may be less than 50 feet in the bottomlands of the principal valleys. Groundwater flow through the Dakota aquifer is generally moving to the northeast; however, locally, the flow systems are hydrologically complex (Gosselin, Harvey, and Flowerday 2003).

Perched water conditions occur in areas underlain by glacial till. Water from precipitation or irrigation moves readily through loess and/or isolated lenses of sand and gravel, but not through glacial till. As a result, water saturates the sediments above the till and a perched water table forms. Many domestic farm and stock wells have been developed in these perched water bodies (Gosselin 1996).

Based on registered wells in Section 22, Township 10 North, Range 6 East, shallow groundwater exists at depths approximately 14.5 feet or less below ground surface (bgs). Overburden thickness was recorded to be 46 to 53 feet bgs at those locations (Nebraska Department of Natural Resources [NDNR] 2010).

2.2.3 Hydrology

The nearest surface water feature is Salt Creek, located adjacent to the northwest corner of the site. The mean daily discharge at the Salt Creek gauging station at Pioneers Boulevard in Lincoln, Nebraska, was 5.2 cubic feet per second (cfs) in 2003 (USGS 2010a). According to the Nebraska Department of Environmental Quality (NDEQ), the designated uses for Salt Creek are recreation, aquatic life, agricultural water supply, and aesthetics (NDEQ 2000).

2.3 SITE HISTORY AND LAND USE

Historical Sanborn Fire Insurance (Sanborn®) maps indicate the property has been a railroad yard since at least the late 1800s. The 1886, 1891, and 1903 Sanborn® maps show coal yards, lumber yards, ice houses, and railroad storehouses located in the south-southeast portion of the site. The 1891 Sanborn® map shows an oil storage area located northwest of the storehouses. The 1903 Sanborn® map extends further northward and shows a Boston & Maine Railroad (identified as B&M RR) repair shop just east of the extension of 5th Street and between westward extensions of R and S Streets. The 1928 Sanborn® map shows only a couple of ice houses and wood platforms in the area where the coal and lumber yards had been located previously. Of the buildings that had housed the B&M RR repair shop in 1903, only a carpenter shop and a lumber shed are still identified on the 1928 map. The 1949 Sanborn® map indicates that a heating plant for the Chicago, Burlington, and Quincy Railroad (identified as CB&Q RR) Company, a pump house, and a water tower were present at the site.

Sanborn® maps show the portion of the site south of O Street largely transgressed by railroad tracks. The 1903 map shows a lunchroom, coal shed, and lamp and oil storehouse amid railroad tracks just east of where O and 5th Streets would cross if extended into the railyard. The 1928 Sanborn® map shows a few icehouses and wood platforms in the former coal yard area. Only one building (unidentified, but assumed to be the oil and lamp storehouse) remains south of O Street on the 1928 map.

The Sanborn® maps do not include an area to the north where a former railroad roundhouse was located. Remnants of the former roundhouse are visible on a 1949 aerial photograph (HWS Consulting Group [HWS] 2007).

2.4 ADJACENT PROPERTY USE

Adjoining properties include a City of Lincoln maintenance facility and the Haymarket Park Sports Complex to the north; railroad tracks and commercial and industrial buildings to the west; and commercial and industrial buildings to the south and east.

2.5 SUMMARY OF PREVIOUS ASSESSMENTS

Phase I and Phase II Environmental Site Assessments (ESA) were completed by HWS in August 2007 and May 2008, respectively. The Phase I and Phase II ESAs were performed under an EPA Targeted Brownfields Assessment grant. The Phase I ESA identified several RECs associated with the BNSF property. The identified RECs included the following:

- In 1987, diesel fuel was discovered along the east boundary of the site as part of a site assessment. A recovery system (currently in operation) was implemented to recover diesel fuel from the groundwater.

- In 1993, while conducting sewer repairs in the BNSF railroad yard, City of Lincoln work crews discovered a diesel fuel spill. The diesel fuel spill was determined to be associated with the previously identified spill (from 1987) and was migrating westward along sanitary sewer lines. A cleanup action involving recovery of the diesel fuel was conducted so the repairs could be made.

- In 2004, BNSF conducted a Tier 2 Risk-Based Corrective Action Assessment related to previously documented diesel spills at locations on the BNSF property. The diesel-contaminated plume is still currently being remediated under NDEQ's Title 200 Program.

- In 2007, NDEQ received notice of a diesel fuel spill at the site. A crack was discovered in a locomotive's fuel tank during refueling, and an estimated 100 gallons of fuel reportedly spilled onto the ballast and soil (HWS 2007).

- Historical documents identified a former railroad roundhouse structure located in the north portion of the site. Railroad roundhouse facilities are possible sources of soil and groundwater contamination, generally associated with fueling, maintenance, and repair of locomotives. Contaminants often associated with railroad roundhouses include petroleum products, degreasing solvents, and heavy metals.

Based on the Phase I ESA findings, HWS conducted Phase II sampling at the former location of the BNSF roundhouse in 2008 (see Appendix A, Figure 3). HWS collected four soil borings (SB-1 through SB-4) around the location of the former BNSF roundhouse facility. The soil borings were advanced to 12 feet bgs. SB-1 was placed near the center of the former turntable; SB-2 was located at a former workshop bay about 175 feet west of SB-1; SB-2 was located at a former workshop about 100 feet northwest of SB-1; and SB-4 was located in a former workshop bay about 100 feet northeast of SB-1. Soil samples from these borings were submitted for laboratory analysis of volatile organic compounds (VOC), semi-volatile organic compounds (SVOC) (polynuclear aromatic hydrocarbons [PAH], in particular), and metals regulated under the Resource Conservation and Recovery Act (RCRA). A soil sample collected from SB-1 (from 6 to 7 feet bgs) contained elevated concentrations of PAHs; benzo(a)anthracene and benzo(b)fluoranthene were detected at 8.45 and 4.72 milligrams per kilogram (mg/kg), respectively. Both of those concentrations of PAHs exceeded their respective Nebraska Voluntary Cleanup Program

Remediation Goals (NVCP-RG). Other PAHs, including fluorene, phenanthrene, pyrene, chrysene, and benzo(k)fluoranthene, were also detected in the sample. A soil sample collected from 1 to 3 feet bgs at SB-1 contained chromium (total) and lead at 34.2 and 4,870 mg/kg, respectively. HWS concluded that the BNSF property may warrant additional sampling prior to redevelopment (HWS 2008).

HWS conducted additional sampling at the site in 2008. Ten soil samples were collected from 1 to 3 feet bgs from an additional six borings at the former roundhouse area and analyzed for SVOCs and metals. Relative to the center of the former roundhouse, locations SB-5, SB-6, and SB-7 were placed about 50 feet southeast, northeast, and west, respectively. SB-8 was about 130 feet southeast, SB-9 was about 250 feet west, and SB-10 was about 200 feet northwest of the center of the former roundhouse (see Appendix A, Figure 3). Soils are believed to have been field screened for VOCs using a photoionization detector (PID); however, no field screening results are available.

Arsenic, chromium, and lead were the only metals that exceeded their respective NVCP-RGs (for residential and industrial soils). In particular, arsenic was reported in nine of the ten soil samples at concentrations ranging from 2.7 to 20.6 mg/kg, exceeding NVCP-RGs for arsenic, which is 0.39 mg/kg for residential soil and 16 mg/kg for industrial soil (cancer endpoint concentrations).

In the soil samples, dibenzofuran and diethyl phthalate (a common laboratory contaminant) were the only SVOCs detected that are not PAHs. The PAHs acenaphthene, anthracene, benzo(a)anthracene, benzo(b)fluoranthene, benzo(k)fluoranthene, chrysene, fluoranthene, fluorene, phenanthrene, and pyrene were also detected. Several SVOCs (including PAHs) were detected above their respective NVCP-RGs. Tables B-1 and B-2 in Appendix B summarize the analytical data for VOCs, SVOCs, and metals in the soil samples collected during the 2008 HWS Limited Phase II ESA.

HWS also collected groundwater samples from the six soil boring locations during the second part of the Phase II investigation. The groundwater samples are assumed to have been collected from the top of the water table (depths unknown). The samples were analyzed for VOCs and metals; it is unknown whether the samples were also analyzed for SVOCs.

A groundwater sample collected from SB-5, located about 50 feet southeast of the center of the former turntable, contained 1.1 micrograms per liter (µg/L) of carbon disulfide and 5.2 µg/L of *cis*-1,2-dichloroethene (cis-1,2-DCE), which is a common degradation product of trichloroethene (TCE). TCE, in turn, may result from degradation of tetrachloroethene (PCE). TCE and PCE are both common metal degreasing solvents.

Arsenic, barium, cadmium, chromium, lead, and mercury were detected in the groundwater samples at concentrations exceeding benchmark levels. No information is available regarding the turbidity of the samples; therefore, these results could reflect high levels of suspended solids. No samples were collected for analysis of dissolved metals. Table B-3 in Appendix B summarizes the VOCs and metals in groundwater samples collected during the 2008 HWS Limited Phase II ESA.

Seagull completed an updated Phase I ESA report (identified as a Phase I TBA) for the site prior to commencing the Phase II TBA. The Phase I TBA identified the following significant findings from review of historic records, environmental database review, site reconnaissance, or interviews.

- The subject property has been operated as a railroad yard since the late 1800s. Historical use of the property as a railroad facility, where fueling and other activities using hazardous materials were likely used, constitutes a REC to the subject property.

- Several spills/releases of petroleum products (diesel, in particular) have occurred at the subject property. Currently, there is an ongoing remedial action to recover diesel fuel from the groundwater. The documented petroleum releases pose RECs to the subject property.

- Five leaking underground storage tank (LUST) sites are located upgradient and within the near site vicinty. One LUST site (U.S. Postal Office) was identified as requiring additional investigation. The U.S. Postal Office site, located at 700 R Street, poses a REC to the subject property based on its regulatory status. The remaining four LUST sites are no longer active (no further action required). Based on their proximity, those four LUST sites pose historical RECs (HREC) to the subject property.

3.0 PHASE II TARGETED BROWNFIELDS ASSESSMENT ACTIVITIES

The following sections describe the scope of the Phase II TBA and field exploration and methods.

3.1 SCOPE OF THE ASSESSMENT

Mini-START field team members conducted sampling to determine if railroad yard operations at the site have impacted soil and groundwater underlying the subject property. Photographs were taken to document the site activities (see Appendix C), which were also recorded in a site logbook (see Appendix D). The sampling was conducted in accordance with an approved Quality Assurance Project Plan

(QAPP). In addition, the Phase II TBA activities were conducted in accordance with an access agreement for the subject property between Seagull and BNSF.

3.1.1 Conceptual Site Model and Sampling Plan

The proposed sampling scheme for collection of soil and groundwater samples was biased/judgmental, in accordance with the *Guidance for Performing Site Inspections under Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA)*, Office of Solid Waste and Emergency Response (OSWER) Directive #9345.1-05. Eighteen subsurface soil, nine surface soil (not including field screened samples), and 13 groundwater samples were collected from the site for analysis of chemical constituents. The subsurface soil and groundwater samples were collected using Geoprobe® direct-push technology equipment, in accordance with Region 7 EPA standard operating procedure (SOP) 4230.07A, Geoprobe® Operations. Quality control (QC) samples collected during the field activities included one water trip blank (laboratory-prepared), one equipment rinsate sample (of the Geoprobe® Screen Point 15 [SP 15] groundwater sampler), and one field blank. Sampling methods and activities are described in Section 3.2. A summary of samples collected during the Phase II TBA activities is included in Table 1.

3.1.2 Chemical Testing Plan

Phase II TBA activities included the collection of surface soil, subsurface soil, and groundwater samples. Subsurface soil and groundwater samples collected during the Phase II TBA activities were analyzed by the following analytical methods: VOCs by Method 8260, total extractable hydrocarbons (TEH) by Iowa Method OA-2, SVOCs by Method 8270, RCRA metals (except mercury) by Methods 6010 (for soil) and 6020 (for water), and mercury by Methods 7471 (for soil) and 7470 (for water). Eighteen of the surface soil samples were field screened with an x-ray fluorescence (XRF) spectrometer, and five were submitted for laboratory confirmation analysis of total lead, along with the other RCRA metals (by Methods 6010 and 7471). The remaining four surface soil samples were submitted for analysis of polychlorinated biphenyls (PCB) by Method 8082. All samples were submitted to Accutest laboratory in Orlando, Florida.

TABLE 1

SUMMARY OF SAMPLES COLLECTED DURING PHASE II TBA ACTIVITIES BURLINGTON NORTHERN AND SANTA FE PROPERTY, LINCOLN NEBRASKA

Sample Description	Sample Type	Total Number of Samples
Subsurface Soil	Field Samples	18
Surface Soil	Field Samples	18 (Field Screened) 9 (Laboratory Analyzed)
Groundwater	Field Samples	13
Water (Equipment Rinsate)	Quality Control Sample	1
Water (Field Blank)	Quality Control Sample	1
Water (Trip Blank)	Quality Control Sample	1

3.1.3 Deviations from the QAPP

Deviations from the QAPP and the rationale for these deviations are presented below:

- Asbestos surveys of the on-site buildings were not completed. BNSF provided Seagull past asbestos inspection results for the site buildings (see Appendix E). Because the site buildings are still occupied and utilized for daily operations, destructive sampling was determined not necessary during the Phase II TBA.

- Four surface soil samples were collected from the BNSF property that bordered the Alter Scrap Yard located on the southeast portion of the site (see Appendix A, Figure 2). Prior to commencing Phase II TBA sampling activities, Seagull obtained information that a remedial action had been conducted on the Alter property in 1999 to address PCB-contaminated soil. Four surface soil samples were collected for analysis of PCBs on BNSF property that bordered the north and west sides of Alter's North Yard, where the remedial action had occurred.

- One additional groundwater sample was collected than proposed in the QAPP. The sample was collected from SB-10, where petroleum-contaminated groundwater was encountered during field activities.

3.2 FIELD EXPLORATION AND METHODS

Field activities at the site were conducted on March 8 through 10, 2010. Seagull team members involved with the field activities were Jeff Pritchard, Cosmo Canacari, Quan Do, and Ryan Lunt.

3.2.1 Subsurface Soil Sampling

Subsurface soil samples were collected from 18 locations at the site (see Appendix A, Figure 4). At each of these boreholes, continuous soil cores were collected to the selected sample depth (generally the groundwater interface) with a Geoprobe® Macro-Core soil sampler fitted with disposable polyvinyl chloride (PVC) liners. Following sample collection, the soil cores were immediately screened for VOCs with a PID and for metals (lead, in particular) with an XRF. From each borehole, one soil sample was collected from a 2-foot interval. The sampled interval was selected based on field screening results, visual observations, and sampler judgement. Individual soil cores were logged to determine lithology and soil characteristics. Boring logs are included as Appendix F. Following sample collection from the soil boring locations, the boreholes were backfilled with bentonite. Geoprobe® rods and samplers were decontaminated with a tap water wash and rinse between sampling locations.

The 18 subsurface soil samples were submitted for analysis of VOCs, SVOCs, TEH, and RCRA metals. Soil samples for analysis of VOCs were collected following EPA Method 5035 guidelines, which involved placing approximately 5 grams of soil into two 40-milliliter (mL) volatile organic analysis (VOA) vials pre-preserved with sodium bisulfate and one VOA vial preserved with methanol. The remaining soil was removed from the Geoprobe® Macro-Core liner and placed into a disposable aluminum pie pan, homogenized, and transferred to a 4-ounce glass jar and a 8-ounce glass jar for analysis of SVOCs, TEH, and RCRA metals.

Pertinent data, including analyses to be performed and sample locations, were included on field sheets (see Appendix G). All soil samples were stored in coolers maintained at or below 4 degrees Celsius (°C). Table 2 in this report summarizes the sample identification numbers, locations, Global Positioning System (GPS) coordinates, depth intervals, and analyses for the subsurface soil samples collected during the Phase II TBA activities.

3.2.2 Surface Soil Sampling

Surface soil samples were also collected from each of the 18 Geoprobe® boring locations to determine if historic railroad yard operations have impacted surface soil. At each of the 18 Geoprobe® boring locations, a 100-foot by 100-foot cell was created, with the borehole serving as the center of the cell (see Appendix A, Figure 5). In each cell, a nine-aliquot composite sample was collected from the upper 2 inches of soil with a disposable stainless steel spoon. The surface soil samples were placed in ziplock bags and transported to a sample preparation facility at the Seagull office, where they were transferred to clean, dedicated aluminum pie pans and allowed to completely dry (because elevated moisture content

can adversely affect XRF readings). Once dry, the samples were homogenized, passed through a number 10 (2-millimeter) sieve, and then screened for lead using an XRF. Three separate XRF readings were taken from each sample and the average was recorded on field sheets. XRF results for lead in the screened samples ranged from 36 to 326 mg/kg. XRF screening indicated that none of the surface soil samples contained lead at concentrations greater than 400 mg/kg, the NVCP-RG established for lead in residential soil. Table B-4 in Appendix B contains the XRF screening results.

To ensure accuracy of the XRF, five surface soil samples were collected for laboratory confirmation analysis of total lead, along with other heavy metals (laboratory confirmation sample results are discussed in Section 4.2). The samples were selected to accurately represent the general range of lead concentrations indicated by XRF screening.

An additional four surface soil samples were collected from BNSF property adjacent to the Alter Scrap Yard, where a historic remedial action to remove PCB-contaminated soil had been conducted (see Appendix A, Figure 2). Those additional surface soil samples were collected to determine if PCBs have migrated off site and impacted the subject property. To assess surface soil adjacent to the Alter property, transect lines were created. Transect-1 was located along the west side of Alter and was approximately 300 feet in length. Transect-2 was located along the north side of Alter and was approximately 100 feet in in length (see Appendix A, Figure 5). From each 100-foot segment, a 10-aliquot composite sample was collected from the upper 2 inches of soil, with aliquots collected at 10-foot intervals. In all, four surface soil samples were collected from the transect lines.

Pertinent data, including analyses to be performed and sample locations, were included on field sheets (see Appendix G). All soil samples were stored in coolers maintained at or below 4 °C. Table 2 in this report summarizes the sample identification numbers, locations, GPS coordinates, depth intervals, and analyses for the surface soil samples collected during the Phase II TBA activities.

3.2.3 Groundwater Sampling

Groundwater samples were collected from 13 temporary monitoring wells installed at the site (see Appendix A, Figure 4). Groundwater sample locations were selected to cover the geographic extent of the site. Groundwater samples were generally collected just below the water table (typically ranging from 16 to 24 feet bgs at the site). Groundwater sample SB-18-GW was collected from 36 to 40 feet bgs, because groundwater was not encountered at shallower depths. At each temporary Geoprobe® well location, a Geoprobe® SP 15 groundwater sampling apparatus was driven below the water table. The sampler sheath was then withdrawn 4 feet, exposing a 4-foot-long, disposable, PVC screen, allowing a

sample to be collected through polyethylene tubing fitted with a check valve. New tubing was used for each sample to avoid cross-contamination from previous sampling locations. Geoprobe® rods and samplers were decontaminated with a tap water wash and rinse between sampling locations. Following sample collection from the temporary monitoring wells, the Geoprobe® rods were removed and the boreholes were backfilled with bentonite.

The groundwater samples (excluding SB-18-GW) were collected for analysis of VOCs, SVOCs, TEH, and total and dissolved RCRA metals. The groundwater sample from SB-18-GW was analyzed for VOCs only, because a limited volume of groundwater was encountered at this location. Samples for analysis of VOCs were collected in three 40-mL VOA vials preserved with hydrochloric acid. Samples for analysis of SVOCs and TEH were collected in two 1-liter amber bottles. Water samples collected for analysis of RCRA metals (total and dissolved) were collected in two 500-mL plastic bottles. The water samples collected for total RCRA metals were preserved with nitric acid to a pH <2, and the samples for dissolved RCRA metals were collected unpreserved (to be filtered at the laboratory). Pertinent data, including analyses to be performed and sample locations, were included on field sheets (see Appendix G). All water samples were stored in coolers maintained at or below 4 °C until they were submitted to the Accutest laboratory. Table 2 summarizes the sample identification numbers, locations, depths, GPS coordinates, and analyses for the groundwater samples.

TABLE 2

SUMMARY OF SAMPLES SUBMITTED FOR LABORATORY ANALYSIS
BURLINGTON NORTHERN AND SANTA FE PROPERTY, LINCOLN, NEBRASKA

Sample Identification	Sample Location	Sample Depth (bgs)	GPS Coordinates	Matrix	Analysis
SUBSURFACE SOIL					
SB-1-10-12	B-1	10-12 feet	40.82052º N 96.71756º W	Subsurface soil	VOCs, SVOCs, TEH, & RCRA metals
SB-2 -8-10	B-2	8-10 feet	40.82059º N 96.71501º W	Subsurface soil	VOCs, SVOCs, TEH, & RCRA metals
SB-3-16-18	B-3	16-18 feet	40.82008º N 96.71446º W	Subsurface soil	VOCs, SVOCs, TEH, & RCRA metals
SB-4-4-6	B-4	4-6 feet	40.82023º N 96.71304º W	Subsurface soil	VOCs, SVOCs, TEH, & RCRA metals
SB-5-12-14	B-5	12-14 feet	40.82056º N 96.71191º W	Subsurface soil	VOCs, SVOCs, TEH, & RCRA metals
SB-6-4-6	B-6	4-6 feet	40.81879º N 96.71569º W	Subsurface soil	VOCs, SVOCs, TEH, & RCRA metals
SB-7-8-10	B-7	8-10 feet	40.81866º N 96.71382º W	Subsurface soil	VOCs, SVOCs, TEH, & RCRA metals
SB-8-4-6	B-8	4-6 feet	40.81900º N	Subsurface	VOCs, SVOCs, TEH, &

Sample Identification	Sample Location	Sample Depth (bgs)	GPS Coordinates	Matrix	Analysis
			96.71250º W	soil	RCRA metals
SB-9-8-10	B-9	8-10 feet	40.81784º N 96.71465º W	Subsurface soil	VOCs, SVOCs, TEH, & RCRA metals
SB-10-13-15	B-10	13-15 feet	40.81778º N 96.71286º W	Subsurface soil	VOCs, SVOCs, TEH, & RCRA metals
SB-11-2-4	B-11	2-4 feet	40.81812º N 96.71209º W	Subsurface soil	VOCs, SVOCs, TEH, & RCRA metals
SB-12-6-8	B-12	6-8 feet	40.81733º N 96.71249º W	Subsurface soil	VOCs, SVOCs, TEH, & RCRA metals
SB-13-8-10	B-13	8-10 feet	40.81452º N 96.71422º W	Subsurface soil	VOCs, SVOCs, TEH, & RCRA metals
SB-14-18-20	B-14	18-20 feet	40.81527º N 96.71192º W	Subsurface soil	VOCs, SVOCs, TEH, & RCRA metals
SB-15-6-8	B-15	6-8 feet	40.81400º N 96.71325º W	Subsurface soil	VOCs, SVOCs, TEH, & RCRA metals
SB-16-10-12	B-16	10-12 feet	40.81411º N 96.71213º W	Subsurface soil	VOCs, SVOCs, TEH, & RCRA metals
SB-17-14-16	B-17	14-16 feet	40.81284º N 96.71423º W	Subsurface soil	VOCs, SVOCs, TEH, & RCRA metals
SB-18-14-16	B-18	14-16 feet	40.81192º N 96.71440º W	Subsurface soil	VOCs, SVOCs, TEH, & RCRA metals
SURFACE SOIL					
SB-1-0-2”	B-1	0-2 inches	40.82052º N 96.71756º W	Surface soil	RCRA metals
SB-4-0-2”	B-4	0-2 inches	40.82023º N 96.71304º W	Surface soil	RCRA metals
SB-6-0-2”	B-6	0-2 inches	40.81879º N 96.71569º W	Surface soil	RCRA metals
SB-8-0-2”	B-8	0-2 inches	40.81900º N 96.71250º W	Surface soil	RCRA metals
SB-13-0-2”	B-13	0-2 inches	40.81452º N 96.71422º W	Surface soil	RCRA metals
SS-1	Transect 1	0-2 inches	40.81277º N 96.71361º W	Surface soil	PCBs
SS-2	Transect 1	0-2 inches	40.81306º N 96.71352º W	Surface soil	PCBs
SS-3	Transect 1	0-2 inches	40.81335º N 96.71344º W	Surface soil	PCBs
SS-4	Transect 2	0-2 inches	40.81352º N 96.71319º W	Surface soil	PCBs
GROUNDWATER					
SB-1-GW	SB-1	16-20 feet	40.82052º N 96.71756º W	Water	VOCs, SVOCs, TEH, & RCRA metals (total and dissolved)
SB-3-GW	SB-3	26-30 feet	40.82008º N 96.71446º W	Water	VOCs, SVOCs, TEH, & RCRA metals (total and dissolved)
SB-5-GW	SB-5	16-20 feet	40.82056º N 96.71191º W	Water	VOCs, SVOCs, TEH, & RCRA metals (total and

Sample Identification	Sample Location	Sample Depth (bgs)	GPS Coordinates	Matrix	Analysis
					dissolved)
SB-6-GW	SB-6	16-20 feet	40.81879º N 96.71569º W	Water	VOCs, SVOCs, TEH, & RCRA metals (total and dissolved)
SB-9-GW	SB-9	16-20 feet	40.81784º N 96.71465º W	Water	VOCs, SVOCs, TEH, & RCRA metals (total and dissolved)
SB-10-GW	SB-10	16-20 feet	40.81778º N 96.71286º W	Water	VOCs, SVOCs, TEH, & RCRA metals (total and dissolved)
SB-12-GW	SB-12	16-20 feet	40.81733º N 96.71249º W	Water	VOCs, SVOCs, TEH, & RCRA metals (total and dissolved)
SB-13-GW	SB-13	24-28 feet	40.81452º N 96.71422º W	Water	VOCs, SVOCs, TEH, & RCRA metals (total and dissolved)
SB-14-GW	SB-14	24-28 feet	40.81527º N 96.71192º W	Water	VOCs, SVOCs, TEH, & RCRA metals (total and dissolved)
SB-15-GW	SB-15	16-20 feet	40.81400º N 96.71325º W	Water	VOCs, SVOCs, TEH, & RCRA metals (total and dissolved)
SB-16-GW	SB-16	28-32 feet	40.81411º N 96.71213º W	Water	VOCs, SVOCs, TEH, & RCRA metals (total and dissolved)
SB-17-GW	SB-17	24-28 feet	40.81284º N 96.71423º W	Water	VOCs, SVOCs, TEH, & RCRA metals (total and dissolved)
SB-18-GW	SB-18	36-40 feet	40.81192º N 96.71440º W	Water	VOCs

Notes:

GPS coordinates for the surface soil sample locations are the approximate center of each sample's transect line sample segment.

bgs	Below ground surface	SVOC	Semi-volatile organic compound
GPS	Global positioning system	TEH	Total extractable hydrocarbon
N	North	VOC	Volatile organic compound
PCB	Polychlorinated biphenyl	W	West
RCRA	Resource Conservation and Recovery Act	°	Degrees

4.0 EVALUATION AND PRESENTATION OF RESULTS

Sections 4.1 through 4.4 summarize the analytical data for the soil (surface and subsurface), groundwater, and QC samples collected during the Phase II TBA. Soil and groundwater sample results from this Phase II TBA were compared to their respective NVCP-RGs. These default values have been established by NDEQ to represent protective concentration thresholds for common environmental contaminants (NDEQ 2006). Comparison to both residential and non-residential values were made (when applicable) to address

multiple land use scenarios for future site redevelopment. Soil and groundwater sample results for TEH (analyzed by Iowa Method OA-2) were also compared to regulatory limits established by NDEQ for petroleum release sites (NDEQ 2009). The complete analytical data package is included as Appendix H. An updated Brownfields Property Profile Form is included as Appendix I. Appendix B contains tables summarizing the analytical results.

4.1 SUBSURFACE SOIL SAMPLES

Eighteen subsurface soil samples were submitted to Accutest laboratory for analysis of VOCs, SVOCs, TEH, and RCRA metals (including mercury).

Volatile Organic Compounds

Ten of the 18 subsurface soil samples contained VOCs at concentrations that ranged from 1.6 J to 1,060 micrograms per kilogram (µg/kg). A J-coded result indicates the concentration was estimated. None of the VOCs were detected at concentrations that exceeded their respective NVCP-RGs. The samples collected from SB-2, SB-3, SB-5, SB-13, SB-15, SB-16, SB-17, and SB-18 contained no reportable concentrations of VOCs. Those samples were primarily collected from the north and south portions of the site (see Appendix A, Figure 4). Those sample locations included SB-2 and SB-3, which were near the former roundhouse located in the north-central portion of the site. Six samples, which were collected from SB-1, SB-4, SB-6, SB-7, SB-9, and SB-11, only contained acetone and vinyl acetate. Acetone, which was detected at concentrations ranging from 29.4 J to 44 J µg/kg, is a common laboratory contaminant and not likely attributable to the site. The detected concentrations of acetone were well below its respective NVCP-RGs. Vinyl acetate, which was detected in the samples collected from SB-1, SB-6, and SB-7 at concentrations ranging from 34.4 to 173 µg/kg, is a compound commonly used to make paint, textiles, and paper. Vinyl acetate is also used as coating in plastic films. The samples containing vinyl acetate (SB-1, SB-6, and SB-7) were located in the northwest portion of the site, which is primarily undeveloped land. The detected concentrations of vinyl acetate were well below NVCP-RGs. In the remaining four samples, which were collected from SB-8, SB-10, SB-12, and SB-14, the following seven VOCs were detected: benzene, n-butylbenzene, sec-butylbenzene, isopropylbenzene, 4-methyl n-propylbenzene, n-propylbenzene, and xylenes. Those VOCs, which were detected at concentrations that ranged from 1.6 J to 1,060 J µg/kg, are generally associated with petroleum products. Sample locations SB-8, SB-10, and SB-12 were located near the east-central portion of the site (see Appendix A, Figure 4). Those sample locations are located just north of the diesel-contaminated groundwater plume that is currently being remediated by BNSF. In particular, the highest concentrations of VOCs were detected in

sample SB-12 (collected from 6 to 8 feet bgs). Sample location SB-14 was located in the southeast portion of the site, just south of the diesel-contaminated groundwater plume. The VOCs detected in SB-8, SB-10, SB-12, and SB-14 are likely attributable to the known groundwater plume. Petroleum odors were noted at SB-10 and SB-12 during sample collection. Table B-5 in Appendix B summarizes the analytical data for VOCs in the soil samples.

Semi-Volatile Organic Compounds

Four of the 18 subsurface soil samples contained SVOCs (primarily PAHs) at concentrations that ranged from 59.7 J to 10,000 µg/kg. The four samples that contained SVOCs were collected from SB-1, SB-4, SB-12, and SB-14. The sample collected from SB-1 (from 10-12 feet bgs) contained six SVOCs at concentrations that ranged from 68.6 J to 105 J µg/kg. Benzo(a)pyrene (detected at 99.2 J µg/kg) was the only SVOC detected at a concentration that exceeded its NVCP-RG established for residential soil, which is 62 ug/kg. SB-1 was located in the northwest corner of the site, in an area of currently (and historically) undeveloped land. The detected concentration of benzo(a)pyrene in SB-1 (99.2 J µg/kg) was well below its NVCP-RG established for industrial soil, which is 21,000 µg/kg.

The sample collected from SB-4 contained 20 SVOCs at concentrations that ranged from 59.7 J to 8,380 µg/kg. This sample was collected from the north portion of the site where fill (including buried railroad ties) was encountered at subsurface depths. SVOCs (PAHs, in particular) are commonly associated with wood treatment chemicals (creosote) associated with railroad ties; therefore, the SVOCs detected in SB-4 could be attributed to the buried railroad ties (and other fill materials). Six SVOCs were detected in the sample collected from SB-4 at concentrations that exceeded their respective NVCP-RGs established for residential soils. Those SVOCs were benzo(a)anthracene (at 4,600 µg/kg), benzo(a)pyrene (at 4,400 µg/kg), benzo(b)fluoranthene (at 4,880 µg/kg), dibenzo(a,h)anthracene (at 496 µg/kg), dibenzofuran (at 179 J µg/kg), and indeno(1,2,3-cd)pyrene (at 3,150 µg/kg); however, only benzo(a)pyrene was detected at a concentration that exceeded its NVCP-RG for industrial soils, which is 2,100 µg/kg.

The sample collected from SB-12 (from 6 to 8 feet bgs) contained the following three SVOCs: acenaphthene (at 341 J µg/kg), fluorene (at 715 J µg/kg), and 1-methylnapthalene (at 496 J µg/kg). None of the SVOCs detected in SB-12 were detected above their respective NVCP-RGs (if established). Sample location SB-12 was located just north of the diesel-contaminated groundwater plume that is currently being remediated by BNSF. The SVOCs (PAHs) detected at SB-12 are commonly associated with petroleum products, diesel in particular.

The sample collected from SB-14 (from 18 to 20 feet bgs) contained 1-methylnapthalene at 103 J µg/kg. Currently, no NVCP-RGs for 1-methylnapthalene have been established. Table B-6 in Appendix B summarizes the analytical data for SVOCs in the soil samples.

Total Extractable Hydrocarbons

Seven of the 18 subsurface soil samples contained reportable concentrations of TEH that ranged from 4.9 J to 1,170 mg/kg. TEH as diesel and TEH as motor oil were the only TEH analytes detected in those samples. Low concentrations of TEH as motor oil were detected in the samples collected from SB-1, SB-2, SB-7, and SB-13. The detected concentration of TEH as motor oil ranged from 4.67 J to 15.1 mg/kg. TEH as diesel was detected in three samples (SB-4, SB-10, and SB-12) at concentrations that ranged from 35.4 to 1,170 mg/kg. Sample location SB-4 was located in the north-central portion of the site, where buried fill materials were located. Sample locations SB-10 and SB-12 were located in the east-central portion of the site, just north of the known diesel-contaminated groundwater plume. Sample SB-12 (from 6 to 8 feet bgs) contained the highest concentration of TEH as diesel, which was 1,170 mg/kg. Currently, no NVCP-RGs for TEH have been established. However, regulatory limits for TEH as diesel and waste oil (comparable to motor oil) have been established for several exposure scenarios by NDEQ for petroleum release sites (NDEQ 2009). The detected concentrations of TEH were compared to NDEQ regulatory limits established for the vapor intrusion pathway; all results were below regulatory limits for the most conservative scenario (residential exposure). Table B-7 in Appendix B summarizes the analytical data for TEH in the soil samples.

RCRA Metals

All 18 of the subsurface soil samples contained RCRA metals. In those samples, the following RCRA metals were detected: arsenic, barium, cadmium, chromium, lead, mercury, and silver (only selenium was not detected). All 18 of the samples contained levels of arsenic that exceeded its NVCP-RG established for residential soil, which is 0.39 mg/kg (cancer endpoint concentration). Concentrations of arsenic ranged from 1.6 to 10.8 mg/kg in those samples. None of the detected concentrations of arsenic exceeded its NVCP-RG established for industrial soil, which is 16 mg/kg. The average concentration for arsenic in Lancaster County is 9.04 mg/kg (USGS 2010b). Only one sample, SB-4 (collected from 4 to 6 feet bgs), contained arsenic above the background concentration established by USGS; therefore, the detected arsenic concentrations in all the samples collected across the site are likely naturally occurring. Lead was detected in sample SB-2 (collected from 8 to 10 feet bgs) at 601 mg/kg, which exceeded its NVCP-RG of 400 mg/kg established for residential soil. That detected concentration of lead was below its NVCP-RG

for industrial soil, which is 750 mg/kg. Sample location SB-2 was in the north portion of the site, just northwest of the former roundhouse facility. The source for the elevated lead concentration is unknown; however, based on sample results from previous investigations and surface soil XRF screening/sampling conducted during the Phase II TBA (discussed below), it does not appear that a wide-spread area of lead-contaminated soil exists. None of the other metals were detected at concentrations that exceeded their respective NVCP-RGs, and are likely representative of naturally occurring concentrations. Table B-8 in Appendix B summarizes the analytical data for metals in the soil samples.

4.2 SURFACE SOIL SAMPLES

Five surface soil samples were submitted to Accutest laboratory for analysis of RCRA metals. In addition, four surface soil samples were submitted for analysis of PCBs.

RCRA Metals

All five of the surface soil samples contained reportable concentrations of RCRA metals. In those samples, the following RCRA metals were detected: arsenic, barium, cadmium, chromium, lead, and mercury (selenium and silver were not detected). Arsenic was the only RCRA metal detected above its NVCP-RGs. Concentrations of arsenic ranged from 3.8 to 50.2 mg/kg in those samples. All of the samples contained levels of arsenic that exceeded its NVCP-RG established for residential soil, which is 0.39 mg/kg (cancer endpoint concentration). For reference, the NVCP-RG non-cancer endpoint concentration established for arsenic (residential soil) is 5.4 mg/kg. The samples collected from SB-8 and SB-13 contained arsenic at 37.6 and 50.2 mg/kg, respectively. Those concentrations exceed the NVCP-RG established for arsenic in industrial soil (cancer endpoint concentration), which is 16 mg/kg. It should be noted that none of the detected concentrations of arsenic exceeded its NVCP-RG non-caner endpoint concentration for industrial soil, which is 260 mg/kg. SB-8 is located in the east-central portion of the site, within 50 feet of several railroad tracks (see Appendix A, Figure 4). SB-13 is located in the southwestern portion of the site, directly adjacent to railroad tracks. There are many potential sources of anthropogenic arsenic, including treated lumber (railroad ties). No other metals were detected at concentrations that exceeded their established NVCP-RGs. Table B-8 in Appendix B summarizes the analytical data for metals in the surface soil samples.

Confirmation of XRF Data

The XRF unit used during the project was checked daily with known standards. To ensure accuracy of the XRF, five samples (representing approximately 30 percent of the surface soil samples screened with

the XRF) were submitted for laboratory confirmation analysis of RCRA metals (lead, in particular). The samples were selected to accurately represent the spatial distribution of lead contamination at the site, as well as to cover the general range of lead concentrations indicated by XRF screening. Table B-4 in Appendix B summarizes the XRF screening results, along with the laboratory results for total lead. For each sample, the laboratory result for lead was recorded in a spreadsheet, along with the associated XRF reading, so that a regression coefficient (r^2) could be calculated for the two sets of data. The r^2 value was 0.9334, greater than the minimum value of 0.7 required for the remaining XRF data to be considered quantitative screening level data (EPA 1998). Correlation data are provided in Appendix J.

Polychlorinated Biphenyls

Four surface soil samples, which were collected from BNSF property adjacent to Alter Scrap Yard's North Yard, were submitted for analysis of PCBs. All four of the samples contained reportable concentrations of PCBs. In those samples, the following PCBs were detected: Aroclor 1248, Aroclor 1254, and Aroclor 1260. Concentrations of the detected PCBs ranged from 15.3 to 852 µg/kg. Sample SS-1 contained Aroclor 1248 and Arochlor 1254 at 852 and 604 mg/kg, respectively. Both of those concentrations exceeded the NVCP-RG established for residential soil, which is 220 µg/kg (for Arochlors 1248 and 1254). The detected concentrations of those PCBs were well below the NVCP-RG established for industrial soil, which is 7,400 µg/kg (for Arochlors 1248 and 1254). Sample SS-1 was collected from BNSF property that was adjacent to the southwest corner of Alter's North Yard. As previously mentioned, a remedial action was conducted in 1999 in the North Yard, which involved the excavation of PCB-contaminated soil. Based on the sample results from SS-1, it appears PCBs have migrated from the North Yard and impacted surface soils in the vicinity of sample SS-1. None of the other surface soil samples contained PCBs above their respective NVCP-RGs. Table B-9 in Appendix B summarizes the analytical data for PCBs in the surface soil samples.

4.3 GROUNDWATER SAMPLES

Twelve groundwater samples were submitted to Accutest laboratory for analysis of VOCs, SVOCs, TEH, and RCRA metals (total and dissolved, including mercury). As previously mentioned, groundwater sample SB-18-GW was analyzed for VOCs only.

Volatile Organic Compounds

Five of the groundwater samples contained reportable concentrations of VOCs. Those groundwater samples were SB-1-GW, SB-6-GW, SB-10-GW, SB-12-GW, and SB-18-GW. In those five samples, 16

VOCs were detected at concentrations that ranged from 0.24 J to 36.7 µg/L. Sample SB-1-GW (collected from 16 to 20 feet bgs), contained cis-1,2-dichlorothene (cis-1,2-DCE) at 4.3 µg/L and TCE at 0.51 J µg/L. SB-1-GW was collected from the northwest corner of the site, in an undeveloped area (see Appendix A, Figure 4). The detected concentrations for both of those VOCs were well below their respective NVCP-RGs established for the groundwater exposure pathway, which were 70 µg/L for cis-1,2-DCE and 5 µg/L for TCE. Those VOCs have historically been used as degreasing solvents and could be associated with the former roundhouse facility that was located upgradient (east) of that sample location.

Sample SB-6-GW (collected from 16 to 20 feet bgs) contained chloroform at 0.25 J µg/L, which exceeded its established NVCP-RG of 0.21 µg/L. SB-6-GW was collected from the west portion of the site, in an undeveloped area (see Appendix A, Figure 4). Chloroform is commonly used as a solvent in making dyes and pesticides. Chloroform is also a by-product of the chlorination process for drinking water. It should also be noted that chloroform is a common laboratory contaminant. For reference, the maximum contaminant level (MCL) for total trihalomethanes (including chloroform) is 80 µg/L.

Sample SB-10-GW (collected from 16 to 20 feet bgs) contained sec-butylbenzene at 0.24 J µg/L, which were well below its NVCP-RG of 370 µg/L, established for the groundwater exposure pathway. SB-12-GW (collected from 16-20 feet bgs) contained six VOCs (n-butylbenzene, sec-butylbenzene, tert-butylbenzene, isopropylbenzene, p-isopropyltoluene, and n-propylbenzene) at concentrations that ranged from 0.49 J to 5.5 µg/L. The detected concentrations of those six VOCs were well below their respective NVCP-RGs established for the groundwater exposure pathway. Samples SB-10-GW and SB-12-GW were collected from the east-central portion of the site, which was just north of the diesel-contaminated groundwater plume currently being remediated by BNSF. The VOCs detected in those samples are typically associated with petroleum products. The groundwater samples collected from those two locations were noted to contain petroleum odors during sample collection.

Sample SB-18-GW (collected from 36 to 40 feet bgs) contained nine VOCs at concentrations that ranged from 0.23 J to 36.7 µg/L. The nine VOCs detected in the sample were carbon disulfide (0.6 µg/L), 1,1-dichloroethane (1,1-DCA) (2.7 µg/L), 1,1-dichloroethylene (1,1-DCE) (5.5 µg/L), 1,2-dichloroethane (1,2-DCA) (36.7 µg/L), isopropylbenzene (0.23 J µg/L), methyl tert butyl ether (MTBE) (0.53 J µg/L, tetrachloroethylene (PCE) (0.46 J µg/L) , 1,1,1-trichloroethane (1,1,1-TCA) (0.56 J µg/L), and TCE (0.96 µg/L). 1,2-DCA, which was detected at 36.7 µg/L, was the only VOC detected in SB-18-GW at a concentration above its NVCP-RG of 5.0 µg/L. No other VOCs were detected at concentrations that exceeded their respective NVCP-RGs. Sample SB-18-GW was located in the southwest corner of the site

adjacent to the north-and-south-running railroad corridor. Industrial and commercial facilities (including Alter Scrap Yard) are located east (upgradient) of this sample location. Most of the VOCs detected in SB-18-GW are chlorinated solvents (including 1,2-DCA, TCE, and PCE); however MTBE is associated with gasoline. The source for the contaminants detected in SB-18-GW is unknown.

The groundwater sample collected from SB-1-GW contained cis-1,2-DCE at 4.3 µg/L and TCE at 0.51 J µg/L. Those VOCs have historically been used as degreasing solvents and could be associated with the former roundhouse facility that was located upgradient (east) of that sample location. Table B-10 in Appendix B summarizes the analytical data for VOCs in groundwater samples.

Semi-Volatile Organic Compounds

Five of the groundwater samples contained reportable concentrations of SVOCs. Those samples were SB-1-GW, SB-3-GW, SB-12-GW, SB-14-GW, and SB-16-GW. In those samples, 17 SVOCs were detected at concentrations that ranged from 1.5 J to 195 µg/L. SB-1-GW (collected from 16 to 20 feet bgs) contained bis(2-ethylhexyl)phthalate at 5.0 µg/L, which was below its NVCP-RG of 6.0 µg/L established for the groundwater exposure pathway. SB-1-GW was collected from the northwest corner of the site.

SB-3-GW (collected from 26-30 feet bgs) contained naphthalene at 4.1 J µg/L, which exceeded its NVCP-RG of 1.5 µg/L established for the groundwater exposure pathway. SB-3-GW was collected within the boundary of the former roundhouse facility. Naphthalene is commonly associated with petroleum products, which were likely historically used during operation of the roundhouse.

SB-12-GW (collected from 12 to 16 feet bgs) contained six SVOCs at concentrations that ranged from 8.9 J to 195 µg/L. The six detected SVOCs were acenaphthylene (at 8.9 J µg/L), dibenzofuran (at 10.7 J µg/L), fluorene (at 20.5 J µg/L), 1-methylnaphthalene (at 195 J µg/L), 2-methylnaphthalene (at 155 µg/L), and phenanthrene (at 36 µg/L). None of the SVOCs detected in SB-12-GW were above their respective NVCP-RGs. SB-12-GW was collected from the east-central portion of the site, which was just north of the diesel-contaminated groundwater plume currently being remediated by BNSF. The SVOCs detected in SB-12-GW are commonly associated with petroleum products. Groundwater sample SB-12-GW was noted to contain petroleum odors during sample collection.

SB-14-GW contained 1-methylnaphthalene and 2-methylnaphthalene at 2.8 J and 1.5 J µg/L, respectively. Currently, NVCP-RGs have not been established for either of those SVOCs. SB-14-GW was collected

from the southeast portion of the site, just south of the diesel-contaminated groundwater plume. The two SVOCs detected in SB-14-GW are commonly associated with petroleum products.

SB-16-GW contained 10 SVOCs at concentrations that ranged from 2.5 to 7.3 J µg/L. Six of those 10 SVOCs were detected at concentrations that exceeded their respective NVCP-RGs for the groundwater exposure pathway. Those SVOCs were benzo(a)anthracene (at 5.0 µg/L), benzo(a)pyrene (at 4.8 µg/L), benzo(b)fluoranthene (at 6.0 µg/L), benzo(k)fluoranthene (at 2.5 µg/L), chrysene (at 4.8 µg/L), and indeno(1,2,3-cd)pyrene (at 3.0 J µg/L). SB-16-GW was collected from the southeast corner of the site, between two railroad lines. The SVOCs detected in the sample are commonly associated with petroleum products, as well as other sources. Table B-11 in Appendix B summarizes the analytical data for SVOCs in groundwater samples.

Total Extractable Hydrocarbons

Two of the groundwater samples contained reportable concentrations of TEH. In those samples, TEH as diesel was the only TEH analyte detected. TEH as diesel was detected in SB-10-GW and SB-12-GW (both collected from 16 to 20 feet bgs) at 3.09 and 32.9 milligrams per liter (mg/L), respectively. Currently, NVCP-RGs have not been established for TEH. However, regulatory limits for TEH as diesel have been established by NDEQ for petroleum release sites (NDEQ 2009). The detected concentrations of TEH were compared to NDEQ regulatory limits established for the groundwater ingestion and vapor inhalation pathways; all results were below regulatory limits for the most conservative scenario (residential exposure). Samples SB-10-GW and SB-12-GW were collected from the east-central portion of the site, which was just north of the diesel-contaminated groundwater plume currently being remediated by BNSF. The TEH concentrations detected in those samples are likely attributable to the groundwater plume. As previously mentioned, the groundwater samples collected from those two locations were noted to contain petroleum odors during sample collection.

None of the other samples contained any detections of TEH. Table B-12 in Appendix B summarizes the analytical data for TEH in groundwater samples.

RCRA Metals

All 12 of the groundwater samples contained reportable concentrations of RCRA metals. The following RCRA metals were detected in the samples: arsenic, barium, cadmium, chromium, lead, mercury, and selenium. Total arsenic, barium, cadmium, chromium, lead, and selenium were detected at concentrations that exceeded their respective NVCP-RGs for the groundwater exposure pathway. The groundwater

samples analyzed for dissolved metals contained concentrations of arsenic, barium, and selenium; however, only arsenic was detected at concentrations that exceeded its established NVCP-RG for the groundwater exposure pathway, which is 50 µg/L (cancer endpoint concentration). Samples SB-10-GW and SB-12-GW (both collected from 16 to 20 feet bgs) contained dissolved arsenic at 425 and 376 µg/L, respectively. The source of the elevated arsenic concentrations is not known. SB-10-GW and SB-12-GW are located just north of the diesel-contaminated groundwater plume; however, arsenic is not generally associated with diesel fuel. Additional groundwater sampling may be warranted to determine the potential source and extent of the arsenic contamination. The elevated concentrations of metals detected in the unfiltered samples (total metals) are likely attributable to suspended sediment in the samples and are not likely representative of groundwater quality in the site area. Table B-13 in Appendix B summarizes the analytical data for metals in the groundwater samples.

4.4 QUALITY CONTROL SAMPLES

The QC samples included a water trip blank, field blank, and equipment rinsate. There were no detections of analyzed compounds (VOCs, SVOCs, TEH, or RCRA metals) in the QC samples.

5.0 DISCUSSION OF FINDINGS AND RECOMMENDATIONS

This section addresses the findings and conclusions of the Phase II TBA activities, which includes RECs to the subject property, as well as the affected media and cleanup planning.

5.1 RECOGNIZED ENVIRONMENTAL CONDITIONS

This Phase II TBA has confirmed the following RECs to the subject property:

- Soil samples (surface and subsurface) collected from the site contained VOCs, SVOCs, TEH, RCRA metals, and PCBs that are likely attributable (excluding PCBs) to historical railroad activities conducted at the site. In particular, subsurface soils contained metals (arsenic and lead) and SVOCs at concentrations that exceeded their respective NVCP-RGs. In addition, surface soil samples collected at the site contained arsenic and PCBs at concentrations that also exceeded their respective NVCP-RGs. The presence of PCBs in surface soil may be attributable to an adjacent property, where a remedial action to address PCB-contaminated soil was previously conducted. A detailed discussion of the Phase II sample results and the risks the detected contaminants may pose for current and future land use are discussed in Section 5.2.

- Groundwater samples collected from the site contained site-related VOCs, SVOCs, TEH, and RCRA metals that are likely attributable to historical railroad activities conducted at the site. Site-related VOCs, SVOCs, and metals (total) were detected in the samples at concentrations that exceeded their respective NVCP-RGs for the groundwater exposure pathway. A detailed discussion of the Phase II sample results and the risks the detected contaminants may pose for current and future land use are discussed in Section 5.2.

5.2 AFFECTED MEDIA AND CLEANUP PLANNING

Based on sampling conducted for this Phase II TBA, subsurface soil, surface soil, and groundwater appear to have been impacted by activities that could be associated with historical railroad operations at the site and/or from off-site sources. For evaluation purposes, sample results have been compared to NVCP-RGs. Future site use and redevelopment plans were taken into consideration while evaluating the Phase II TBA sample results. Appendix K contains preliminary development plans for the site (and the entire West Haymarket Redevelopment Area) that were provided by the City of Lincoln. Figure 6 in Appendix A shows Phase II TBA sample locations in reference to proposed development plans.

Subsurface soil contained VOCs, SVOCs, TEH, and RCRA metals. VOCs were detected in 10 of the 18 subsurface soil samples at concentrations that ranged from 1.6 J to 1,060 µg/kg. None of those VOCs were detected at concentrations that exceeded their respective NVCP-RGs. VOCs associated with current and historical operations at the site were detected in four samples, which were collected from SB-8, SB-10, SB-12, and SB-14. Seven VOCs, which are commonly associated with petroleum products, were detected in those four samples. The highest concentrations of VOCs were detected in samples from SB-8, SB-10, and SB-12, which were collected the east-central portion of the site (see Appendix A, Figure 4). Those sample locations are located just north of the diesel-contaminated groundwater plume that is currently being remediated by BNSF. In addition, SB-14 was located in the southeast portion of the site, just south of the diesel-contaminated groundwater plume. The VOCs detected in SB-8, SB-10, SB-12, and SB-14 are likely attributable to the known groundwater plume. Petroleum odors were noted at SB-10 and SB-12 during sample collection.

Four of the 18 subsurface soil samples contained SVOCs (primarily PAHs) at concentrations that ranged from 59.7 J to 10,000 µg/kg. The four samples that contained SVOCs were collected from SB-1, SB-4, SB-12, and SB-14. The sample collected from SB-1 contained six SVOCs at concentrations that ranged from 68.6 J to 105 J µg/kg. Benzo(a)pyrene (detected at 99.2 J µg/kg) was the only SVOC detected at a concentration that exceeded its NVCP-RG established for residential soil, which is 62 ug/kg. SB-1 was located in the northwest corner of the site, in an area of currently (and historically) undeveloped land.

The detected concentration of benzo(a)pyrene in SB-1 (99.2 J µg/kg) was well below its NVCP-RG established for industrial soil, which is 21,000 µg/kg. The sample collected from SB-4 contained 20 SVOCs at concentrations that ranged from 59.7 J to 8,380 µg/kg. This sample was collected from the north portion of the site where fill (including buried railroad ties) was encountered at subsurface depths. SVOCs (PAHs in particular) are commonly associated with wood treatment chemicals (creosote) associated with railroad ties; therefore, the SVOCs detected in SB-4 could be attributed to the buried railroad ties (and other fill materials). Six SVOCs were detected in the sample collected from SB-4 at concentrations that exceeded their respective NVCP-RGs established for residential soils. Those SVOCs were benzo(a)anthracene (at 4,600 µg/kg), benzo(a)pyrene (at 4,400 µg/kg), benzo(b)fluoranthene (at 4,880 µg/kg), dibenzo(a,h)anthracene (at 496 µg/kg), dibenzofuran (at 179 J µg/kg), and indeno(1,2,3-cd)pyrene (at 3,150 µg/kg); however, only benzo(a)pyrene was detected at a concentration that exceeded its NVCP-RG for industrial soils, which is 2,100 µg/kg. Planned future site use near sample locations SB-1 and SB-4 includes surface parking and a sidewalk for a walking trail. Redevelopment plans, including construction and grading, should be evaluated to determine if the detected contaminant concentrations pose risks to human health and the environment. Since the detected concentrations of those SVOCs were at subsurface depths, they currently pose limited risk to human health.

In addition, the samples collected from SB-12 and SB-14 contained three SVOCs: acenaphthene, fluorene, and 1-methylnapthalene; however, none of those SVOCs were detected in either of the samples at concentrations that exceeded their respective NVCP-RGs (if established). Sample locations SB-12 and SB-14 were located just north and south of the diesel-contaminated groundwater plume that is currently being remediated by BNSF. The SVOCs detected in both of the samples are commonly associated with petroleum products.

TEH as diesel and TEH as motor oil were the only TEH analytes detected in the subsurface samples. Concentrations of TEH ranged from 4.9 J to 1,170 mg/kg. The detected concentrations of TEH were all below regulatory limits established by NDEQ. The highest concentrations of TEH were detected in SB-10 and SB-12, where petroleum odors were noted during sample collection. Those sample locations are just north of a diesel-contaminated groundwater plume currently being remediated by BNSF; therefore, the detected concentrations of TEH could be associated with that source of petroleum contamination. The portion of the site that has been impacted by the diesel-contaminated groundwater plume was not addressed during this Phase II TBA, because previous investigations conducted by BNSF have primarily focused on this area for remedial purposes. The diesel-contaminated plume is still currently being remediated under NDEQ's Title 200 Program. Future redevelopment plans include an arena in the area north of the diesel-contaminated groundwater plume. Based on field observations and sample results

from this Phase II TBA, petroleum-contaminated soil and groundwater would be encountered in the near vicinity of sample locations SB-10 and SB-12.

RCRA metals were detected in all of the subsurface soil samples. Lead and arsenic were the only metals detected above their respective NVCP-RGs. Lead was detected in SB-2 (collected from 8 to 10 feet bgs) at 601 mg/kg. This concentration of lead exceeded its NVCP-RG established for residential soil, which is 400 mg/kg; however, it is below its NVCP-RG established for industrial soil, which is 750 mg/kg. All 18 of the subsurface soil samples contained levels of arsenic that exceeded its NVCP-RG established for residential soil, which is 0.39 mg/kg (cancer endpoint concentration). Concentrations of arsenic ranged from 1.6 to 10.8 mg/kg in those samples. None of the detected concentrations of arsenic exceeded its NVCP-RG established for industrial soil, which is 16 mg/kg. The average concentration for arsenic in Lancaster County is 9.04 mg/kg (USGS 2010b). Only one sample, SB-4 (collected from 4 to 6 feet bgs) contained arsenic above the background concentration established by USGS; therefore, the detected arsenic concentrations are likely naturally occurring. For reference, the NVCP-RGs (non-cancer endpoint concentrations) established for arsenic in residential and industrial soil are 5.4 and 260 mg/kg, respectively. Planned future site use near sample locations SB-2 and SB-4 include surface parking and sidewalk walking trails. Based on the subsurface depths of the detected lead and arsenic concentrations, there is likely limited exposure to those metals. However, redevelopment plans, including construction plans and grading, should be evaluated to determine if the detected contaminant concentrations pose a risk to human health and the environment.

Surface soil samples collected during the Phase II TBA activities determined that arsenic and PCBs were detected at concentrations that exceeded their respective NVCP-RGs. Arsenic was the only RCRA metal detected in the surface soil above its NVCP-RGs. Concentrations of arsenic ranged from 3.8 to 50.2 mg/kg. All of the samples contained arsenic at concentrations that exceeded its NVCP-RG established for residential soil, which is 0.39 mg/kg (cancer endpoint concentration). Two of the surface soil samples, which were collected from grid cells around SB-8 and SB-13, contained arsenic at 37.6 and 50.2 mg/kg, respectively. These arsenic concentrations exceeded its NVCP-RG established for industrial soil (cancer endpoint concentration), which is 16 mg/kg. It should be noted that none of the detected concentrations of arsenic exceeded its NVCP-RG non-cancer endpoint concentration for industrial soil, which is 260 mg/kg. The surface soil sample collected from the grid cell around SB-8 is located in the east-central portion of the site, within 50 feet of several railroad tracks. The surface soil sample collected from the grid cell around SB-13 is located in the southwestern portion of the site, direct adjacent to railroad tracks. There are many potential anthropogenic sources of arsenic, including treated lumber (railroad ties). No other metals were detected at concentrations that exceeded their established NVCP-RGs. As previously

mentioned, the average concentration for arsenic in Lancaster County is 9.04 mg/kg (USGS 2010b). Three of the five surface soil samples that were submitted for laboratory analysis contained arsenic above the background concentration.

Additional surface soil sampling conducted during the Phase II TBA activities included the collection of four surface soil samples from BNSF property that is adjacent to the west and north sides of the Alter Scrap Yard North Yard, where a remedial action involving excavation of PCB-contaminated soil was conducted in 1999. Those four surface soil samples were submitted for analysis of PCBs. PCBs were detected in those samples at concentrations that ranged from 15.3 to 852 µg/kg. Sample SS-1 contained Aroclor 1248 and Arochlor 1254 at 852 and 604 mg/kg, respectively. Both of those concentrations exceeded the NVCP-RG established for residential soil, which is 220 µg/kg (for both Arochlors). The detected concentrations were well below the NVCP-RG established for industrial soil, which is 7,400 µg/kg for both Arochlor 1248 and Arochlor 1254. None of the other surface soil samples contained PCBs above their respective NVCP-RGs. Sample SS-1 was collected on the BNSF property near the southwest corner of the Alter Scrap North Yard. The detected concentrations of PCBs may indicate off-site migration from Alter. Based on the limited PCB surface soil data, it appears PCB contamination in the surface soil may be localized. However, additional surface soil sampling should be considered to delineate the horizontal and vertical extent of PCBs near sample location SS-1. There are plans for an environmental assessment to be conducted on the Alter property in the near future. That assessment will include additional sampling/assessment of surface soils for PCBs. The planned future site use near sample location SS-1 includes a roadway, surface parking lots, and railroad lines (all non-residential uses). Future site use should be evaluated to determine if the detected concentrations of arsenic and PCBs pose a risk to human health and the environment.

Groundwater samples collected from the site contained concentrations of VOCs, SVOCs, TEH, and RCRA metals. Five of the groundwater samples contained reportable concentrations of VOCs. Those groundwater samples were SB-1-GW, SB-6-GW, SB-10-GW, SB-12-GW, and SB-18-GW. In those five samples, 16 VOCs were detected at concentrations that ranged from 0.24 J to 36.7 µg/L. Of the 16 VOCs detected in the groundwater samples, only two (chloroform and 1,2-DCA) were detected at concentrations that exceeded their respective NVCP-RGs established for the groundwater exposure pathway. Sample SB-6-GW (collected from 16 to 20 feet bgs) contained chloroform at 0.25 J µg/L, which exceeds its established NVCP-RG of 0.21 µg/L. SB-6-GW was located in the west portion of the site, in an undeveloped area. Chloroform is commonly used as a solvent in making dyes and pesticides. Chloroform is also a by-product of the chlorination process for drinking water. It should also be noted

that chloroform is a common laboratory contaminant. For reference, the MCL for total trihalomethanes (including chloroform) is 80 µg/L.

Sample SB-18-GW (collected from 36 to 40 feet bgs) contained nine VOCs at concentrations that ranged from 0.23 J to 36.7 µg/L. Of those nine VOCs, only 1,2-DCA, detected at 36.7 µg/L, was the only VOC detected at a concentration above its respective NVCP-RG, which is 5 µg/L. Sample SB-18-GW was collected from the southwest corner of the site adjacent to the north-and-south-running railroad corridor. Industrial and commercial facilities (including Alter Scrap Yard) are located east (upgradient) of this sample location. Most of the VOCs detected in SB-18-GW are chlorinated solvents (including 1,2-DCA, TCE, and PCE); however, MTBE is associated with gasoline. The source for the contaminants detected in SB-18-GW is unknown.

None of the other VOCs were detected in the groundwater samples at concentrations that exceeded their respective NVCP-RGs. The groundwater sample collected from SB-1-GW contained cis-1,2-DCE at 4.3 µg/L and TCE at 0.51 J µg/L. Those VOCs may be associated with the former roundhouse facility that was located upgradient of that sample location. Groundwater samples collected at the former roundhouse facility (SB-2-GW) and further upgradient (to the east) (SB-5-GW) did not contain any reportable concentrations of VOCs. Groundwater samples collected from SB-10-GW and SB-12-GW contained contaminants commonly associated with petroleum products. The groundwater samples collected from those two locations were noted to contain petroleum odors during sample collection. Those sample locations are just north of a diesel-contaminated groundwater plume currently being remediated by BNSF. Additional assessment should be considered to determine the source(s) and extent of groundwater contamination detected in SB-18-GW. It should be noted that an environmental assessment is currently planned to be completed on the adjacent Alter property. That investigation should provide additional information to assist in identifying source(s) and the extent of contamination.

Five of the groundwater samples contained reportable concentrations of SVOCs. Those samples were SB-1-GW, SB-3-GW, SB-12-GW, SB-14-GW, and SB-16-GW. In those samples, 17 SVOCs were detected at concentrations that ranged from 1.5 J to 195 µg/L. Two of the samples, SB-3-GW and SB-16-GW, contained SVOCs at concentrations above their respective NVCP-RGs established for the groundwater exposure pathway. SB-3-GW (collected from 26 to 30 feet bgs) contained naphthalene at 4.1 J µg/L, which exceeded its NVCP-RG of 1.5 µg/L established for the groundwater exposure pathway. SB-3-GW was collected within the boundary of the former roundhouse facility. Naphthalene is commonly associated with petroleum products, which were likely historically used during the operation of the roundhouse. SB-16-GW contained 10 SVOCs at concentrations that ranged from 2.5 to 7.3 J µg/L.

Six of those 10 SVOCs; were detected at concentrations that exceeded their respective NVCP-RGs for the groundwater exposure pathway. Those SVOCs were benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, chrysene, and indeno(1,2,3-cd)pyrene. SB-16-GW was collected from the southeast corner of the site, between two railroad lines. The SVOCs detected in the sample are commonly associated with petroleum products, as well as other sources.

The groundwater samples collected from SB-1-GW, SB-12-GW, and SB-14-GW contained SVOCs, however, the detected concentrations were below their respective NVCP-RGs for the groundwater exposure pathway. SB-1-GW was collected from the northwest corner of the site. SB-12-GW and SB-14-GW were located on the east side of the site, with SB-12-GW just north and SB-14-GW just south of the diesel-contaminated groundwater plume that is currently being remediated by BNSF. The SVOCs detected in both of the samples are commonly associated with petroleum products.

Two of the groundwater samples contained reportable concentrations of TEH. In those samples, TEH as diesel was the only TEH analyte detected. TEH as diesel was detected in SB-10-GW and SB-12-GW at 3.09 and 32.9 mg/L, respectively. The detected concentrations of TEH are below regulatory limits established by NDEQ. Samples SB-10-GW and SB-12-GW were collected from the east-central portion of the site, which was just north of the diesel-contaminated groundwater plume currently being remediated by BNSF. The TEH concentrations detected in those samples are likely attributable to the groundwater plume. None of the other samples contained any detections of TEH.

All 12 of the groundwater samples contained reportable concentrations of RCRA metals. Total arsenic, barium, cadmium, chromium, lead, and selenium were detected at concentrations that exceeded their respective NVCP-RGs for the groundwater exposure pathway. The groundwater samples analyzed for dissolved metals contained concentrations of arsenic, barium, and selenium; however, only arsenic was detected at concentrations that exceeded its established NVCP-RG for the groundwater exposure pathway, which is 50 µg/L (cancer endpoint concentration). Samples SB-10-GW and SB-12-GW (both collected from 16 to 20 feet bgs) contained dissolved arsenic at 425 µg/L and 376 µg/L, respectively. The source of the elevated arsenic concentrations is not known. SB-10-GW and SB-12-GW are located just north of the diesel-contaminated groundwater plume; however, arsenic is not generally associated with diesel fuel. Additional groundwater sampling may be warranted to determine the potential source and extent of the arsenic contamination. The elevated concentrations of metals detected in the unfiltered samples (total metals) are likely attributable to suspended sediment in the samples and are not likely representative of groundwater quality in the site area.

Evaluation of the groundwater sample results should consider that groundwater at the site and in the near site vicinity is not currently used for domestic purposes. Although groundwater contaminants were detected in several of the samples at elevated concentrations, the groundwater exposure pathway presents minimal risk for current and proposed future use, because groundwater is not currently used. Currently, there are no standards established by the NVCP for evaluating the vapor intrusion exposure pathway (for contaminated soil and groundwater); those standards are currently under development. Once vapor intrusion standards are established, sample results from this Phase II TBA should be reevaluated to determine risks presented for future development at the site.

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