Bruce A. Sheppard
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November 7, 2014

Mr. Daniel Hafley
Cleanup Program – Northwest Region
Oregon Department of Environmental Quality
2020 SW 4th Avenue, Suite 400
Portland, OR 97201-4987

Re: Former Hoyt Street Railyard Site – Updated Groundwater Closeout Report and Request for Consent Decree Groundwater Certification of Completion

Dear Mr. Hafley:

This letter concerns BNSF Railway Company's (BNSF) request for a Groundwater Certification of Completion under the terms of the February 8, 2002 Consent Decree (*State of Oregon v. Burlington Northern and Santa Fe Railway Company and Hoyt Street Properties, LLC,* Multnomah County Case No. 0202-01268) (Consent Decree) for the former Hoyt Street Railyard site in Portland, Oregon (Hoyt Site). BNSF makes this request under Consent Decree Section 7.A that provides for a Groundwater Certification of Completion once BNSF has commenced groundwater monitoring and completed the Tanner Creek sewer evaluation. BNSF has completed those requirements with DEQ's approval. No mitigative actions have been necessary. Section 7.A excludes long-term groundwater monitoring and reporting for purposes of certification of completion.

Enclosed for your consideration are BNSF's Updated Project Closeout Report and draft Groundwater Certification of Completion (similar in format to DEQ's Hoyt Site soil certifications). Section 7.A states that upon submission of a groundwater closeout report and request for certification of completion, DEQ shall preliminarily determine if the groundwater remedial action has been fully and satisfactorily performed in accordance with the Consent Decree. Upon such preliminary determination, Section 7.A requires provision of public notice and opportunity to comment. Section 7.A also specifies that DEQ is to issue a final decision within 90 days of receiving BNSF's Closeout Report. Issued certifications are submitted to the court.

Please contact Linda Baker, of Integral Consulting Inc., or myself if you have any questions.

Thank you.

Bruce A. Sheppard
Manager Environmental Remediation

Enclosures

Cc: Linda Baker, Integral Consulting Inc.
Robert Lowry, Kell Alterman & Runstein, L.L.C.

STATE OF OREGON

DEPARTMENT OF ENVIRONMENTAL QUALITY

In the Matter of:	**)**	**[DRAFT] GROUNDWATER**
BNSF Railway Company	**)**	**CERTIFICATION OF COMPLETION**
Former Hoyt Street Railyard	**)**	

1. Findings

A. On February 8, 2002, a Stipulation and Consent Decree was entered in the Circuit Court for the State of Oregon for Multnomah County (Case No. 0202-01288) (Consent Decree) between the State of Oregon, ex. rel. the Oregon Department of Environmental Quality (DEQ), as plaintiff and The Burlington Northern Santa Fe Railway Company, now known as BNSF Railway Company (BNSF), and Hoyt Street Properties, LLC (HSP) as Defendants. The Consent Decree required BNSF to perform groundwater remedial actions and HSP to perform soil remedial actions at the former Hoyt Street Railyard site in northwest Portland, Oregon (Hoyt Site), in accordance with a Record of Decision (ROD) issued by DEQ on December 15, 2000. Since 1998, the Hoyt Site has been under development by HSP, other developers, and the City of Portland as an integral part of the Pearl District. Exhibit B to the Consent Decree was a *Groundwater Remedial Design/Remedial Action Scope of Work* (Groundwater SOW).

B. Consent Decree Section 7.A states:

> Upon BNSF's submission, in accordance with the Groundwater SOW, of a final project closeout report and a request for certification of completion, DEQ shall preliminarily determine whether the groundwater remedial action has been fully and satisfactorily performed in accordance with the Consent Decree. For purposes of this certification, the groundwater remedial action is defined to include commencement of groundwater monitoring and completion of the Tanner Creek evaluation and any Tanner Creek mitigative measure, but to exclude long-term operation, maintenance, and reporting relating to the groundwater monitoring and any Tanner Creek mitigative measure. Upon a preliminary determination that the groundwater remedial

action, as so defined, has been fully and satisfactorily performed, DEQ shall provide public notice and opportunity to comment on a proposed certification decision in accordance with ORS 465. 320 and 465. 325(10)(b). After consideration of public comment, and within 90 days after receiving BNSF's project closeout report, the Director of DEQ shall issue a final certification decision. The certification decision shall subsequently be submitted by DEQ to this Court.

C. BNSF's remedial actions have included a DEQ-approved 2001 excavation and removal of light, nonaqueous-phase liquid (LNAPL) and LNAPL-contaminated soils from the subsurface of the former fueling area in place of the ROD-required LNAPL recovery and recycling system. The excavation and removal was not required but was consistent with the ROD and anticipated in the Consent Decree stipulations. In 2002, BNSF submitted a *Groundwater Remedial Design/Remedial Action Work Plan* (RETEC 2002b) (Groundwater RD/RA Work Plan), which DEQ approved in accordance with the Groundwater SOW. The Groundwater RD/RA Work Plan addressed the work necessary to complete the remedial design and implement the groundwater remedy. The stated objectives taken from the ROD and Groundwater SOW included investigation and evaluation of the Tanner Creek Sewer and groundwater monitoring for a period of time sufficient to determine if the goals of the groundwater remedy are being met and whether the groundwater and LNAPL result in a significant adverse effect on beneficial uses of the Willamette River, or pose an unacceptable risk to human or ecological receptors exposed to surface water or sediments.

D. BNSF submitted and DEQ approved the *Final Groundwater Monitoring and Contingency Plan* (RETEC 2004a), *Addendum to Groundwater Monitoring and Contingency Plan* (RETEC 2005), and *Addendum No. 2 to the Groundwater Monitoring and Contingency Plan* (RETEC 2007), collectively referenced herein as the GMCP. BNSF

constructed the groundwater monitoring wells in accordance with the Groundwater RD/RA Work Plan and the GMCP. BNSF commenced groundwater monitoring in 2006 and has conducted groundwater monitoring for eight years through 2013 in accordance with the GMCP. The groundwater monitoring data have all been below trigger levels except for a single sample anomaly for one constituent of concern. The groundwater monitoring data through 2013 demonstrate that the goals of the groundwater remedy are being met and groundwater migration does not result in a significant adverse effect on beneficial uses of the Willamette River, or pose an unacceptable risk to human or ecological receptors exposed to surface water or sediments. Although the GMCP requires annual groundwater monitoring through 2016, DEQ has suspended sampling to consider whether further monitoring is necessary based on the data to date. No mitigation measures have been required.

E. BNSF submitted and DEQ approved the *Tanner Creek Sewer Investigation Work Plan* (RETEC 2002c). In 2008, DEQ approved BNSF's satisfactory completion of the work required by that work plan as described in the *Tanner Creek Sewer Investigation and Evaluation* (RETEC 2004b). DEQ concluded that: (1) the information collected indicates contaminants in soil and groundwater in the vicinity of the Tanner Creek Sewer are not exacerbating water quality conditions in the Tanner Creek Sewer, (2) based upon the risk assessment criteria that were established for the Hoyt Site recorded in the ROD, the former Hoyt Site does not appear to be contributing significant levels of contaminants to the Willamette River that would pose a risk to human or ecological receptors, and (3) BNSF could discontinue the groundwater monitoring required for the Tanner Creek Sewer evaluation and remove the boom which had been placed at the Tanner Creek Sewer Outfall. No mitigation measures were required.

F. DEQ provided oversight for all of the above-described remedial actions. BNSF's groundwater remedial actions have been performed in accordance with the requirements of the Consent Decree, the ROD, and DEQ-approved work plans. BNSF submitted an *Updated Groundwater Closeout Report* (Integral 2014) (Closeout Report) documenting the remedial actions performed for groundwater contamination as required by Consent Decree Section 7.A and Groundwater SOW Section J where no groundwater-related mitigation measures have been required. Based upon DEQ's oversight and reviews, DEQ preliminarily determined that the remedial actions required by Consent Decree Section 7.A for Groundwater Certification of Completion at the Hoyt Site have been fully and satisfactorily completed.

G. On _____, 201_, DEQ provided public notice and opportunity to comment on this proposed certification decision, in accordance with ORS 465.320 and 465.325(10)(b). Notices were published on_____, 201_ in the Oregon Secretary of State's Bulletin, and in the Oregonian. The comment period was _____ through _____, 201_. No comments were received.

H. DEQ finds that the remedial actions for contaminated groundwater at the Hoyt Site except for completion of long-term groundwater monitoring and related operation, maintenance, and reporting have been fully and satisfactorily completed by BNSF, and that no further groundwater remedial actions are required to protect the public health, safety, and welfare or the environment for issuance of this Groundwater Certification of Completion under the requirements of Consent Decree Section 7.A.

2. Conclusion

BNSF has fully and satisfactorily completed the groundwater remedial actions

required for the Hoyt Site for issuance of this Groundwater Certification of Completion under Consent Decree Section 7.A.

3. Conditions

A. This Groundwater Certification of Completion applies only to the remedial actions for groundwater at the Hoyt Site as required by the Consent Decree. For purposes of this Groundwater Certification of Completion as defined by the Consent Decree, the groundwater remedial actions shall be considered to include commencement of groundwater monitoring, completion of the Tanner Creek evaluation, and any Tanner Creek mitigative measure (none required), but to exclude long-term groundwater monitoring and related operation, maintenance, and reporting.

B. DEQ's determination that no further action is required for groundwater at the Hoyt Site under Consent Decree Section 7.A may be withdrawn upon discovery of new information showing that public health, safety, welfare or the environment are not being protected.

C. DEQ does not, by this certification, assume liability for any claim arising from acts or omissions of BNSF or its officers, employees, agents, successors, subsidiaries, or assigns relating to implementation of the Consent Decree.

4. Notice

This order constitutes certification of completion under ORS 465.325(10), and may be appealed by any aggrieved person in accordance with ORS 465.325(10(c).

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ISSUED BY:

State of Oregon

Department of Environmental Quality

_____
Nina DeConcini
Administrator, Northwest Region

_____Date

CERTFICATE OF SERVICE

I certify that I served a true copy of the above Groundwater Certification of Completion by depositing in the United States mail, postage prepared, and addressed to the following persons:

Mr. Bruce A. Sheppard
BNSF Railway Company
2454 Occidental Avenue S., Bldg 1A
Seattle, WA 98134-1451

Mr. Robert B. Lowry
Kell, Alterman & Runstein, L.L.P.
520 SW Yamhill Street, Suite 600
Portland, OR 97204-1329
Attorney for BNSF Railway Company

_____
(Name)

_____
(Date)

UPDATED GROUNDWATER PROJECT CLOSEOUT REPORT

Former Hoyt Street Railyard

Prepared for
BNSF Railway Company
2454 Occidental Ave S, Suite 1A
Seattle, WA 98134-1451

Prepared by

319 SW Washington Street
Suite 1150
Portland, OR 97204

November 2014

UPDATED GROUNDWATER PROJECT CLOSEOUT REPORT
Former Hoyt Street Railyard

Prepared by Eron Dodak, R.G., Managing Hydrogeologist

Reviewed by Linda Baker, R.G., Principal

Professional Certification

Updated Groundwater Project Closeout Report for the Former Hoyt Street Railyard
October 2014
The BNSF Railway Company
Seattle, Washington

This report has been prepared by the staff of Integral Consulting Inc. under the professional supervision of the person whose seal and signature appear hereon.

Eron Dodak
Managing Hydrogeologist
Registered Geologist #G2023

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ACRONYMS AND ABBREVIATIONS

BNSF	BNSF Railway Company
COC	chemical of concern
DEQ	Oregon Department of Environmental Quality
GMCP	Groundwater Monitoring and Contingency Plan
Hoyt Site	former Hoyt Street Railyard Site
IRM	interim remedial measure
LNAPL	light, nonaqueous-phase liquid
OAR	Oregon Administrative Rules
PAH	polycyclic aromatic hydrocarbon
RD/RA	remedial design/remedial action
ROD	record of decision
SOW	scope of work

1 INTRODUCTION

This *Updated Project Closeout Report, Former Hoyt Street Railyard* (Project Closeout Report) summarizes BNSF Railway Company's (BNSF) satisfactory performance of the groundwater remedial action required by the Oregon Department of Environmental Quality (DEQ) record of decision (ROD) for the former Hoyt Street Railyard Site (Hoyt Site) in Portland, Oregon (DEQ 2000) contained in the February 8, 2002 Consent Decree *(State of Oregon v. Burlington Northern and Santa Fe Railway Company and Hoyt Street Properties, LLC,* Multnomah County Case No. 0202-01268) (Consent Decree) and the Groundwater Remedial Design/Remedial Action Scope of Work (Groundwater SOW; Consent Decree, Attachment B). This Project Closeout Report is submitted pursuant to Section 7.A of the Consent Decree, and Section J of the Groundwater SOW. By submittal of this Project Closeout Report, BNSF requests a Groundwater Certification of Completion from DEQ under Consent Decree Section 7.A.

Consent Decree Section 7.A states that upon submission of a groundwater closeout report and request for Groundwater Certification of Completion, DEQ shall preliminarily determine if the groundwater remedial action has been fully performed in accordance with the Consent Decree. The groundwater remedial actions required by the Consent Decree are only commencement of groundwater monitoring under an approved plan and completion of the Tanner Creek Sewer evaluation (along with related mitigative measures, if any). Section 7.A. excludes completion of long-term groundwater monitoring and reporting for purposes of a Groundwater Certificate of Completion. Upon DEQ's preliminary determination of satisfactory performance, Section 7.A. calls for DEQ to provide public notice and opportunity to comment, issue a final decision within 90 days of receipt of the Project Closeout Report, and submit any issued Groundwater Certification of Completion to the court.

BNSF has performed the ROD-required groundwater remedy for the Hoyt Site in accordance with the Consent Decree as follows:

1. Continued light, nonaqueous-phase liquid (LNAPL) recovery efforts required by the ROD were completed as a result of BNSF's 2001 election of removal by mass excavation of LNAPL, groundwater, and soil approved by DEQ.
2. BNSF's investigation and evaluation of the Tanner Creek Sewer and backfill was completed in 2004 with follow-on groundwater sampling in the Tanner Creek Sewer backfill through 2006. This work concluded that additional remedial actions were not necessary for the Tanner Creek Sewer and backfill. In 2008, DEQ approved that investigation and evaluation, concluding that remaining hydrocarbons at the Hoyt Site are not exacerbating conditions in the Tanner Creek Sewer and do not pose an unacceptable risk for Willamette River human or ecological receptors. No mitigative measures were required.

3. BNSF has completed the Consent Decree Section 7.A requirements for long-term groundwater monitoring, which require construction of the monitoring wells and commencement of monitoring pursuant to a DEQ-approved final monitoring, maintenance, and contingency plan for the groundwater remedial action selected by DEQ. Section 7.A states that Groundwater Certification of Completion under the Consent Decree is required even if BNSF must complete further long-term groundwater monitoring under the ROD.[1]

All components of the groundwater remedy have been completed as summarized in this Project Closeout Report. The monitoring component of the remedy is constructed, and routine monitoring has been conducted since 2006; all required groundwater monitoring wells have been installed, and 11 monitoring events have been conducted over the past 8 years (2006-2013)(ENSR 2008).

Consistent with the Groundwater SOW, this Project Closeout Report follows DEQ's January 5, 2005, approval of both the *Tanner Creek Sewer Investigation and Evaluation* (RETEC 2004b) and the *Final Groundwater Monitoring and Contingency Plan* (GMCP; RETEC 2004a), and its May 1, 2008, approval of the Tanner Creek Sewer investigation (DEQ 2008).

1.1 SITE DESCRIPTION

The Hoyt Site is a 26-acre parcel that was formerly used for railroad fueling and maintenance and for other industrial activities from the late 1800s through the late 1990s. The Hoyt Site is generally bounded by Naito Parkway (formerly Front Avenue), NW 9th Avenue, NW Johnson Street, NW Lovejoy Street, and NW 12th Avenue (Figure 1-1). Historical railroad fueling and maintenance activities resulted in the release of fuel oils (diesel and Bunker C) and lead to the soil and groundwater. Other former industrial activities on the Hoyt Site and surrounding properties included a woolen mill, a lumber mill, a petroleum distributor, and a manufactured gas plant. These industrial activities unrelated to former BNSF operations also released petroleum products and/or other process residuals to the soil and groundwater. Additional details on past uses at the Hoyt Site and surrounding areas are provided in the remedial investigation (RETEC 1996) and the feasibility study (RETEC 1999).

Since the 1990s, the Hoyt Site has been and is currently being redeveloped by others into upscale, high-density, mixed-use residential and commercial space, with two city parks and private urban open spaces. Redevelopment is proceeding northward across the Hoyt Site.

[1] DEQ recently proposed suspension of the 2014 annual groundwater monitoring event while it reviews information to determine if further groundwater monitoring is necessary given the results from the 8 years of groundwater monitoring through 2013. Consistent with DEQ's proposal, BNSF intends to separately ask DEQ for a letter specifying that no further Hoyt Site groundwater monitoring is necessary. The Consent Decree Section 7.A request for a groundwater Certification of Completion does not depend on whether BNSF will be required to do further groundwater monitoring.

Construction on the southern half of the property is complete, and construction on the northern half of the Hoyt Site is partially finished, planned, or currently in progress. Redeveloped portions of the property are largely covered with buildings and roads; subgrade parking is present on a number of the blocks. Fields Park, completed in May 2013, encompasses approximately 3 acres that are capped with clean soil, landscape, or hardscape. For additional details on Hoyt Site redevelopment and soil remediation work, see the block closure reports (Anchor 2004; Kleinfelder 2007). The soil remedial actions required by the ROD are being implemented by Hoyt Street Properties, LLC pursuant to the Consent Decree and the Soil Remedial Design/Remedial Action Scope of Work (Soil RD/RA SOW; Consent Decree, Attachment C).

1.2 HYDROGEOLOGIC CONDITIONS

Groundwater occurs at the Hoyt Site under unconfined and semiconfined conditions and generally lies between 10 and 20 ft below ground surface. Seasonal fluctuations in groundwater elevation range from approximately 1 to 9 ft, depending on the location at the site. The regional groundwater flow direction in the area is to the north/northeast (toward the Willamette River). The local flow direction is quite variable due to the network of storm and sanitary sewers in the area. The groundwater flow direction described in the remedial investigation was generally north and northeast towards the Willamette River, with deviations adjacent to the deep sewers. The Tanner Creek Sewer and the deep sewer under NW 9th Avenue had the most significant influence on groundwater flow at the Hoyt Site. The direction of groundwater flow observed from October 2006 to September 2013 varied from that observed during the remedial investigation (ENSR 2008; AECOM 2009). From October 2006 to September 2013, groundwater flow has been consistently to the south and southeast towards the Tanner Creek Sewer with little seasonal variation. This change from historical flow is attributable to redevelopment by others in the area.

While this change in groundwater flow direction has not resulted in the need for mitigative measures, the Consent Decree Groundwater SOW expressly excludes any remedial actions that may be required as a result of groundwater conditions that arise from permitted redevelopment activities.

1.3 DESCRIPTION OF GROUNDWATER REMEDY

The selected remedial action for groundwater at the Hoyt Site was developed in accordance with Oregon Administrative Rules (OAR) 340-122-010 through 340-122-110 and is described in the ROD (DEQ 2000). The objectives of the groundwater remedy are as follows:

- Prevent human exposure to contaminated groundwater and free petroleum hydrocarbons associated with groundwater (LNAPL)

- Prevent migration of contaminated groundwater and LNAPL to surface water, which would result in unacceptable risk levels or a significant adverse effect on the beneficial uses of water (defined in OAR 340-122-010 to 115)
- To the extent feasible, remediate hot spots (including LNAPL) in groundwater to non-hot-spot levels or acceptable risk levels by reducing hydrocarbon concentration, volume, or mobility.

In 2001, BNSF completed an interim remedial measure (IRM) under Order on Consent (Order) No. WMCSR-NWR-95-08 that addressed these objectives, consistent with the ROD. The 2001 IRM consisted of removal of mobile LNAPL from the former fueling area and was completed on an accelerated schedule to accommodate redevelopment. The LNAPL removal is detailed in the *2001 Annual Progress Report- Hoyt Street Property Containment-Recovery System and LNAPL Excavation Completion Report* (RETEC 2002a) and is summarized in Section 2.

In 2002, BNSF submitted a *Groundwater Remedial Design/Remedial Action Work Plan* (RETEC 2002b) (Groundwater Work Plan). That document described the work necessary to complete the remedial design and implement the groundwater remedy. The Groundwater Work Plan identified the following tasks:

- Investigate and evaluate the Tanner Creek Sewer and backfill as a potential hydrocarbon pathway to the Willamette River to determine if hydrocarbons from the Hoyt Site result in a significant adverse effect on beneficial uses of the Willamette River, or pose an unacceptable risk to human or ecological receptors exposed to surface water or sediments. Propose mitigation measures, if necessary, to prevent such possible hydrocarbons in the Tanner Creek Sewer or backfill from having significant adverse effect on the beneficial uses of the Willamette.
- Conduct groundwater monitoring for a period of time sufficient to demonstrate that the goals of the groundwater remedy are being met and that the groundwater and LNAPL do not pose a threat to human health or result in a significant adverse effect on beneficial use of the Willamette River.

The *Tanner Creek Sewer Investigation Work Plan* (RETEC 2002c) and the *Tanner Creek Sewer Investigation and Evaluation* (RETEC 2004b) describe the scope and findings as summarized in Section 3 of this report.

The scope and findings of the groundwater monitoring program are presented in the *Final Groundwater Monitoring and Contingency Plan* (RETEC 2004a), *Addendum No. 2 to the Groundwater Monitoring and Contingency Plan* (RETEC 2007), and the *2013 Annual Groundwater Monitoring Report* (Integral 2014), and are summarized in Section 4 of this report.

2 LNAPL RECOVERY AND REMOVAL ACTIVITIES

BNSF operated an LNAPL containment and recovery system at the Hoyt Site from the 1970s until 2001, when BNSF elected to excavate the area containing LNAPL and DEQ approved decommissioning of the system. Each phase of work is summarized briefly below.

2.1 LNAPL RECOVERY OPERATIONS

The LNAPL containment and recovery system (treatment system) contained and removed free LNAPL from the subsurface of the former fueling area. Beginning in June 1995, the treatment system was expanded and operated as an IRM under Order No. WMCSR-NWR-95-08 between BNSF and DEQ.

The upgraded LNAPL containment-recovery system operated consistently for approximately 6 years. The primary goals of the system were met during its operation under the IRM as follows:

- Groundwater levels were depressed, and LNAPL was intercepted before reaching the sewers.
- Approximately 2,900 gallons of LNAPL were recovered between 1995 and 2001.
- National Pollutant Discharge Elimination System permit criteria were met during the groundwater treatment system operation.

More detailed information regarding the treatment system and LNAPL can be found in the *2001 Annual Progress Report- Hoyt Street Property Containment-Recovery System and LNAPL Excavation Completion Report* (RETEC 2002a).

2.2 LNAPL REMOVAL

Consistent with the ROD, BNSF elected to discontinue the LNAPL containment and recovery operations and excavate the remaining LNAPL from the former fueling area. The objective of the work was to remove, to the extent practicable, mobile LNAPL and soil containing mobile LNAPL. The excavation work was conducted between September and December 2001 as an IRM.

The project objectives, scope of work, and methods were described in a series of design documents submitted to DEQ for review and approval. DEQ approved the design on September 7, 2001. Soil removal began on September 28 and was essentially completed on November 8, 2001. Approximately 13,000 tons of soil with mobile LNAPL and 5,800 tons of soil with lesser hydrocarbon impacts were sent offsite for treatment and disposal. A total of

284,700 gallons of water and 1,900 gallons of LNAPL were removed from the excavation. The excavation extended until mobile LNAPL was exhausted to the north, west, and south, and with depth. To the east, the excavation was limited by NW 9th Avenue. To the extent practicable, measures were implemented to drain LNAPL from the eastern wall prior to backfilling.

In addition to removing mobile LNAPL, the excavation removed significant quantities of residual LNAPL with the soil. As such, the removal was more aggressive and protective than the continued operation and expansion of the LNAPL recovery system and exceeded the requirements for LNAPL removal and groundwater hotspot cleanup in the ROD. DEQ approved decommissioning of the recovery system accordingly.

2.3 ASSESSMENT OF LNAPL REMOVAL EFFECTIVENESS

The activities completed to date have effectively removed LNAPL from the area of the former fueling facility (RETEC 2002a). The Groundwater Monitoring program (see Section 4) included the installation and sampling of a temporary well, LTM-101, to further assess the effectiveness of these removal activities. This approach was described in *Addendum No. 2 to the Groundwater Monitoring and Contingency Plan* (RETEC 2007). Historical wells H-1, H-2, HMW-4, and MW-3 were used for the comparison as specified in Section 3.1.3 of the 2004 GMCP. Polycyclic aromatic hydrocarbon (PAH) and lead concentrations at LTM-101 were below the trigger levels. Figure 1-1 shows the wells in the 2001 LNAPL removal area vicinity and the location of the 2007 temporary well LTM-101. In general, the concentrations at temporary well LTM-101 were lower than historical results in that same area. PAH concentrations in LTM-101 are much lower than those found in the same area prior to the LNAPL removal. For example, historical well MW-3, located less than 50 feet upgradient of LTM-101, contained PAH concentrations orders of magnitude greater than those observed in LTM-101.

3 TANNER CREEK SEWER INVESTIGATION AND EVALUATION

The *Tanner Creek Sewer Investigation and Evaluation* (RETEC 2004b) was completed to assess the potential for residual LNAPL or dissolved hydrocarbons from the Hoyt Site to cause adverse effects on beneficial uses of the Willamette River. The scope and findings of that investigation are summarized below.

3.1 INVESTIGATION SCOPE

As defined in the *Tanner Creek Sewer Investigation Work Plan* (RETEC 2002c), the goals and objectives of the investigation and evaluation were as follows:

- Assess conditions in the Tanner Creek Sewer and backfill, including groundwater quality and seepage to the sewer
- Evaluate if the backfill or the sewer are preferential migration pathways for hydrocarbons (as LNAPL or dissolved in groundwater) from the Hoyt Site to the Willamette River at levels that present an unacceptable risk, or a significant adverse effect on the beneficial uses of the Willamette River (as defined in OAR 340-12-0115(50)), or pose an unacceptable risk to human or ecological receptors exposed to surface water or sediments.
- If necessary, identify appropriate mitigative measures, according to the standards in OAR 340-122-085 and 090, to address any unacceptable risk or significant adverse effects on beneficial uses.

To achieve these objectives, the following six phases of investigation were completed: 1) a records search for available construction information, routing information, and historical reports of hydrocarbons in the sewers or sewer backfill; 2) an inspection of the interior of the Tanner Creek Sewer and related 27-inch storm sewer using remote video equipment; 3) inspection and sampling of the backfill surrounding the Tanner Creek Sewer; 4) sampling of groundwater in the backfill surrounding the sewer; 5) sampling of water within the sewer during high- and low-flow conditions; and 6) the ongoing monitoring of Outfall 11. Details of the activities conducted in each phase are provided in *Tanner Creek Sewer Investigation and Evaluation* (RETEC 2004b).

3.2 SUMMARY OF INVESTIGATION RESULTS

Numerous other sources of petroleum hydrocarbons are present and may have affected the sewer backfill around the Tanner Creek Sewer. Potential upgradient petroleum hydrocarbon

sources include the Horse Barn site, former Pintsch Compressing Company site, and other sites in the large industrial portion of the Tanner Creek Sewer drainage basin. Another source of petroleum hydrocarbon contamination in the sewer backfill downgradient of the Hoyt Site is from the former leaking underground storage tanks at the Centennial Mills site. During higher river stages, river water flows into the sewer backfill causing water and petroleum in the sewer backfill at the Centennial Mills site to migrate in a southward direction (typically upgradient) toward the Hoyt Site. Some of the petroleum hydrocarbon contamination in the backfill around the Tanner Creek Sewer may also have originated from upgradient discharges of petroleum to the combined sewer. The *Tanner Creek Sewer Investigation and Evaluation* (RETEC 2004b) was conducted to assess whether petroleum present downgradient of the Hoyt Site had the potential to adversely affect the Willamette River.

The *Tanner Creek Sewer Investigation and Evaluation* found that the Tanner Creek Sewer and backfill have the potential to act as a preferential pathway for groundwater to reach the Willamette River. Sampling of sewer waters found concentrations protective of surface water receptors. Prior to discharge, additional sewer backfill sampling was completed at the northern property boundary at the downgradient edge of the Hoyt Site. Investigation results indicate the concentrations in the sewer backfill are also protective of surface water receptors. The investigation found that elevated concentrations of PAHs in the sewer are upstream of the impacts related to the Hoyt Site (i.e., upstream of the former LNAPL area). The investigation shows that any sheens observed during the investigation at Outfall 11 were not related to the Hoyt Site. No mitigative measures were necessary.

The LNAPL removal eliminated potentially mobile LNAPL, decreased the mass of source material, and resulted in lower hydrocarbon concentrations in groundwater at the Hoyt Site. Findings from the *Tanner Creek Sewer Investigation and Evaluation* and results of the 8 years of groundwater monitoring confirm the following:

- LNAPL and dissolved-phase contaminants are not migrating to the river and are not causing significant adverse effects on beneficial uses of water as defined by OAR-340-122-0115(50) or posing an unacceptable risk to human or ecological receptors exposed to surface water or sediments.
- Dissolved contaminant concentrations have decreased over time.
- LNAPL volumes have decreased.

3.3 DETERMINATION OF NO FURTHER ACTION FOR THE TANNER CREEK SEWER

Based on the finding of this investigation, BNSF recommended no further remedial action for the Tanner Creek Sewer. DEQ (2008) concurred in a letter and attached memo dated May 1, 2008, which stated that "BNSF has satisfactorily completed the monitoring required for the

Tanner Creek stormwater pathway," and "BNSF may therefore discontinue monitoring and boom placement [at the outfall]." That letter further states that

> *"…the information collected at the former Hoyt Street Railyard indicates contaminants in soil and groundwater in the vicinity of the Tanner Creek Sewer are not exacerbating water quality conditions in the Tanner Creek Sewer. Based upon the risk assessment criteria that were established for the Hoyt Street Railyard recorded in the ROD, the former Hoyt Street Railyard does not appear to be contributing significant levels of contaminants to the Willamette River that would pose a risk to human or ecological receptors."*

4 GROUNDWATER MONITORING PROGRAM

This section summarizes the objectives, procedures, and results of the third component of the groundwater remedy, long-term monitoring, as described in the Final GMCP (RETEC 2004a).

4.1 MONITORING OBJECTIVES

The GMCP describes the steps to evaluate the concentration of the chemicals of concern (COCs) in groundwater, to assess their migration potential towards the Willamette River, and to ensure protection of the beneficial uses of the Willamette River for human or ecological receptors.

The objectives of the groundwater monitoring program are as follows:

- Monitor the contaminants that could migrate toward the Willamette River
- Verify results of fate and transport modeling that were used to develop trigger levels for protection of beneficial uses and organisms in the Willamette River
- Evaluate the ability of the aquifer to attenuate COCs
- Evaluate the effectiveness of source removal and other remedial actions (Section 2).

4.2 DESCRIPTION OF GROUNDWATER MONITORING NETWORK

The groundwater monitoring network consists of six long-term monitoring wells (LTM-102 through LTM-107). These wells were installed in August 2006, and monitoring well locations are shown on Figure 1-1. These six wells are periodically sampled for COCs (PAHs and lead), general water quality, water elevations, and for natural attenuation parameters[2]. Temporary well LTM-101 (Figure 1-1) was installed and sampled in May 2007 to assess the effectiveness of the LNAPL removal (Section 2). Table 4-1 summarizes well sampling frequency, and Table 4-2 presents the monitoring parameters.

The first objective of the groundwater monitoring program is to monitor COC (PAHs and lead) concentrations and to assess whether groundwater concentrations have the potential to cause a significant adverse effect on beneficial uses of the Willamette River. This objective is met by monitoring at the northern Site boundary, closest to the river. Four wells (LTM-102, LTM-104, LTM-106, and LTM-107) were installed near the northern property boundary as shown on Figure 1-1. These wells are sampled, and reported concentrations of PAHs and lead are compared to trigger levels (see GMCP) to ensure that the Hoyt Site is not adversely affecting beneficial uses. Over an extended period of time, the monitoring data can be used to determine

[2] Consistent with the GMCP, lead and natural attenuation parameters were only analyzed in 2007 because of the sampling results obtained.

whether concentrations are stable, decreasing, or increasing. Water levels are measured in each of the monitoring wells to assess groundwater flow directions that may influence contaminant migration. Sample collection and analytical procedures are detailed in the GMCP.

To verify the fate and transport modeling findings and to assess natural attenuation, wells LTM-103 and LTM-105 are paired with wells LTM-104 and LTM-106, respectively. Each well pair is located along the presumed groundwater flow lines, and attenuation is assessed by comparing COC concentrations within each well pair. Additional understanding of migration and attenuation is provided by the analysis of the natural attenuation water quality parameters listed in Table 4-2. These parameters can provide indications of whether natural biodegradation is occurring.

4.3 SUMMARY OF 2006 TO 2013 MONITORING RESULTS

The results of the groundwater monitoring conducted from October 2006 through September 2013 are presented in detail in the *2013 Groundwater Monitoring Report* (Integral 2014). The results are summarized below:

- The Hoyt Site redevelopment has affected groundwater infiltration and flow direction through installation of impervious and low permeability surfaces, which reduce recharge; installation of new utility pathways, sewers, and storm drains; construction and operation of dewatering systems in building basements; and installation of localized stormwater infiltration systems. Groundwater flow directions changed between the remedial investigation and the installation of monitoring wells in 2006, with the northern portion of the property being dominated by east-southeasterly flow.
- Lead was only detected in two groundwater samples, and the concentrations were below the trigger level. Based on acceptable results during the first year of groundwater sampling, lead analyses were discontinued.
- Concentrations of PAHs in groundwater at the site have decreased significantly from historical levels. This can be traced back to the multiple remedial actions undertaken since the mid-1970s. Monitoring shows that the concentrations of PAHs in groundwater have not historically nor do they currently adversely affect beneficial uses of the river. Detected PAH concentrations did not exceed the risk-based trigger concentrations in any wells with one exception. The only detection above trigger levels during the 6 years of long-term monitoring was benzo(g,h,i)perylene during the July 2009 sampling event in the groundwater sample collected from monitoring well LTM-107. Benzo(g,h,i)perylene was detected at 0.32 µg/L, which was slightly above the trigger level of 0.26 µg/L. During the 2010 through 2013 monitoring events, benzo(g,h,i)perylene was not detected at or above the trigger level. The 2010 through 2013 sampling events confirm that the July 2009 trigger level exceedance was an anomaly.

- The planned verification of the fate and transport modeling findings (the attenuation factor) was not conducted because of the change in groundwater flow direction. Given the changes in flow direction, the modeled attenuation rate based on groundwater flow to the north, the closest distance to the river, is overly conservative. Current measurements show flow to the east-southeast, resulting in a longer travel distance to the river and attenuation that would be greater than previously estimated.
- Analysis of natural attenuation parameters indicates that biological degradation is occurring at the Hoyt Site.

Long-term monitoring groundwater elevation and analytical results are included in Tables 4-3 and 4-4, respectively.

5 CONCLUSIONS

As required for this request for a Groundwater Certification of Completion under Consent Decree Section 7.A, BNSF has completed the Tanner Creek Sewer investigation and evaluation and commencement of groundwater monitoring pursuant to the approved Hoyt Site GMCP. This Project Closeout Report supports this request in compliance with Section J of the Groundwater SOW. Although not required for the requested Consent Decree Groundwater Certification of Completion, data collected since August 2006 demonstrate that the groundwater remedy meets the goals in the ROD and is protective of human health and the environment, and the potential stormwater and groundwater pathways are not adversely affecting beneficial uses of the Willamette River or posing an unacceptable risk to human or ecological receptors exposed to surface water or sediments.

BNSF requests that DEQ issue a preliminary Groundwater Certification of Completion for public comment and a final Groundwater Certification of Completion within 90 days of receipt of this Project Closeout Report as required by Section 7.A of the Consent Decree.

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FIGURES

SITE BOUNDARY

ABANDONED SEWER

COMBINED STORM AND SANITARY SEWER

WELL FOR MONITORING OF CONCENTRATION AND MIGRATION

WELL FOR MONITORING OF CONCENTRATION AND MIGRATION, AND VERIFYING FATE AND TRANSPORT MODELING

Source: Adapted from AECOM (2011), Figure 1-1, Site Map and Monitoring Well Locations, BNSF Railway Company, Former Hoyt Street Railyard

0 100 200
Feet

N

WILLAMETTE RIVER

TANNER CREEK SEWER OUTFALL (OUTFALL 11)

NW FRONT AVE (NAITO PARKWAY)

LOVEJOY (ramp)

LOVEJOY (at grade)

NW LOVEJOY ST

NW MARSHALL ST

NW NORTHRUP ST

NW OVERTON ST

NW PETTYGROVE ST

NW QUIMBY ST

THURMAN ST

KEARNEY ST

NW 9TH AVE

NW 10TH AVE

NW 11TH AVE

NW 12TH AVE

NW 13TH AVE

NW 14TH AVE

N.W. 10th

N.W. 11th

N.W. 12th

N.W. 13th

N.W. 14th

LTM-101

LTM-102

LTM-103

LTM-104

LTM-105

LTM-106

LTM-107

BLOCK 29 BLOCK 26 BLOCK 27 BLOCK 23 BLOCK 25 BLOCK 21 (FUTURE PARK) BLOCK 18 (FUTURE PARK) BLOCK 22 BLOCK 19 BLOCK 24 BLOCK 28 BLOCK 18 BLOCK 17 BLOCK 15 BLOCK 16 BLOCK 14 BLOCK 12 BLOCK 13 BLOCK 11 BLOCK 9 BLOCK 10 BLOCK 8

10" CSP
8" CSP
12" CSP
24" V.S.P.
12" V.S.P.
10" CSP
6'-6"x 9'-1"
8" VSP
6'-6"x 9'-5"
14" VSP
8" CSP
6'-0"x 9'-5"
6'-6"x 8'-11"
10" CSP
12" VSP
18" VSP
8" VSP
27" VSP
60"x90"
16" VSP
14" V.S.P.
48" VSP
24" CSP
38"x66" INTRCPT
10" VSP
30" VSP
36" VSP
42" VSP
24" VSP
16" CSP
21" CSP
ST.
8" SP
38"x66" INTRCPT

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integral consulting inc.

Figure 1-1.
Site Map and Monitoring Well Locations
Former Hoyt Street Railyard

TABLES

Table 4-1. Monitoring Locations, Rationale, and Parameters – Groundwater Monitoring and Contingency Program

Well	Rationale	Monitoring Parameters	Sampling Frequency		
			Year 1 (2007)	Years 2–3 (2008 to 2009)	Years 4–10[a] (2010 to 2016)
LTM-101	Source Removal Evaluation	PAHs	Once		
		Lead[b]	Once		
		Water Surface Elevation	Once		
LTM-102	Concentration and migration monitoring; protection of beneficial uses	PAHs	Quarterly	Semiannually	Annually
		Lead[b]	Quarterly		
		Natural Attenuation Parameters	Semiannually		
		Water Surface Elevation	Quarterly	Semiannually	Annually
LTM-103	Verification of fate and transport modeling	PAHs	Quarterly	Semiannually	Annually
		Lead[b]	Quarterly		
		Natural Attenuation Parameters	Semiannually		
		Water Surface Elevation	Quarterly	Semiannually	Annually
LTM-104	Concentration and migration monitoring; protection of beneficial uses; verification of fate and transport modeling	PAHs	Quarterly	Semiannually	Annually
		Lead[b]	Quarterly		
		Natural Attenuation Parameters	Semiannually		
		Water Surface Elevation	Quarterly	Semiannually	Annually
LTM-105	Verification of fate and transport modeling	PAHs	Quarterly	Semiannually	Annually
		Lead[b]	Quarterly		
		Natural Attenuation Parameters	Semiannually		
		Water Surface Elevation	Quarterly	Semiannually	Annually
LTM-106	Concentration and migration monitoring; protection of beneficial uses; verification of fate and transport modeling	PAHs	Quarterly	Semiannually	Annually
		Lead[b]	Quarterly		
		Natural Attenuation Parameters	Semiannually		
		Water Surface Elevation	Quarterly	Semiannually	Annually
LTM-107	Concentration and migration monitoring; protection of beneficial uses	PAHs	Quarterly	Semiannually	Annually
		Lead[b]	Quarterly		
		Natural Attenuation Parameters	Semiannually		
		Water Surface Elevation	Quarterly	Semiannually	Annually

Notes:
DEQ = Oregon Department of Environmental Quality
PAH = polycyclic aromatic hydrocarbon

[a] Wells to be monitored annually were confirmed in a letter from Mike Greenburg of DEQ to Bruce Sheppard of BNSF dated August 16, 2010.

[b] Lead sampling was discontinued after the first year of monitoring because results showed no risk to aquatic receptors in the Willamette River.

Table 4-2. Groundwater Monitoring Parameters

Parameter	Measurement/ Analytical Method
General Parameters	
Temperature	Field Probe
pH	Field Probe
Conductivity	Field Probe
Turbidity	Field Probe
Oxidation-Reduction Potential	Field Probe
Chemical Parameters	
Polycyclic Aromatic Hydrocarbons (PAHs)	EPA 8270-SIM
Lead	EPA 6010
Natural Attenuation Parameters	
Dissolved Oxygen	Field Probe
Nitrate	EPA Method 300.0
Manganese	EPA Method 6010
Ferrous Iron	SM 3500 FeD
Total Iron	EPA Method 6010
Sulfate	EPA Method 300.0
Sulfide	EPA Method 376.2
Methane	GG/FID
Alkalinity	EPA Method 310.1

Notes:
Lead and natural attenuation parameters were only measured during 2007.

Table 4-3. Groundwater Gauging and Elevation Data

	Depth to Water, feet							Water Elevation[a]						
Date	LTM-101	LTM-102	LTM-103	LTM-104	LTM-105	LTM-106	LTM-107	LTM-101	LTM-102	LTM-103	LTM-104	LTM-105	LTM-106	LTM-107
TOC Elevation	—	—	—	—	—	—	—	33.95	42.99[b]/ 41.03[c]	42.06[b]/ 39.19[c]	34.18[b]/ 34.70[c]	30.52	34.02	33.11
19-Oct-06	—	30.39	23.97	11.66	10.19	13.33	12.51	—	12.60	18.09	22.52	20.33	20.69	20.60
20-Jan-07	—	29.10	22.78	11.25	8.79	12.46	11.26	—	13.89	19.28	22.93	21.73	21.56	21.85
26-Apr-07	—	28.23	22.79	11.36	9.08	12.58	11.52	—	14.76	19.27	22.82	21.44	21.44	21.59
5-May-07	10.05	—	—	—	—	—	—	23.90	—	—	—	—	—	—
11-Jul-07	—	27.55	23.52	11.86	9.71	13.27	12.64	—	15.44	18.54	22.32	20.81	20.75	20.47
9-Oct-07	—	31.95	24.56	15.62	9.51	13.32	13.24	—	11.04	17.50	18.56	21.01	20.70	19.87
21-Jan-08	—	28.68	23.61	12.53	8.54	12.31	10.91	—	14.31	18.45	21.65	21.98	21.71	22.20
10-Jul-08	—	29.42	23.49	15.50	10.75	14.11	13.03	—	13.57	18.57	18.68	19.77	19.91	20.08
29-Jan-09	—	28.89	22.83	13.27	9.21	12.94	11.60	—	14.10	19.23	20.91	21.31	21.08	21.51
28&29-Jul-09	—	25.74	21.56	15.90	10.64	14.11	13.01	—	17.25	20.50	18.28	19.88	19.91	20.10
28&29-Jan-10	—	26.84	22.14	12.43	8.02	11.90	10.42	—	16.15	19.92	21.75	22.50	22.12	22.69
15-Sep-11	—	30.69	23.01	16.12	10.81	14.22	13.20	—	12.30	19.05	18.06	19.71	19.80	19.91
2-Oct-12	—	30.26	23.28	16.09	10.90	14.34	13.23	—	12.73	18.78	18.09	19.62	19.68	19.88
10-May-13[d]	—	26.35	19.80	14.97	—	—	—	—	14.68	19.39	19.73	—	—	—
19-Sep-13	—	28.63	20.25	16.04	10.60	14.04	12.91	—	12.40	18.94	18.66	19.92	19.98	20.20

Notes:
— = not measured
TOC = top of casing

[a] Elevations are in City of Portland Vertical Datum in feet above mean sea level.
[b] These TOC elevations were used to calculate groundwater elevations from October 2006 through October 2012.
[c] TOC elevations were resurveyed in February 2013 following construction of Fields Park using the City of Portland Vertical Datum in feet above mean sea level. These TOC elevations were used to calculate groundwater elevations for September 2013.
[d] Depth to water measurements were collected opportunistically during the inspection of wells LTM-102, -103, and -104 on May 10, 2013.

Table 4-4. Long-term Groundwater Monitoring Analytical Results

Sample ID	Sample Date	Sample Type	Chemical Name	Benzo(a) anthracene (µg/L)	Benzo(a) pyrene (µg/L)	Benzo(b) fluoranthene (µg/L)	Benzo(g,h,i) perylene (µg/L)	Benzo(k) fluoranthene (µg/L)	Chrysene (µg/L)	Fluoranthene (µg/L)	Indeno(1,2,3-cd) pyrene (µg/L)	Pyrene (µg/L)	Lead (µg/L)
			Action Level	10	3.8	14	0.26	0.55	1.5	14	62	3.8	338
LTM-101													
LTM-101-0507	5/5/2007			0.0305	0.0397	< 0.01	< 0.1	< 0.01	0.0351	< 0.1	< 0.01	< 0.1	323
LTM-102													
LTM-102-1006	10/19/2006			< 0.00971	< 0.00971	< 0.00971	< 0.0971	< 0.00971	< 0.00971	< 0.0971	< 0.00971	< 0.0971	2.65
LTM-102-0107	1/30/2007			< 0.01	< 0.01	< 0.01	< 0.1	< 0.01	< 0.01	< 0.1	< 0.01	< 0.1	< 50
LTM-102-0407	4/26/2007			< 0.00943	< 0.00943	< 0.00943	< 0.0943	< 0.00943	< 0.00943	< 0.0943	< 0.00943	0.125	< 50
LTM-102-0707	7/11/2007			0.0143	< 0.00962	0.0189	< 0.0962	0.0154	0.0247	< 0.0962	0.0272	0.159	< 50
LTM-102-0108	1/21/2008			0.013	< 0.00943	< 0.00943	< 0.0943	< 0.00943	0.0114	< 0.0943	< 0.00943	0.129	—
LTM-102-0708	7/10/2008			0.0676	< 0.00943	0.0417	< 0.0943	0.0474	0.0596	< 0.0943	< 0.00943	< 0.0943	—
LTM 102 0109	1/29/2009			< 0.00962	< 0.00962	< 0.00962	< 0.0962	< 0.00962	< 0.00962	< 0.0962	< 0.00962	0.131	—
LTM 102 072909	7/29/2009												
LTM-102-0110	1/29/2010			< 0.09	< 0.09	< 0.09	< 0.09	< 0.09	< 0.09	< 0.09	< 0.09	0.24	—
LTM-102-0911	9/15/2011			< 0.5 J	< 0.5 J	< 0.5 J	< 0.5 J	< 0.5 J	< 0.5 J	< 0.5 J	< 0.5 J	< 0.5 J	—
GW2012091901	9/19/2012			< 0.029	< 0.029	< 0.029	< 0.029	< 0.029	< 0.029	< 0.029	< 0.029	< 0.029	—
GW2013092001	9/20/2013			< 0.0059	< 0.0059	< 0.0059	< 0.0059	< 0.0059	< 0.0059	0.01 J	< 0.0059	0.045	—
LTM-103													
LTM-103-1006	10/19/2006			0.0153	< 0.0101	< 0.0101	< 0.101	< 0.0101	0.0157	0.378	< 0.0101	0.644	< 1
LTM-103-0107	1/30/2007			0.0342	< 0.0108	< 0.0108	< 0.108	< 0.0108	0.0457	0.404	< 0.0108	0.799	< 50
LTM-103-0407	4/26/2007			0.0864	0.0836	0.0503	< 0.0971	0.0681	0.0998	0.681	0.031	1.18	< 50
LTM-103-0707	7/11/2007			0.0524	0.0457	0.0187	< 0.0962	0.0303	0.0638	0.568	0.0258	0.966	< 50
LTM-103-1007	10/9/2007			0.0654	0.0439	0.0247	0.0281 J	0.0464	0.0824	0.47	0.0254	0.59	< 50
LTM-103-0108	1/21/2008			0.0778 J	0.022	0.0132	< 0.099	0.017	0.0956 J	0.661	0.0766 J	0.997	—
LTM-103-0708	7/10/2008			0.0711	< 0.00943	< 0.00943	< 0.0943	< 0.00943	0.0681	0.904	< 0.00943	1.35	—
LTM 103 0109	1/29/2009			< 0.00971	< 0.00971	< 0.00971	< 0.0971	< 0.00971	< 0.00971	< 0.0971	< 0.00971	< 0.0971	—
LTM103072909	7/28/2009			0.044	< 0.01	< 0.0096	< 0.0096	< 0.0096	0.042	0.99	< 0.0096	2.3	—
LTM-103-0110	1/29/2010			0.25	0.19	< 0.09	0.097	0.13	0.23	1.2	< 0.09	2.3 J	—
LTM-103-0911	9/15/2011			< 0.0971 J	< 0.0971 J	< 0.0971 J	< 0.0971 J	< 0.0971 J	< 0.0971 J	0.197 J	< 0.0971 J	2.44 J	—
LTM-113-0911	9/15/2011	Duplicate		< 0.0943 J	< 0.0943 J	< 0.0943 J	< 0.0943 J	< 0.0943 J	< 0.0943 J	0.154 J	< 0.0943 J	1.86 J	—
GW2012100201	10/2/2012			< 0.029	< 0.029	< 0.029	< 0.029	< 0.029	< 0.029	0.17	< 0.029	0.81	—
GW2013091901	9/19/2013			0.14	0.034	0.03	0.017 J	0.024	0.12	0.41	0.021	2.7	—
LTM-104													
LTM-104-1006	10/19/2006			< 0.01	< 0.01	< 0.01	< 0.1	< 0.01	< 0.01	< 0.1	< 0.01	< 0.1	< 1
LTM-104-0107	1/30/2007			< 0.00962	< 0.00962	< 0.00962	< 0.0962	< 0.00962	< 0.00962	< 0.0962	< 0.00962	< 0.0962	< 50
LTM-104-0407	4/26/2007			< 0.00962	< 0.00962	< 0.00962	< 0.0962	< 0.00962	< 0.00962	< 0.0962	< 0.00962	< 0.0962	< 50
LTM-104-0707	7/11/2007			< 0.00971	< 0.00971	< 0.00971	< 0.0971	< 0.00971	< 0.00971	< 0.0971	< 0.00971	< 0.0971	< 50
LTM-104-1007	10/9/2007			< 0.00943	< 0.00943	< 0.00943	< 0.0943	< 0.00943	< 0.00943	< 0.0943	< 0.00943	< 0.0943	< 50
LTM-104-0108	1/21/2008			0.0114	< 0.00962	< 0.00962	< 0.0962	< 0.00962	< 0.00962	< 0.0962	< 0.00962	< 0.0962	—
LTM-204-0108	1/21/2008	Duplicate		0.0147	< 0.01	< 0.01	< 0.1	< 0.01	< 0.01	< 0.1	< 0.01	< 0.1	—
LTM-104-0708	7/10/2008			< 0.00943	< 0.00943	< 0.00943	< 0.0943	< 0.00943	< 0.00943	< 0.0943	< 0.00943	< 0.0943	—
LTM 104 0109	1/29/2009			< 0.00943	< 0.00943	< 0.00943	< 0.0943	< 0.00943	< 0.00943	< 0.0943	< 0.00943	< 0.0943	—
LTM104072809	7/28/2009			< 0.0097	< 0.01	< 0.0097	< 0.0097	< 0.0097	< 0.0097	< 0.0097	< 0.0097	0.01	—
LTM-104-0110	1/29/2010			< 0.09	< 0.09	< 0.09	< 0.09	< 0.09	< 0.09	< 0.09	< 0.09	< 0.09	—
LTM-104-0911	9/15/2011			< 0.0943 J	< 0.0943 J	< 0.0943 J	< 0.0943 J	< 0.0943 J	< 0.0943 J	< 0.0943 J	< 0.0943 J	< 0.0943 J	—
GW2012091801	9/18/2012			< 0.029	< 0.029	< 0.029	< 0.029	< 0.029	< 0.029	< 0.029	< 0.029	< 0.029	—
GW2013092002	9/20/2013			< 0.0057	< 0.0057	< 0.0057	< 0.0057	< 0.0057	< 0.0057	< 0.0057	< 0.0057	< 0.0057	—
LTM-105													
LTM-105-1006	10/19/2006			< 0.103	< 0.103	< 0.103	< 1.03	< 0.103	< 0.103	< 1.03	< 0.103	< 1.03	128
LTM-105-0107	1/30/2007			< 0.0962	< 0.0962	< 0.0962	< 0.962	< 0.0962	< 0.0962	< 0.962	< 0.0962	< 0.962	< 50
LTM-105-0407	4/26/2007			< 0.00943	< 0.00943	< 0.00943	< 0.0943	< 0.00943	< 0.00943	< 0.0943	< 0.00943	< 0.0943	< 50
LTM-105-0707	7/11/2007			< 0.0472	< 0.0472	< 0.0472	< 0.472	< 0.0472	< 0.0472	< 0.472	< 0.0472	< 0.472	< 50
LTM-105-1007	10/9/2007			< 0.0952	< 0.0952	< 0.0952	< 0.952	< 0.0952	< 0.0952	< 0.952	< 0.0952	0.316 J	< 50
LTM-105-0108	1/21/2008			< 0.0098 J	< 0.0098 J	< 0.0098 J	< 0.098 J	< 0.0098 J	< 0.0098 J	< 0.098 J	< 0.0098 J	< 0.098 J	—
LTM-105-0708	7/10/2008			< 0.00943	< 0.00943	< 0.00943	< 0.0943	< 0.00943	< 0.00943	< 0.0943	< 0.00943	< 0.0943	—
LTM 105 0109	1/29/2009			0.012	< 0.00971	< 0.00971	< 0.0971	< 0.00971	< 0.00971	< 0.0971	< 0.00971	< 0.0971	—
LTM105072909	7/29/2009			0.045	0.05	0.058	0.027	0.019	0.061	0.098	0.022	0.12	—
LTM500072909	7/29/2009	Duplicate		0.044	0.043	0.051	0.025	0.018	0.057	0.096	0.022	0.12	—
LTM-105-0110	1/29/2010			< 0.09	< 0.09	< 0.09	< 0.09	< 0.09	< 0.09	< 0.09	< 0.09	< 0.09	—
LTM-500-0110	1/29/2010	Duplicate		< 0.09	< 0.09	< 0.09	< 0.09	< 0.09	< 0.09	< 0.09	< 0.09	< 0.09	—
LTM-105-0911	9/15/2011			< 0.0952 J	< 0.0952 J	< 0.0952 J	< 0.0952 J	< 0.0952 J	< 0.0952 J	< 0.0952 J	< 0.0952 J	< 0.0952 J	—
GW2012091904	9/19/2012			< 0.029	< 0.029	< 0.029	< 0.029	< 0.029	< 0.029	< 0.029	< 0.029	< 0.029	—
GW2013092005	9/20/2013			0.0095 J	< 0.0057	< 0.0057	< 0.0057	0.0059 J	< 0.0057	0.022	< 0.0057	0.024	—

Table 4-4. Long-term Groundwater Monitoring Analytical Results

Sample ID	Sample Date	Sample Type	Benzo(a) anthracene (µg/L)	Benzo(a) pyrene (µg/L)	Benzo(b) fluoranthene (µg/L)	Benzo(g,h,i) perylene (µg/L)	Benzo(k) fluoranthene (µg/L)	Chrysene (µg/L)	Fluoranthene (µg/L)	Indeno(1,2,3-cd) pyrene (µg/L)	Pyrene (µg/L)	Lead (µg/L)
Action Level			10	3.8	14	0.26	0.55	1.5	14	62	3.8	338
LTM-106												
LTM-106-1006	10/19/2006		< 0.0102	< 0.0102	< 0.0102	< 0.102	< 0.0102	< 0.0102	< 0.102	< 0.0102	< 0.102	< 1
LTM-206-1006	10/19/2006		< 0.00943	< 0.00943	< 0.00943	< 0.0943	< 0.00943	< 0.00943	< 0.0943	< 0.00943	< 0.0943	< 1
LTM-106-0107	1/30/2007		< 0.01	< 0.01	< 0.01	< 0.1	< 0.01	< 0.01	< 0.1	< 0.01	< 0.1	< 50
LTM-206-0107	1/30/2007	Duplicate	< 0.00962	< 0.00962	< 0.00962	< 0.0962	< 0.00962	< 0.00962	< 0.0962	< 0.00962	< 0.0962	< 50
LTM-106-0407	4/26/2007		< 0.00943	< 0.00943	< 0.00943	< 0.0943	< 0.00943	< 0.00943	< 0.0943	< 0.00943	< 0.0943	< 50
LTM-206-0407	4/26/2007	Duplicate	< 0.00943	< 0.00943	< 0.00943	< 0.0943	< 0.00943	< 0.00943	< 0.0943	< 0.00943	< 0.0943	< 50
LTM-106-0707	7/11/2007		< 0.00962	< 0.00962	< 0.00962	< 0.0962	< 0.00962	< 0.00962	< 0.0962	< 0.00962	< 0.0962	< 50
LTM-206-0707	7/11/2007	Duplicate	< 0.00943	< 0.00943	< 0.00943	< 0.0943	< 0.00943	< 0.00943	< 0.0943	< 0.00943	< 0.0943	< 50
LTM-106-1007	10/9/2007		0.0116	< 0.0098	< 0.0098	< 0.098	< 0.0098	< 0.0098	< 0.098	< 0.0098	0.0507 J	< 50
LTM-206-1007	10/9/2007	Duplicate	0.0129	< 0.00943	< 0.00943	< 0.0943	< 0.00943	0.0117	0.0331 J	< 0.00943	< 0.0943	< 50
LTM-106-0108	1/21/2008		< 0.00943	< 0.00943	< 0.00943	< 0.0943	< 0.00943	0.0111	< 0.0943	< 0.00943	< 0.0943	—
LTM-106-0708	7/10/2008		< 0.00962	< 0.00962	< 0.00962	< 0.0962	< 0.00962	< 0.00962	< 0.0962	< 0.00962	< 0.0962	—
LTM-206-0708	7/10/2008	Duplicate	< 0.00943	< 0.00943	< 0.00943	< 0.0943	< 0.00943	< 0.00943	< 0.0943	< 0.00943	< 0.0943	—
LTM 106 0109	1/29/2009		< 0.00962	< 0.00962	< 0.00962	< 0.0962	< 0.00962	< 0.00962	< 0.0962	< 0.00962	< 0.0962	—
LTM106072909	7/29/2009		0.015	< 0.01	0.014	< 0.0097	< 0.0097	0.014	0.053	< 0.0097	0.051	—
LTM-106-0110	1/29/2010		< 0.09	< 0.09	< 0.09	< 0.09	< 0.09	< 0.09	< 0.09	< 0.09	0.095	—
LTM-106-0911	9/15/2011		< 0.0943 J	< 0.0943 J	< 0.0943 J	< 0.0943 J	< 0.0943 J	< 0.0943 J	< 0.0943 J	< 0.0943 J	< 0.0943 J	—
GW2012091802	9/18/2012		< 0.029	< 0.029	< 0.029	< 0.029	< 0.029	< 0.029	< 0.029	< 0.029	0.037 J	—
GW2013092003	9/20/2013		0.012 J	< 0.0058	0.0067 J	< 0.0058	< 0.0058	0.01 J	0.044	< 0.0058	0.047	—
GW2013092004	9/20/2013	Duplicate	0.0073 J	< 0.0057	< 0.0057	< 0.0057	< 0.0057	0.0064 J	0.031	< 0.0057	0.038	—
LTM-107												
LTM-107-1006	10/19/2006		0.114	< 0.01	0.0385	< 0.1	0.0569	0.124	0.903	0.0685	1.13	< 1
LTM-107-0107	1/30/2007		0.102	0.05	0.0256	< 0.0943	0.0451	0.107	0.836	0.0216	1.23	< 50
LTM-107-0407	4/26/2007		0.103	0.0828	0.0532	< 0.0943	0.0664	0.119	0.903	0.0288	1.05	< 50
LTM-107-0707	7/11/2007		0.183	0.345	0.105	≤ 0.962	< 0.0962	0.19	1.09	0.137	1.21	< 50
LTM-107-1007	10/9/2007		0.522	0.46	0.236	0.248 J	0.419	0.577	1.57	0.213	2.64	< 50
LTM-107-0108	1/21/2008		0.162	0.108	0.0537	≤ 0.472	0.0805	0.193	0.947	< 0.0472	0.784	—
LTM-107-0708	7/10/2008		0.144	0.103	0.0594	< 0.0943	0.0877	0.131	1.01	0.0508	0.764	—
LTM 107 0109	1/29/2009		0.0608	0.0364	0.0178	< 0.0943	0.0304	0.0665	0.653	0.0136	0.86	—
LTM107072909	7/29/2009		0.65	0.61	0.44	**0.32**	0.22	0.73	1.4	0.26	1.7	—
LTM-107-0110	1/28/2010		0.14	0.11	< 0.095	< 0.095	< 0.095	0.13	0.51	< 0.095	0.6	—
LTM-107-0911	9/15/2011		< 0.0952 J	< 0.0952 J	< 0.0952 J	< 0.0952 J	< 0.0952 J	< 0.0952 J	0.603 J	< 0.0952 J	0.681 J	—
GW2012091902	9/19/2012		0.19	0.12 J	0.12	0.071 J	0.052 J	0.21	0.88	0.085 J	1.1	—
GW2012091903	9/19/2012	Duplicate	0.043 J	< 0.029	< 0.029	< 0.029	< 0.029	0.042 J	0.56	< 0.029	0.64	—
GW2013091902	9/19/2013		0.086	0.051	0.037	0.02	0.025	0.086	0.83	0.024	0.89	—
FieldQC												
FB-0707	7/11/2007	FB	< 0.00952	< 0.00952	< 0.00952	< 0.0952	< 0.00952	< 0.00952	< 0.0952	< 0.00952	< 0.0952	< 50
FB-0108	1/21/2008	FB	< 0.00943 J	< 0.00943 J	< 0.00943 J	< 0.0943 J	< 0.00943 J	< 0.00943 J	< 0.0943 J	< 0.00943 J	< 0.0943 J	—
FIELD BLANK_0109	1/29/2009	FB	< 0.0099	< 0.0099	< 0.0099	< 0.099	< 0.0099	< 0.0099	< 0.099	< 0.0099	< 0.099	—
Field Blank072909	7/29/2009	FB	< 0.0098	< 0.02	< 0.0098	< 0.0098	< 0.0098	< 0.0098	< 0.0098	< 0.0098	< 0.0098	—
Rinsate Blank_0110	1/29/2010	RB	< 0.09	< 0.09	< 0.09	< 0.09	< 0.09	< 0.09	< 0.09	< 0.09	< 0.09	—
LTM-RB-0911	9/15/2011	RB	< 0.1 J	< 0.1 J	< 0.1 J	< 0.1 J	< 0.1 J	< 0.1 J	< 0.1 J	< 0.1 J	< 0.1 J	—
ERB2012091901	9/19/2012	RB	< 3.0	< 3.0	< 3.0	< 3.0	< 3.0	< 3.0	< 3.0	< 3.0	< 3.0	—
ERB2013092001	9/20/2013	RB	< 0.0058	< 0.0058	< 0.0058	< 0.0058	< 0.0058	< 0.0058	< 0.0058	< 0.0058	< 0.0058	—

Notes:

All analytes are totals.

Underline = detection limit exceeds trigger level

Bold = result exceeds trigger level

< = not detected at detection limit shown

— = not sampled

COC = contaminant of concern

FB = field blank

J = estimated concentration

NR = not reported

RB = rinsate blank