Five-Year Review Report

Fourth Five-Year Review Report
for
Brio Refining Superfund Site
Harris County, Texas

July 2013

PREPARED BY:

United States Environmental Protection Agency
Region 6
Dallas, Texas

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List of Acronyms

AER	Annual Effectiveness Report
ARAR	Applicable or Relevant and Appropriate Requirement
BSTF	Brio Site Task Force
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
1,2-DCA	1,2-Dichloroethane
DNAPL	Dense Non-aqueous Phase Liquid
DOP	Dixie Oil Processors
EA	Endangerment Assessment
EPA	United States Environmental Protection Agency
FFSZ	Fifty-Foot Sand Zone
FML	Flexible Membrane Liner
ICP	Institutional Control Plan
LNAPL	Light Non-aqueous Phase Liquid
MCL	Maximum Contaminant Level
MCU	Middle Clay Unit
MNA	Monitored Natural Attenuation
MOM	Maintenance, Operations, and Monitoring
NCP	National Contingency Plan
NPL	National Priorities List
NRDA	Natural Resources Damages Assessment
NSCZ	Numerous Sand Channel Zone
O&M	Operation and Maintenance
RA	Remedial Action
RAO	Remedial Action Objective
RD	Remedial Design
RI/FS	Remedial Investigation/Feasibility Study

ROD	Record of Decision
RPM	Remedial Project Manager
SOP	Standard Operating Procedure
1,1,2-TCA	1,1,2-Trichloroethane
TCEQ	Texas Commission on Environmental Quality
VOC	Volatile Organic Compound

Executive Summary

The U.S. Environmental Protection Agency (EPA) Region 6 has conducted the fourth five-year review of the remedial action (RA) implemented at the Brio Refining Superfund Site (Site), located in Harris County, Texas. The purpose of this fourth five-year review was to determine whether the selected remedy for the Site continues to protect human health and the environment. This review was conducted from November 2012 to January 2013, and its findings and conclusions are documented in this report. RA construction activities were completed in April 2004, and the Third Five-Year Review Report was completed in April 2008; this established the fourth five-year review period of 2008 to 2013.

Located in Harris County, Texas, the Brio Refining Site was used as a chemical re-processing and refining facility from the 1950's to 1982. In general, processing activities consisted of reclamation of petrochemicals from various source materials, most of which were residues, tank bottoms, and tars of other processes performed at off-Site locations. The Site was placed on the National Priorities List (NPL) on March 31, 1989.

Following numerous investigations, studies, and Site activities, a Record of Decision (ROD) was issued on March 31, 1988, which selected the following remedial actions (RAs): incineration of pit residuals, removal of surface contamination, channel improvements to Mud Gully, demobilization of remaining process equipment and removal of debris on the Site, removal of dense non-aqueous phase liquids (DNAPL), and pump and treat for groundwater in the Numerous Sand Channel Zone (NSCZ). A consent decree was entered in April 1991 between the United States Environmental Protection Agency (EPA) and the Brio Site Task Force (BSTF) for implementation of the ROD. Major Site contaminants identified included styrene tars, vinyl chloride, chlorinated solvent residues, metallic catalyst, and fuel oil residues.

After the remedial design was performed and approved by the EPA in July 1993, exceedances of fence line air quality standards during excavation of pit materials led to work stoppage. An amended ROD was signed by the EPA on July 2, 1997, which selected a containment remedy to replace on-Site incineration. The elements of the amended remedy included a vertical barrier wall, Site cover system, groundwater flow control, air monitoring, long-term groundwater monitoring, and channel improvements to Mud Gully. Construction of the amended remedy began in July 2000 and was completed in April 2004. Since mid-2004, the Site has been in the post-closure phase. Following successful demonstrations of the remedy effectiveness, deletion of the Brio Refining Superfund Site from the NPL became effective on December 28, 2006.

The trigger for this review was the April 25, 2008, signature date of the Third Five-Year Review. The five-year review for the Site included a review of relevant documents, including the Amended ROD; the Maintenance, Operations and Maintenance Plan; the Fourth, Fifth, and Sixth Annual Effectiveness Reports; and the Fifty-Foot Sand Zone (FFSZ) Groundwater Investigation. As part of the Fourth Five-Year Review, the EPA and Texas Commission on Environmental Quality (TCEQ) conducted an inspection of the Site on December 13, 2012. Interviews were conducted with key citizens who have the possibility of being impacted by the Brio Site. No major issues regarding the Site were identified during the interviews.

The assessment of this Fourth Five-Year Review found that the remedy remains protective and consistent with the remedial action objectives (RAOs) of this response action. Groundwater gradient control of the NSCZ plume is being maintained by the on-Site groundwater/DNAPL recovery and treatment system. Air, cover gas collection, and surface water quality are all within compliance levels. Continued monitoring will be necessary to evaluate the effectiveness of the

remedy.

The ROD requires that Site control be maintained through the use of fencing and the imposition of deed notices and restrictions. The BSTF currently controls the Site with Site perimeter fencing and locked gates. The expected long-term maintenance and operations at the Site will involve a continual Site presence. The Institutional Control Plan (ICP), dated February 2, 2006, documents that deed notices and deed restrictions were executed on the Site. During this review period, certified copies of the filed deed notices and restrictions were obtained from the Harris County Clerk's Office.

Issues

At this time, one issue identified during the five-year review is groundwater quality in the second transmissive zone, termed the Fifty Foot-Sand Zone (FFSZ), which was in compliance over the five-year review period with the exception of one of five on-Site FFSZ monitoring wells. In Well BMW-3B, 1,2-dichloroethane and vinyl chloride were detected above the MCLs. In accordance with the Site operating plan requirements, the BSTF proposed and implemented actions consisting of: (1) increasing the monitoring frequency at the affected FFSZ well, (2) conducting an on-Site FFSZ groundwater investigation, and (3) increasing the pumping rates of the NSCZ recovery system. The results of the water quality monitoring indicated a peaking and then decreasing constituent concentration trend during this review period. The results of the on-Site FFSZ groundwater investigation indicated that: (1) groundwater is slowly moving east towards unoccupied property with no known FFSZ wells within a half mile of the Site, (2) an off-Site FFSZ groundwater investigation is warranted (requiring property access agreements), and (3) the FFSZ groundwater has favorable characteristics for naturally degrading the detected constituents. This issue will continue to be evaluated. Other issues identified as part of this review are: minor soil cover repair should be performed; with no prior requirement for operational performance monitoring, objectives and a scope of work for the operational performance monitoring are needed; and obsolete south plume monitoring wells should be abandoned.

Actions Needed

It is recommended that the following actions be taken: (1) conduct an off-Site FFSZ groundwater delineation investigation; (2) assess monitored natural attenuation (MNA) and other options as potential response measures for Site constituents in the FFSZ; (3) investigate existence of FFSZ wells located east of the Brio Site; (4) continue with increased pumping rates at the Pit J-NSCZ groundwater recovery system to maintain upward gradient per Maintenance, Operations and Monitoring (MOM)-specified goals; and (5) sample wells BMW-3B and BMW-18B and analyze for drinking water volatiles quarterly until EPA approves a return to annual sampling. In addition, minor soil cover repair should be performed by importing clay soil and repairing the cover to design specifications; a work plan should be prepared specifying the objectives and scope of the operational performance monitoring; and a work plan should be prepared for the proper plugging and abandonment of obsolete south plume monitoring wells.

Determinations

The remedy for the Brio Refining Superfund Site is operating as designed and is protective of human health and the environment in the short term, and is expected to be protective of human health and the environment upon completion if the recommendations and follow-up actions identified in this five-year review are addressed. The RA has removed exposure pathways that could have resulted in unacceptable risks by preventing exposure of human receptor populations to contaminated air, soils or groundwater. Long-term protectiveness of the RA will be achieved by continued monitoring of air, groundwater, and surface water to assess the effectiveness of the

Site controls. The affected FFSZ groundwater is currently an issue under investigation and will be evaluated during the next five-year review period.

Approved by: Date:

Pam Phillips, Acting 9/18/13

Carl E. Edlund, P.E., Director

Superfund Division
U.S. EPA, Region 6

Five Year Review Summary Form

SITE IDENTIFICATION		
Site Name: Brio Refining Superfund Site		
EPA ID: TXD980625453		
Region: 6	**State:** TX	**City/County:** Harris
SITE STATUS		
NPL Status: Deleted		
Multiple OUs? No	**Has the site achieved construction completion?** Yes	
REVIEW STATUS		
Lead agency: EPA		
Author name (Federal or State Project Manager): Gary G. Miller		
Author affiliation: Remedial Project Manager		
Review period: 5/13/2008 – 12/31/2012		
Date of site inspection: 12/13/2012		
Type of review: Statutory		
Review number: 4		
Triggering action date: 4/25/2008		
Due date (five years after triggering action date): 4/25/2013		

Five-Year Review Summary Form (continued)

Issues/Recommendations
OU(s) without Issues/Recommendations Identified in the Five-Year Review:
None

Issues and Recommendations Identified in the Five-Year Review:

OU(s): #1	Issue Category: Monitoring			
	Issue: Affected FFSZ Groundwater: Well BMW-3B 1,2-dichloroethane and vinyl chloride above MCLs. Well BMW-18B drinking water volatile detections below MCLs.			
	Recommendation: (1) Conduct an off-Site FFSZ groundwater delineation investigation, (2) Assess monitored natural attenuation (MNA)) and other options as potential response measures for Site constituents in the FFSZ, (3) Investigate existence of FFSZ wells located east of the Brio Site, (4) Continue with increased pumping rates at the Pit J-NSCZ groundwater recovery system to maintain upward gradient per Maintenance, Operations and Monitoring (MOM)-specified goals, and (5) sample wells BMW-3B and BMW-18B and analyze for drinking water volatiles quarterly until EPA approves a return to annual sampling.			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Implementing Party**	**Oversight Party**	**Milestone Date**
No	Yes	PRP	EPA	12/31/2013

OU(s): #1	Issue Category: Operations and Maintenance			
	Issue: Minor cover soil repair.			
	Recommendation: Import clay soil and repair cover to design specifications.			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Implementing Party**	**Oversight Party**	**Milestone Date**
No	No	PRP	EPA	12/31/13

OU(s): #1	Issue Category: Remedy Performance			
	Issue: No requirement for operational performance monitoring.			
	Recommendation: Prepare a work plan specifying the objectives and scope of work.			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Implementing Party**	**Oversight Party**	**Milestone Date**
No	No	PRP	EPA	9/31/2013

OU(s): #1	Issue Category: Operations and Maintenance
	Issue: South plume monitoring well abandonment
	Recommendation: Prepare a work plan for proper plugging and abandonment of obsolete south plume monitoring wells.

Affect Current Protectiveness	Affect Future Protectiveness	Implementing Party	Oversight Party	Milestone Date
No	No	PRP	EPA	9/31/2013

Protectiveness Statement(s)

Operable Unit:	*Protectiveness Determination:*	*Addendum Due Date (if applicable):*
#1	Short-term Protective	None

Protectiveness Statement:

The remedy for the Brio Refining Superfund Site is operating as designed and is protective of human health and the environment in the short term, and is expected to be protective of human health and the environment upon completion if the recommendations and follow-up actions identified in this five-year review are addressed. The remedial action has removed exposure pathways that could have resulted in unacceptable risks by preventing exposure of human receptor populations to contaminated air, soils or groundwater. Long-term protectiveness of the remedial action will be verified achieved by continued monitoring of air, groundwater, and surface water to assess the effectiveness of the Site controls. The affected FFSZ groundwater is currently an issue under investigation and will be evaluated during the next five-year review period.

Sitewide Protectiveness Statement (if applicable)

Protectiveness Determination:	*Addendum Due Date (if applicable):*
Short-term Protective	*None*

Protectiveness Statement:

As part of the Fourth Five-Year Review, the EPA and Texas Commission on Environmental Quality (TCEQ) conducted an inspection of the Site on December 13, 2012, and determined that the implemented remedial action is functioning as intended and remains protective of human health and the environment in the short-term. The remedial action has removed exposure pathways that could have resulted in unacceptable risks by preventing exposure of human receptor populations to contaminated air, soils or groundwater. Long-term protectiveness of the remedial action will be verified achieved by continued monitoring of air, groundwater, and surface water to assess the effectiveness of the Site controls. The affected FFSZ groundwater is currently an issue under investigation and will be evaluated during the next five-year review period.

I. Introduction

The purpose of a five-year review is to evaluate the implementation and performance of the selected remedy in order to determine if the remedy is or will be protective of human health and the environment. Since this will be the fourth five-year review, it will determine if the remedy continues to be protective of human health and the environment. The methods, findings, and conclusions of reviews are documented in five-year review reports. In addition, five-year review reports identify issues found during the review, if any, and identify recommendations to address them.

The Agency is preparing this Five-Year Review Report pursuant to CERCLA § 121 and the National Contingency Plan (NCP). CERCLA § 121 states:

> *If the President selects a remedial action that results in any hazardous substances, pollutants, or contaminants remaining at the site, the President shall review such remedial action no less often than each five years after the initiation of such remedial action to assure that human health and the environment are being protected by the remedial action being implemented. In addition, if upon such review it is the judgment of the President that action is appropriate at such site in accordance with section [104] or [106], the President shall take or require such action. The President shall report to the Congress a list of facilities for which such review is required, the results of all such reviews, and any actions taken as a result of such reviews.*

The Agency interpreted this requirement further in the NCP; 40 CFR § 300.430(f)(4)(ii) states:

> *If a remedial action is selected that results in hazardous substances, pollutants, or contaminants remaining at the site above levels that allow for unlimited use and unrestricted exposure, the lead agency shall review such action no less often than every five years after the initiation of the selected remedial action.*

The BSTF, under the direction of the EPA, Region 6, conducted this Fourth Five-Year Review of the remedy implemented at the Brio Refining Superfund Site in Harris County, Texas. This review was conducted from November 2012 through January 2013. This report documents the results of the review.

The triggering action for this statutory review is the completion of the Third Five-Year Review on April 25, 2008. The five-year review is required due to the fact that hazardous substances, pollutants, or contaminants remain at the Site above levels that allow for unlimited use and unrestricted exposure.

II. Site Chronology

Table 1 - Chronology of Site Events

Event	Date
Chemical Reprocessing and Refining Activities at the Site	1950's – 1982
Removal Activities – Placement of Pit Cover	1985
Remedial Investigation/Feasibility Study (RI/FS) complete	3/1988
Record of Decision Signed	3/31/1988
Final Listing on EPA National Priorities List	3/1989
Start of On-Site Construction for Building/Structures Demolition and Decontamination (1st phase of Site Remedial Action and date that triggers a five-year review)	6/29/1989
Facility dismantlement completed	12/1989
Consent Decree Finalizing Settlement for Responsible Party Performance of Remedy Entered by Federal Court	4/04/1991
EPA approval of Remedial Design	7/1993
ROD Amendment Issued by EPA, Changing from On-Site Incineration to Containment	7/2/1997
First Five-Year Review (Type Ia)	1/8/1998
Consent Decree Amended to Include Modified Remedy	3/5/1999
Start of On-Site Construction for Modified Remedy	7/11/2000
Completion of Brio North Soil Bentonite Barrier Wall	11/2/2000
Completion of Brio South Soil Bentonite Barrier Wall	12/6/2000
Completion of Sheet Pile Wall on Brio North	10/10/2001
Completion of Brio South Cover System	2/21/2002
Completion of Sheet Pile Wall Crossing Dixie Farm Road	5/5/2002
Second Five-Year Review	5/13/2003
Completion of Mud Gully Improvements	6/13/2003
Completion of Brio North Cover System	10/2003
Completion of Groundwater/DNAPL Recovery System	4/9/2004
Remedial Action Completion Report	12/16/2004
First Annual Effectiveness Report	9/1/2005
Completion of Gas Treatment System	11/16/2005
Final Inspection (EPA & TCEQ)	4/20/2006
Final Close Out Report (signed)	5/26/2006
Second Annual Effectiveness Report	11/8/2006
Deletion from National Priorities List	12/28/2006
Third Annual Effectiveness Report	7/18/2007
Third Five-Year Review Report	4/25/2008
Fourth Annual Effectiveness Report	7/8/2009
Phase I Fifty-Foot Sand Zone (FFSZ) Groundwater Investigation Report	1/14/2011
Maintenance, Operations, and Monitoring Plan, February 2004 with Revisions through January 2011 (Rev. 4)	1/31/2011

Event	Date
Phase 2 FFSZ Groundwater Investigation Work Plan	6/29/2011
Fifth Annual Effectiveness Report	2/15/2012
Sixth Annual Effectiveness Report	2/15/2012

III. Background

Physical Characteristics

The Brio Site is located almost 20 miles south of Houston, Texas, and occupies approximately 58 acres (acs). The Site is divided by Dixie Farm Road, with Brio North being historically used for storage purposes and Brio South being primarily used for processing activities. A neighboring residential subdivision (Southbend, now vacant) was located along and north of the northern boundary of Brio North. Mud Gully, a flood control ditch and local tributary of Clear Creek, runs along the western boundary of the Brio Site. Figure 1 in Attachment 1 shows the general location of the Brio Site. Figure 2 in Attachment 1 illustrates the Site layout.

The Brio Site is located within the Pleistocene Deltaic Plain of the Brazos River, known as the Alameda Delta. The Site is underlain with Pleistocene and Pliocene deposits to a depth of approximately 2,400 feet (ft.).

A generalized geologic cross-section is presented in Figure 3 of Attachment 1. The NSCZ and the FFSZ are the two water-bearing units investigated at the Brio Site. The upper water bearing zone, the NSCZ, lies below the Upper Clay Unit and is comprised of interbedded sands and silty clays. The NSCZ is generally encountered from 14 to 32 ft. below ground surface (bgs) and has a low well yield. The thickness of the NSCZ varies from less than 10 ft. to over 20 ft. The groundwater in the NSCZ typically flows toward and discharges to Mud Gully to the west.

The FFSZ is separated from the NSCZ by the Middle Clay Unit (MCU), a confining layer ranging in thickness from 8 to 20 ft. Ranging in thickness from 35 to 45 ft., the FFSZ is generally encountered between 52 and 61 ft. bgs and has a reasonably high well yield. Groundwater in the FFSZ flows in an eastwardly direction at rates on the order of 10 to 50 ft. per year.

Land and Resource Use

In general, processing activities consisted of reclamation of petrochemicals from various source materials, most of which were residues, tank bottoms, and tars of other processes performed at off-Site locations. Spanning the period of 1957 to 1982, processing operations included regeneration of copper catalysts; recovery of ethylbenzene from styrene tars, chemicals from vinyl chloride bottoms, phenol heavy ends, chlorinated hydrocarbons, cresylic acid and ethylene glycol; and the production of ethylbenzene, toluene, aromatic solvents, styrene pitch, cresylic acid, sodium sulfide, sodium cresyllite, fuel oil, cumene, diesel fuel,

residual oil, naphtha, kerosene and jet fuel. Most of the feedstock materials for processing at Brio were stored in on-Site pits, many of which were located on Brio North. However, disposal areas were located on both the Brio North and Brio South Sites. All of the pits were closed during Site operations, which ceased in December 1982. The EPA placed the Site on the NPL on March 31, 1989.

Current land use of the surrounding area includes residential development, a college, a hospital, and commercial development to the northeast. The area to the east includes residential development, a convenience store that sells fuel, and an active oil field. A buffer of undeveloped properties exists to the north, west and south of the Site. Mud Gully separates Brio North from the northern part of the Dixie Oil Processors (DOP) Superfund site; Brio South and the southern part of the DOP site are adjacent. The property to the south of the Site has been used for the establishment of a wetland habitat and preservation of forest habitat as part of a Natural Resource Restoration Project implemented by the BSTF in conjunction with several state and federal agencies. Residential development is evident approximately 0.75 miles to the west of the Site, and approximately 0.1 miles to the east of the Site.

History of Contamination

Numerous investigations, studies, and Site activities have been performed at the Brio Site in efforts to determine the location of the former storage pits and the nature and extent of contamination. The investigations found that the majority of the contamination at the Site is located within the former storage pit areas. The pits were constructed within the uppermost geologic unit designated the Upper Clay Unit. This unit occurs across the entire Site and ranges in depth from 14 to 32 ft. bgs.

Following the Site investigations, the EPA issued a ROD on March 31, 1988, that selected on-Site incineration of pit residuals, removal of surface contamination, channel improvements to Mud Gully, demobilization of remaining process equipment and removal of debris from the Site, removal of DNAPL, and pump and treat for groundwater in the NSCZ. The ROD addressed all potential threats to human health and the environment at the Site as a single operable unit, including groundwater contamination. A consent decree was entered in April 1991 between the EPA and BSTF for implementation of the ROD.

A remedial design was performed by the BSTF and approved by the EPA in July 1993. Demolition of the majority of the remaining process equipment was completed prior to mobilization of the incinerator.

A rotary kiln incinerator and support equipment were mobilized to the Site following the demolition work. Temporary enclosures were erected over the pits requiring remediation in order to contain emissions during excavation. The incinerator began clean burn operations with imported off-Site material. Excavation began at Pit R on Brio South for shakedown operations and to stockpile material for the trial burn. Emission problems during excavation led to a "stop work" order until appropriate emission control equipment could be installed. Before additional controls could be installed, a force majeure claim by the BSTF was submitted, which eventually resulted in the decision by the EPA to allow the dismantling of the incinerator. The incinerator and support equipment were demobilized by December 1994.

An amended ROD was signed by the EPA on July 2, 1997. As the preferred remedial alternative to incineration, the amended ROD selected a containment system with elements including: vertical barrier wall, Site cover, groundwater flow control, air monitoring, long-term groundwater monitoring, and channel improvements to Mud Gully. Construction of the amended remedy began in July 2000 and was completed in April 2004.

Following successful demonstrations of the remedy's effectiveness, deletion of the Brio Refining Superfund Site from the NPL became effective December 28, 2006.

Basis for Taking Action

The three primary affected media at the Site include groundwater, surface soils, and subsurface soils. The extent of affected soils and groundwater has been defined through previous investigations and studies. The principle contaminants of concern at the Site are organic compounds and chlorinated solvent compounds. Some of the notable contaminants include the following:

1,1,2-Trichloroethane (1,1,2-TCA)	1,2-Dichloroethane (1,2-DCA)
1,2-Dichloroethene	1,1-Dichloroethene
1,1-Dichloroethane	vinyl chloride
bis-(2-chloroethyl) ether	phenanthrene

An Endangerment Assessment (EA) was performed shortly after a Remedial Investigation/Feasibility Study (RI/FS) was completed. The EA estimated the potential for adverse effects on human health and the environment from exposure to contaminants at the Site. The actual contaminant concentrations found on the Site were compared to the exposure from a concentration known to have an adverse impact. From the EA, it was determined that the Site potentially posed four major risks to human health and the environment. The identified pathways were:

- Direct (dermal) contact and ingestion of contaminated surface soils and sediments on the Site.
- Inhalation of contaminated dust and volatile organic compound (VOC) emissions from the Site.
- Ingestion of contaminated groundwater from the FFSZ beneath the Site.
- Exposure of aquatic biota to NSCZ discharges of contaminated groundwater to Mud Gully.

IV. Remedial Actions

Remedy Selection

The original 1988 ROD included the following major elements:

> Affected materials and soils - Affected materials and soils shall be treated using either incineration or biological treatment. This media is defined as all contaminated sludges and liquids and waste material found to exist above the action levels defined in the EA.

This media is largely found in the on-Site pits.

Storage tanks, drums, and process equipment - Remove tank contents, decontaminate tanks, and transport the tanks to an EPA-approved off-Site disposal facility.

Monitoring and control of migration pathways - Control exposure through ambient air, surface water, and groundwater pathways. Specifically, the ambient air should be monitored on a semi-annual basis and emissions should be controlled from treatment processes. Discharges to Mud Gully should be controlled and monitored. Groundwater pathways in the NSCZ and the FFSZ should be monitored and action taken if the action levels are exceeded.

Summary of Work Performed during First Five-Year Review Period (1993-1998)

In June 1989, an Administrative Order on Consent was signed with a group of companies, referred to as the BSTF, to begin dismantlement of the process equipment on the Site. The facility dismantlement was completed in December 1989. Material present in the process equipment and tanks was consolidated into remaining tanks. Approximately 30 tanks were left on the Site that could potentially be used in the implementation of the bioremediation remedy. The process equipment and tanks were decontaminated and sent to an off-Site smelter for reclamation.

A consent decree with a scope of work to implement the remainder of the ROD was entered by the federal district court on April 4, 1991. The BSTF began implementation of a remedial design (RD) to address the scope of work. The BSTF chose to implement the incineration alternative in the ROD due to lack of competitive bids for the biological alternative.

A RD was approved by the EPA in July 1993 and addressed installation and operation of an incinerator to treat contaminated soils, sludges, and liquids above the action levels specified in the ROD. In addition, the RD addressed installation of a barrier well system to control groundwater migration in the NSCZ.

In May 1993, surface water discharges were found to be occurring in Mud Gully. Characterization of the water and sediments in Mud Gully and Clear Creek (downstream of Mud Gully) found that chlorinated VOCs were discharging from the Brio Site into the streams. A groundwater barrier well system was installed on the Brio Site in the area of Pit B in order to control the discharges of contaminated groundwater to Mud Gully. The surface water in Mud Gully and Clear Creek were sampled periodically to check compliance with the standards evaluated in the 1988 ROD. Over 12 million gallons (gals) of groundwater were extracted and treated between 1993 and 1998. In addition, the barrier well system removed approximately 30,000 gals of DNAPL from the NSCZ during the same time frame. The DNAPL was sent off-Site for incineration.

In December 1993, Site preparation work for the mobilization of the incinerator began. This work included removal of the majority of the remaining tanks from the initial dismantling operation. The tanks were cleaned and sent off-Site for smelting. Residual materials from the tanks were consolidated into Tank 402, the sole remaining tank on Brio South, or placed into roll-off boxes for subsequent treatment.

A rotary kiln incinerator and support equipment were mobilized to the Site following the demolition work. Temporary enclosures were erected over the pits requiring remediation in order to contain emissions during excavation. The incinerator began clean burn operations with imported off-Site material and excavation began at Pit R on Brio South for shakedown operations and to stockpile material for the trial burn. Emission problems during excavation led to a "stop work" order until appropriate emission control equipment could be installed. Before additional controls could be installed, a force majeure claim was submitted by the BSTF, which eventually resulted in the decision by the EPA to allow the dismantling of the incinerator. The incinerator and support equipment were demobilized by December 1994. After demobilization, operation of the groundwater treatment system and DNAPL recovery system also continued. Additionally, drums stockpiled since the inception of investigations, roll-off boxes containing affected material, and the contents of Tank 402 were sent off-Site for disposal at licensed facilities.

Amended Record of Decision

A focused feasibility study was initiated to evaluate alternatives to the incineration remedy selected in 1988. An amended ROD was signed by the EPA on July 2, 1997. The RAOs developed for Site response actions include:

- Protection of the health and safety of the community, workers, and the environment during implementation of the remedy;
- Minimization, to the extent practicable, of disruption and inconvenience to the community during implementation of the remedy;
- Long-term, effective control of migration of leachable organic liquids from the source area;
- Long-term, effective control of off-Site migration of free-phase liquids or Site constituents moving through the groundwater, surface water, soil, or air pathways;
- Long-term, effective reduction of potential future risk to the community and the environment resulting from off-Site exposure to Site constituents by maintaining or achieving:
  - Target levels of public exposure to air emissions,
  - Target levels of affected soil (dermal contact and ingestion),
  - Control of off-Site transport of affected soils to acceptable levels,
  - Protection of existing aquatic life in Mud Gully, and
  - Target levels of organic constituents in the FFSZ within a reasonable time.

- Minimization of potential negative impact of natural disasters such as flooding, hurricanes, etc.; and

- Long-term, effective Site control and aesthetics.

The Amended ROD selected containment as the preferred remedial alternative. The elements of the containment remedy include:

Vertical Barrier Wall - A sub-grade barrier wall will be constructed to limit the potential for off-Site migration of contaminated groundwater in the NSCZ. The wall will be designed to encompass the Site and will be keyed into the MCU. The technique of construction will be established in the remedial design.

Site Cover - A composite cap will be constructed over the Site, extending to the limits of the barrier wall. The cap will include a gas collection layer, a flexible membrane liner (FML), compacted clay, and top soil to promote vegetative growth.

Groundwater Flow Control - A groundwater pumping system will be installed within the barrier wall to limit the migration of Site contaminants. Recovered groundwater will be treated and discharged to Mud Gully.

Air Monitoring and Long-Term Groundwater Monitoring - An air monitoring system will be maintained during the construction of the remedy to protect public health. The groundwater will be monitored in the FFSZ to ensure groundwater is below established Maximum Contaminant Levels (MCLs). The NSCZ groundwater outside the barrier wall will be monitored to demonstrate compliance with water quality criteria for Mud Gully.

Mud Gully - Similar to the original proposal, this option includes channel improvements to the gully, but also allows the option of relocation of the gully by Harris County.

Common Components - The containment remedy retains several components unmodified from the original remedy, which include addressing the following:

- Off-Site soil contamination: Off-Site contamination encountered during RI or RA will be removed to background levels;
- Debris and rubble: Inert debris and rubble from past operations to be consolidated and disposed;
- Wastewater treatment system: Capture and treatment of on-Site wastewater;
- Storage tanks and drums: Empty, decontaminate, and dispose of existing storage tanks and drums;
- Process equipment: Dismantle remaining process facility; and
- Site control: Permanent Site control and implementation of deed notices and restrictions.

Remedy Implementation

Summary of Work Performed during Second Five-Year Review Period (1998-2003)

Construction of the RA pursuant to the Amended ROD began in July 2000 and was implemented in phases. The construction was managed by the BSTF and was conducted by various specialty contractors as required for each remedy component. The primary components of the construction completed during the Second Five-Year Review period were:

- Soil bentonite barrier wall,
- Sheet pile barrier wall, and
- Cover system on Brio South.

Soil Bentonite Barrier Wall

Approximately 5,900 lineal ft. of slurry wall was constructed around the perimeter of the Site from September to December 2000. The slurry wall was constructed by excavating a 30-inch (in.) wide trench to a depth that seals the wall into the low-permeable MCU. The depth of the slurry wall ranged from approximately 35 to 50 ft. below ground surface. The stability of the excavation was maintained using a drilling mud fluid (slurry) that was prepared on-Site. Once the excavation achieved the proper depth, a backfill material (consisting of thoroughly mixed native soils and fresh slurry) was placed in the excavation. Once installed, the backfill material became the barrier wall and was tested to confirm that the constructed barrier wall achieved the required impermeability.

The EPA provided oversight of the construction. An interim completion report was issued by the BSTF to provide the construction quality assurance documentation. The interim report was incorporated by reference into the Remedial Action Completion Report dated December 16, 2004.

Sheet Pile Barrier Wall

The sheet pile barrier wall was installed from July 2001 to December 2001. The wall is approximately 1,781 ft. long and varies in depth from 35 to 50 ft. bgs. The wall was installed to designed depths into the low permeable MCU. The sheet pile wall is composed of two sections:

- The main alignment is approximately 1,188 linear ft. and was installed on the Brio Site.

- The cofferdam alignment is approximately 593 linear ft., and was installed within the Mud Gully easement to contain an off-Site groundwater plume.

Cover System (Brio South)

The construction of the cover system was divided into two components: Brio North and Brio South; the Brio South component was further divided as described below. The two areas are divided by Dixie Farm Road and separate borrow pit areas were developed in order to minimize truck traffic over the road. The Brio South cover was initiated first due to its smaller size. The Brio South cover system was constructed from May 2001 to February 2002. An

additional compacted clay layer was extended over a segment of the Dixie Oil Processors (DOP) South Site to provide controlled surface water runoff.

The Brio-South cover system components are as follows:

- Bedding Layer (varies in thickness),
- Gas Collection Layer,
- FML,
- Compacted Clay Layer (eighteen in.), and
- Vegetative cover

The Brio South cover system comprises approximately 11.7 acs, and was constructed to the limits of the soil-bentonite barrier wall on the east and south sides, to Dixie Farm Road right-of-way on the north side, and to DOP South on the west side.

The DOP South cover system components consist of a compacted clay layer of variable thickness, and a vegetative cover. The DOP South compacted clay cover encompasses approximately 3.8 acs. The compacted clay cover was constructed to the limits of the soil bentonite barrier wall on the south and west sides, and was tied-in with the Brio-South compacted clay layer on the east side, and to the Dixie Farm Road right-of-way on the north side. A vegetative cover was also installed over the DOP South cover system.

Summary of Work Performed during the Third Five-Year Review Period (2003-2008)

Components of the RA completed during the Third Five-Year Review included:

- The Brio North cover system,
- Mud Gully improvements,
- Groundwater control systems, and
- Recordation of deed restrictions and notices.

Cover System (Brio North)

The Brio North cover system was constructed from December 2001 to October 2003. As with the Brio South cover system, the Brio North cover system components are as follows:

- Bedding Layer (varies in thickness)
- Gas Collection Layer, and a FML,
- Compacted Clay Layer (eighteen in.), and
- Vegetative cover

The Brio North cover system comprises approximately 50.5 acs, and was constructed to the limits of the of the soil bentonite barrier wall on the east and north sides, to the Dixie Farm Road right-of-way on the south side, and to the sheet pile barrier wall on the west side. As is visible on Figure 2 in Attachment 1, the Brio North cover system was designed with three compartments to provide for control of surface runoff and to facilitate gas collection. Prior to

placement of the FML, one gas collection trench was excavated in the bedding layer of each compartment.

Mud Gully Improvements

Under the jurisdiction of the Harris County Flood Control District, construction of Mud Gully improvements was performed from June 2002 to June 2003. The affected area of Mud Gully comprises a length of approximately 1,160 ft. between Brio North and DOP North. The construction activity consisted of:

- Clearing of trees and brushes along and within the improvement area,
- Reshaping channel surface to design elevation,
- Installing new drainage pipes, abandoning and retrofitting existing drainage pipes,
- Installing articulated concrete block,
- Restoring the DOP North property to its pre-construction condition, and
- Placing top soil layer and vegetative cover.

EPA provided oversight of the construction. An interim completion report was issued by the BSTF that provided the construction quality assurance documentation. The interim report was incorporated by reference into the Remedial Action Completion Report dated December 16, 2004.

Groundwater Control Systems

Construction on the groundwater control system began in February 2001 and was completed in February 2004. The Groundwater Control System, also referred to as the Groundwater/ DNAPL Recovery System, utilizes a pumping system to maintain an inward hydraulic gradient within the Brio Site barrier wall using wells within the NSCZ. Components of the recovery system include:

- A system of seventeen (17) groundwater recovery wells on the Brio North and Brio South Sites,
- A system of thirteen (13) DNAPL recovery wells on Brio North,
- Hub facilities to provide air pressure for the recovery well pumps and to separate groundwater, DNAPL, and light non-aqueous phase liquid (LNAPL).
- Pipeline system for the recovery and transfer of collected water to the treatment facility, and
- Vegetative cover.

Institutional Controls

Dated February 2, 2006, the ICP for the Brio Refining Superfund Site provides for institutional controls to reduce the risk to public health and the environment from potential hazards posed by the Site. The ICP was incorporated into the Maintenance, Operations, and Monitoring Plan (MOM) as Revision 2 in April 2006. The plan implementation tasks are listed as recordation of institutional control documents and monitoring of Site security.

Deed restrictions and notices have been filed at the Harris County Clerk's Office for the Site. During this review period, certified copies of each of the deed restriction and notices were obtained from the Harris County Clerk's Office. The certified copies are maintained at the Brio Site office.

Site personnel inspect the perimeter fencing, gates, and locks on a weekly basis, at a minimum, to evaluate compliance with institutional control documents.

Operations and Maintenance

The BSTF operates an on-Site groundwater treatment plant to treat recovered NSCZ groundwater. The groundwater is treated in batches, held pending laboratory analysis for discharge parameters, and then discharged after confirmation that the discharge criteria have not been exceeded. Discharge criteria are listed in Attachment 3. The treatment plant is staffed with two operators and one maintenance worker.

At the treatment plant, groundwater produced from the groundwater and DNAPL recovery wells is collected in Tank T-212 prior to treatment. The water treatment consists of pre-filtering, air stripping and final polishing using carbon filters. The treated groundwater is held in Tanks T-213A, -B, or –C, tested prior to disposal, and then the treated water is discharged to Mud Gully via an on-Site ditch or to the cover system to support the cover system vegetation. Exhaust gases produced from the air stripping process are passed through a resin filter system or activated carbon beds to scrub the gases of volatile components prior to release. Two parallel units of resin filters are available to permit regeneration of one unit while the other unit is in use and thus eliminate down time. The use of a resin bed system was discontinued in 2011 due to the unavailability of replacement parts for the system. The activated carbon bed system continues to provide pollution control for the water treatment system.

Annual treated groundwater discharge volumes (in gallons) for the Fourth Five-Year Review period were:

- 2008 - 3,358,036
- 2009 - 2,793,840
- 2010 - 3,317,004
- 2011 - 3,245,339
- 2012 - 2,647,575

Total for Review Period - 15,361,794 gals

Over 32-million gals of groundwater has been recovered and treated (1993 to 2012).

Starting in 2009, the BSTF increased groundwater pumping from the NSCZ in the Pit J

plume area to increase an existing upward hydraulic gradient between the NSCZ and FFSZ. This measure was performed to mitigate potential vertical constituent migration from the NSCZ plume to the FFSZ groundwater.

DNAPL and LNAPL collected from recovery system separators are collected in Tank T-218 at the treatment plant. When sufficient volumes are collected in T-218, the tank is emptied using a commercial tanker to transport the liquids to an approved disposal facility. DNAPL and LNAPL shipment volumes (in gallons) for the Fourth Five-Year Review period were:

- 2008 - 17,100
- 2009 - 14,970
- 2010 - 15,068
- 2011 - 11,374
- 2012 - 8,284

Total for Review Period - 66,796 gals

The cumulative volume of DNAPL and LNAPL (1993 to 2012) shipped from the Brio Site for disposal is approximately 230,820 gals.

As part of the cover system, the gas collection system is designed to intercept volatile emissions from the buried waste material. Each compartment has a gas collection layer that funnels intercepted gas to a surface vent. Each compartment vent connects to two carbon canisters in series. On a weekly basis, the canisters are monitored for gas emission break through. If break through levels are detected, then the leading canister is replaced with the end canister and a new canister is added as the end canister in the treatment series.

A review of gas collection canister data for the Fourth Five-Year Review period indicates that total annual canister replacement ranged from no replacements to four replacements. Certain canisters were replaced during this period because of rust deterioration of the canister and not due to gas emission break through.

During the 2008-2009 time period, a fire protection system was installed for Tank T-218. A registered fire protection engineer designed and oversaw the installation of the fire protection system. The system is comprised of an automatic tank foam suppression unit to address fire and/or fumes. A fire protection contractor inspects the system quarterly.

In February 2004, an operations and maintenance plan, designated the MOM Plan, was developed by the BSTF. The MOM Plan addresses inspection, maintenance, operations, and monitoring activities at the Site. The MOM Plan also contains listings of requirements for the Annual Effectiveness Report (AER) in Section 6.0. Section 7.0 of the MOM Plan incorporates by reference the Worker Health and Safety Plan, the Spill and Volatile Emissions Release Contingency Emergency Notification Plan, and the Community Relations Plan for the site. While the Community Relations Plan is included as an appendix to the MOM Plan, the other two plans are separate documents.

The MOM Plan, last updated as Revision 4 dated January 2011, added Appendix J for a Groundwater Recovery Performance Goal. Revision 1, dated December 2004, incorporated a new standard operating procedure (SOP) in Appendix C for Secondary Containment Fluid

Handling (SOP-10). Dated April 2006, Revision 2 added Appendix I containing an ICP. Revision 3, dated September 2006, added the Long-Term Gas Collection System Operations Plan.

The criteria used to evaluate treated water discharge, air, surface water, and groundwater monitoring are summarized from the MOM Plan and presented in Attachment 3.

Operating costs, presented in the table below, represent all expenditures at the Site during the Fourth Quarter Review period. The high cost incurred in 2010 and 2011 was largely due to the Phase 1 FFSZ groundwater investigation. The high cost incurred in 2012 was the result of: i) defending a Natural Resources Damages Assessment (NRDA) property conservation easement from a proposed pipeline project, and ii) the rebuilding of two T-213 discharge holding tanks.

Table 2 - Annual System Operations/O&M Costs

Dates		Total Annual Cost
From	To	
1/1/2008	12/31/2008	$757k
1/1/2009	12/31/2009	$833k
1/1/2010	12/31/2010	$1.6 M
1/1/2011	12/31/2011	$1.1 M
1/1/2012	12/31/2012	$1.3M

V. Progress since the Last Five-Year Review

This section reviews the protectiveness statement and issues and recommendations from the last five-year review (i.e., the third five-year review for the Brio Site). The status of the recommendations made in that report are also reviewed and discussed.

Protectiveness Statement from the Last Review

"Since the Second Five-Year Review, the EPA and TCEQ 'conducted a final inspection on April 20, 2006 and determined that the remedial action had been successfully executed' (Final Close Out Report, December 25, 2006). Installation of the remedial alternative has been completed. The action has removed exposure pathways that could have resulted in unacceptable risks by preventing exposure of human receptor populations to contaminated soils or groundwater. The implemented actions are functioning as intended and remain protective of human health and the environment.

Long-term protectiveness of the remedial action will be verified by continuing to monitor air, groundwater, and surface water to assess the effectiveness of the Site controls."

Status of Recommendations

The previous five-year review report stated that the remedy continues to be protective for the short and long-term. One issue was identified potentially requiring further evaluation. A summary of this issue and the actions taken at the Brio Site since the previous five-year review are given below:

Issue- "Increasing trend of contaminants in FFSZ. Detections reported from October 2006 and 2007 in wells BMW-3B and BMW-18B represent too few data points at the current time to determine if a trend exists. As required by the ROD two consecutive detections above the applicable MCL will trigger the generation of a report within 60 days. The report will evaluate the likely cause for the presence of the compound and propose relevant response actions. Since the MCL for 1,2-DCA of 5 ug/l was exceeded in BMW-3B (5.7 ug/l) in October 2007, the next result from this well will determine whether a report will be necessary".

Action- Groundwater monitoring at wells BMW-3B and BMW-18B was conducted on a more frequent basis beginning in May 2008 (i.e., several times annually instead of once annually). The BSTF prepared an FFSZ groundwater investigation work plan, dated October 8, 2009, implemented the investigation in 2010, and provided the findings in a report dated January 14, 2011. A summary of the FFSZ investigation and results are discussed in Section VI below under Data Review.

VI. Five-Year Review Process

Administrative Components

The BSTF and the TCEQ were notified of the initiation of the five-year review on October 24, 2012. The Fourth Five-Year Review team was led by Gary Miller of the EPA, Remedial Project Manager (RPM) for the Brio Site, with the assistance of the BSTF.

Community Involvement

A notice was published in the Houston Chronicle and South Belt-Ellington Leader newspapers on November 15, 2012, stating that a five-year review was to be conducted for the Brio Refining Site. At the time of this report, no correspondence has been received by the EPA as a result of these published notices.

Document Review

This five-year review included a review of relevant documents. See Attachment 2 for documents reviewed for this report.

Data Review

The data review focused on an evaluation of the current groundwater, surface water, gas collection, and air monitoring data collected during this five-year review period. The sampling was conducted as outlined in the MOM Plan. Groundwater, DNAPL, cover gas collection, and surface water data contained in the submitted AERs (Fourth, Fifth and Sixth AERs) for the period April 2007 to March 2010 were reviewed for this evaluation. More current data (April 2010 to December 2012) was provided by the BSTF to supplement the reports.

NSCZ Gradient Evaluation

A review of the NSCZ gradient control data indicates that the performance standard is being

met. The ROD requires that "an inward gradient shall be maintained within the barrier wall in areas of plume concentration." To monitor gradient control, piezometers have been installed in the NSCZ in eight (8) arrays parallel to the desired gradient direction as shown on Figures 4 and 5 in Attachment 1. To evaluate the gradient control performance of the groundwater recovery system, the gradient maps in the AERs and supplemental data were reviewed. The results are presented on Figure 6 of Attachment 1. As the figure indicates, gradient control was generally maintained throughout this review period. Periodic maintenance of the groundwater/DNAPL recovery system accounts for a small number of events when one or more arrays showed an outward gradient.

It should also be noted that the NSCZ groundwater plumes are contained by a subsurface soil-bentonite and sheet pile barrier wall that surrounds the Brio Site.

FFSZ Groundwater Evaluation

The FFSZ groundwater quality beneath the Site is monitored at five locations, as shown in Figure 7 in Attachment 1. Groundwater quality at four of these wells remained within compliance levels. However, analysis of groundwater samples collected from monitoring well BMW-3B resulted in the detection of concentrations above compliance levels for Site constituents (1,2-DCA and vinyl chloride) during this review period (see Figure 8 in Attachment 1). In accordance with the MOM Plan requirements, a FFSZ groundwater investigation work plan (action plan), dated October 8, 2009, was prepared. This on-Site investigation was initiated in February 2010 and finalized with a report dated January 14, 2011. Seventeen borings/temporary sampling points were advanced and sampled at locations shown in Figure 9 in Attachment 1. Analysis of samples collected from 6 of the 17 borings/temporary sampling points resulted in the detection of Site constituents in the FFSZ groundwater above compliance levels as shown in Figure 9.

The Phase 1 report recommended a Phase 2 groundwater investigation to assess the potential off-Site presence of Brio Site constituents. The Phase 1 investigation collected monitored natural attenuation (MNA) data and tentatively concluded that MNA is a reasonable response measure for affected groundwater within the FFSZ. Other options will also be evaluated to address the groundwater within the FFSZ. The Phase 2 investigation will include a more comprehensive MNA evaluation to support the Phase 1 findings. In addition, the Phase 2 work will include the installation of a permanent FFSZ monitoring well cluster for long-term water quality monitoring.

The Phase 2 work is scheduled to be conducted during the next review period. Access agreements are currently being negotiated.

Since February 2009, enhanced NSCZ DNAPL and groundwater recovery has created a significant upward hydraulic gradient between the FFSZ and the NSCZ, thus minimizing the potential for downward migration of Site constituents from the NSCZ to the FFSZ. In December 2010, the MOM Plan was modified to include a criteria of seven to ten ft. of upward hydraulic head differential between the FFSZ and the NSCZ.

An area-wide well inventory survey was commissioned by the Brio Site to assess the potential for affected FFSZ groundwater to reach off-Site FFSZ wells. The results of the survey

indicated that there were no registered FFSZ wells located downgradient within 0.5 miles of the Brio Site. The RI/FS reported that FFSZ groundwater moves eastwardly at rates of approximately 10 to 50 ft. per year. For informational purposes, the local community's drinking water is served by a municipal utility district that gets water in part or whole from deep water wells (i.e., several hundred ft. or more below the FFSZ) located several miles upgradient of the Site.

Surface Water Evaluation

A review of the quarterly surface water data concluded that the performance standards for Mud Gully and Clear Creek were met during this five-year review period. Graphs of those results are shown in Figures 10 through 13 of Attachment 1.

Air Monitoring Evaluation

A review of the semi-annual Site-wide air data generated by the fence line air monitoring network indicates that compliance to the performance standard was met during this five-year review period.

Compartmental Cover Gas Collection/Treatment Evaluation

A review of the gas collection/treatment data indicates that treatment carbon canisters were replaced whenever break through levels were detected or when canisters showed signs of rust deterioration. Several canister replacements per year were typical for this review period.

Site Inspection

A Site inspection was conducted on December 13, 2012, to acquaint the participants with current Site conditions. Site visit participants included Gary Miller (EPA, Region 6), Fay Duke (TCEQ, Austin), Sherell Heidt (TCEQ, Region 12), Matthew Foresman (BSTF Site Coordinator), John Danna (BSTF Site Manager), Lawrence Engle (BSTF), Paul Clark (BSTF), Roger Pokluda (GSI Environmental), Stephanie Phillips (Celanese), and Brad Weaver (Celanese). The Site inspection checklist completed during the Site inspection is included as Attachment 4. Photo documentation of the visit is included in Attachment 5.

Overall, the team noted that the Site appeared to be well maintained with no apparent maintenance or operational problems.

Applicable or Relevant and Appropriate Requirements Review

A review of applicable or relevant and appropriate requirements (ARARs) was conducted and the results are presented in Attachment 6.

Interviews

Interviews were conducted with key citizens who have the possibility of being impacted by the Brio Site. Mrs. Marie Flickinger is an area resident, the publisher of the local newspaper, Chairperson for the Brio Site Community Advisory Group, and sits on the Board of Trustees for the nearby community college. Mr. Chris Clark is the general manager of the Clear Brook City Municipal Utility District, which provides water, sewer, garbage, parks, police, emergency medical services, and fire protection to the residents near the Brio Site. Ms. Fay Duke is the TCEQ representative with responsibility for this Site. Details of these interviews are provided in Attachment 7. No major issues regarding the Site were identified during the interviews.

VII. Technical Assessment

Question A: Is the remedy functioning as intended by the decision documents?

The review of documents, sampling results, ARARs, risk assumptions, and the results of the Site inspection indicate that the remedy is functioning as intended by the amended ROD. Following the implementation of the remedy, all measures appear to be functioning as designed to control affected NSCZ groundwater gradients, treated groundwater discharges, and air emissions.

Maintenance activities (i.e., groundwater and LNAPL/DNAPL recovery, monitoring of the slurry wall and sheet piles; soil cover, vegetation, and Site perimeter, and cap mowing) will maintain the effectiveness of the remedy.

Monitoring activities are being conducted and are adequate to determine the protectiveness and effectiveness of the remedy. The monitoring program may be modified at any time to assess new protectiveness issues; for example, the monitoring frequency at the affected FFSZ well was increased in response to sampling data. Laboratory analytical methods were previously changed to lower the detection and quantification limits of constituents of interest.

The proper filing of deed restrictions and notices was verified at the Harris County Clerk's Office. Certified copies are maintained at the Brio Site office as part of the ICP. Perimeter fencing, signage, and appropriate locked gates continue to provide Site control measures.

Question B: Are the exposure assumptions, toxicity data, cleanup levels, and remedial action objectives (RAOs) used at the time of the remedy selection still valid?

Since the development of the exposure assumptions, the area surrounding the Brio Site has changed dramatically. At the time of the RI, the Southbend Subdivision was located immediately adjacent to the north portion of the Site. The subdivision has since been abandoned and demolished, substantially reducing the potential receptors. However, a new subdivision named College Place was developed approximately .1 miles northeast of the Site. The new subdivision is located crosswind from the Site based on the prevailing wind direction in the area.

The cleanup levels used to establish the extent of the remedy are still valid.

Question C: Has any other information come to light that could call into question the protectiveness of the remedy?

During this review period, affected groundwater was detected at one of the five FFSZ on-Site monitoring wells. A Phase 1 work plan was prepared and implemented from February 2010 to January 2011. While affected FFSZ groundwater was detected at 6 of the 17 borings/temporary sampling points, it was also concluded that MNA may be a suitable remedy. A Phase 2 FFSZ investigation will be conducted in the next five-year review period and will assess the potential off-Site presence of Site constituents and the effectiveness of MNA, as a response measure, in the affected FFSZ areas.

Technical Assessment Summary

According to the data reviewed, the Site inspection, and the interviews, the remedy is functioning as intended by the amended ROD. There have been no changes in the physical conditions of the Site that would affect the current protectiveness of the remedy. The affected FFSZ groundwater issue is currently under evaluation.

VIII. Issues

Table 3 - Issues

Issue	Currently Affects Protectiveness (Y/N)	Affects Future Protectiveness (Y/N)
Affected FFSZ groundwater	N	Potential Issue
Minor cover soil repair	N	N
South plume operational performance monitoring	N	N
Unused South plume monitoring well abandonment	N	N

IX. Recommendations and Follow-Up Actions

Table 4 - Recommendations and Follow-Up Actions

Issue	Recommendations/ Follow-up Actions	Party Responsible	Oversight Agency	Milestone Date	Affects Protectiveness? (Y/N)	
					Current	Future
Affected FFSZ Groundwater: Well BMW-3B 1,2-dichloroethane and vinyl chloride above MCLs. Well BMW-18B drinking water volatile detections below MCLs.	(1) Conduct an off-Site FFSZ groundwater delineation investigation, (2) Assess monitored natural attenuation (MNA)) and other options as potential response measures for Site constituents in the FFSZ, (3) Investigate existence of FFSZ wells located east of the Brio Site, (4) Continue with increased pumping rates at the Pit J-NSCZ groundwater recovery system to maintain upward gradient per Maintenance, Operations and Monitoring (MOM)-specified goals, and (5) sample wells BMW-3B and BMW-18B and analyze for drinking water volatiles quarterly until EPA approves a return to annual sampling.	BSTF	EPA	12/31/2013	N	Potential Issue
Cover soil repair	Import clay soil and repair cover to design specifications.	BSTF	EPA	12/31/2013	N	N
South plume operational performance monitoring	Prepare a work plan specifying the objectives and scope of work.	BSTF	EPA	9/31/2013	N	N

South plume monitoring well abandonment	Prepare a work plan for plugging and abandonment of obsolete south plume monitoring wells.	BSTF	EPA	9/31/2013	N	N

X. Protectiveness Statement(s)

As part of the Fourth Five-Year Review, the EPA and TCEQ conducted an inspection on December 13, 2012, and determined that the implemented RA is protective of human health and the environment in the short-term. The remedial action has removed exposure pathways that could have resulted in unacceptable risks by preventing exposure of human receptor populations to contaminated air, soils, and groundwater.

Long-term protectiveness of the RA will be achieved by continued monitoring of air, groundwater, and surface water to assess the effectiveness of the Site controls. The affected FFSZ groundwater is currently an issue under investigation and will be evaluated during the next five-year review period.

XI. Next Review

The next five-year review for the Brio Refining Superfund Site is required five years from the date of signing this review.

ATTACHMENT 1

Figures

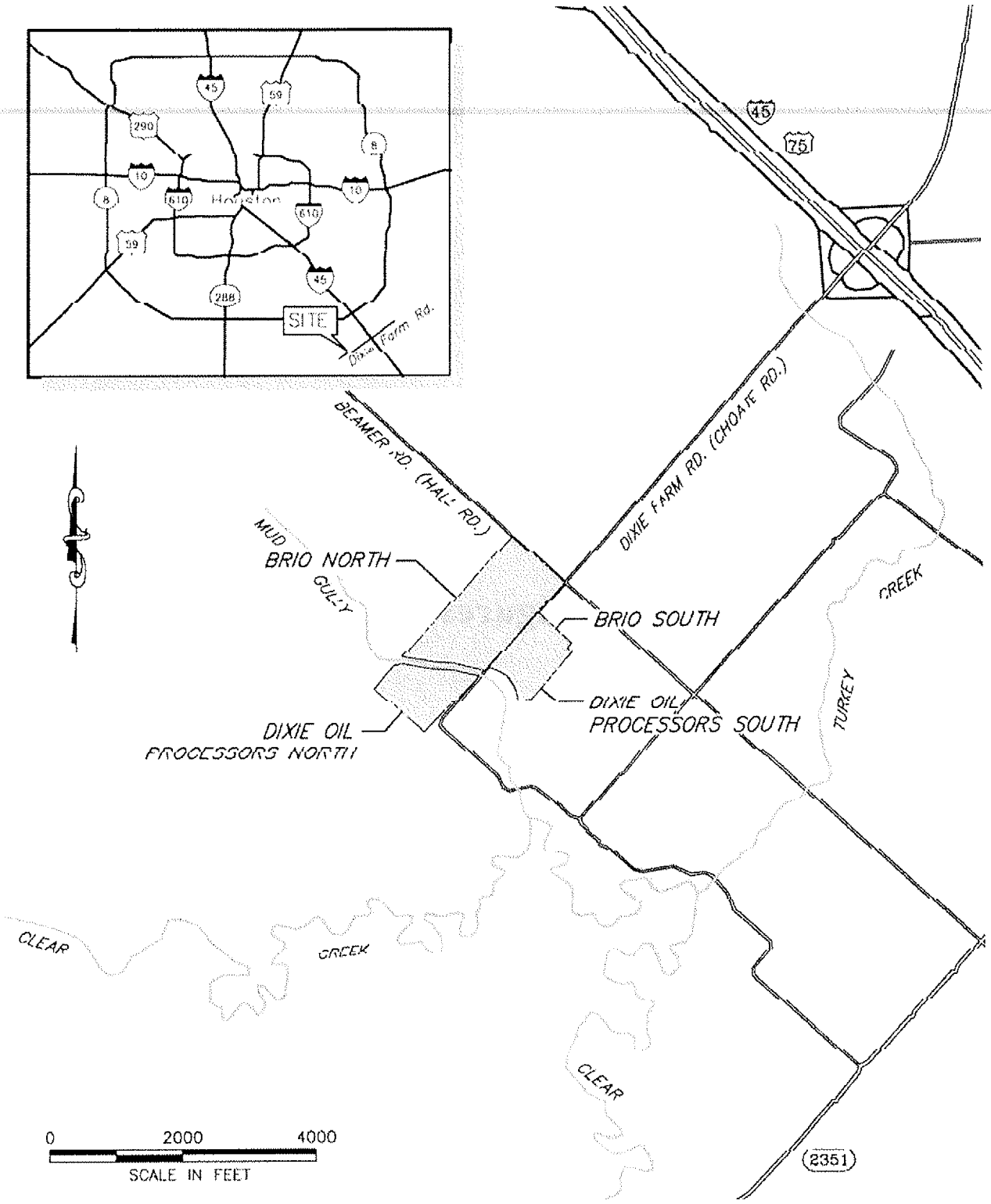


Figure 1
Site Location

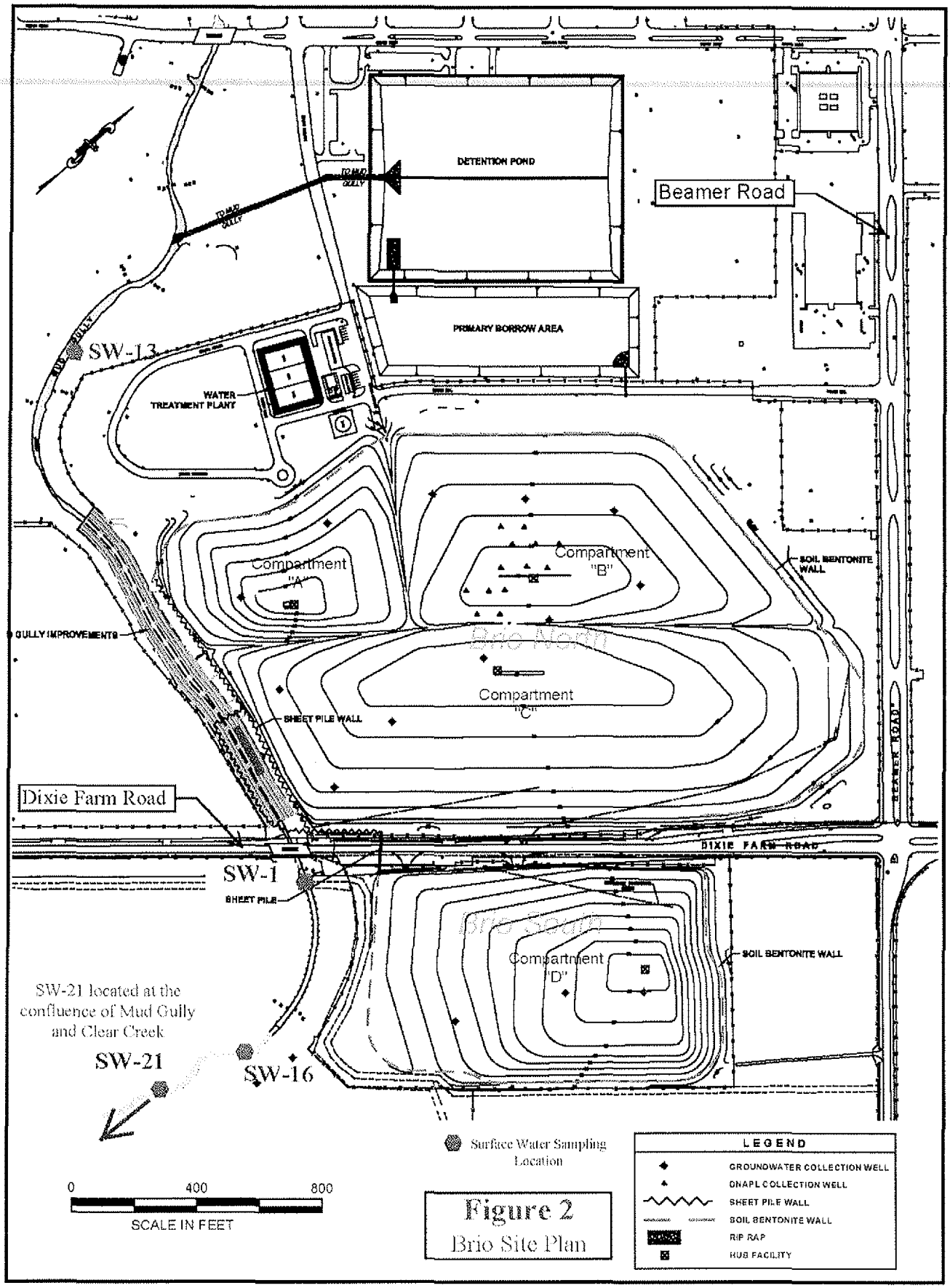
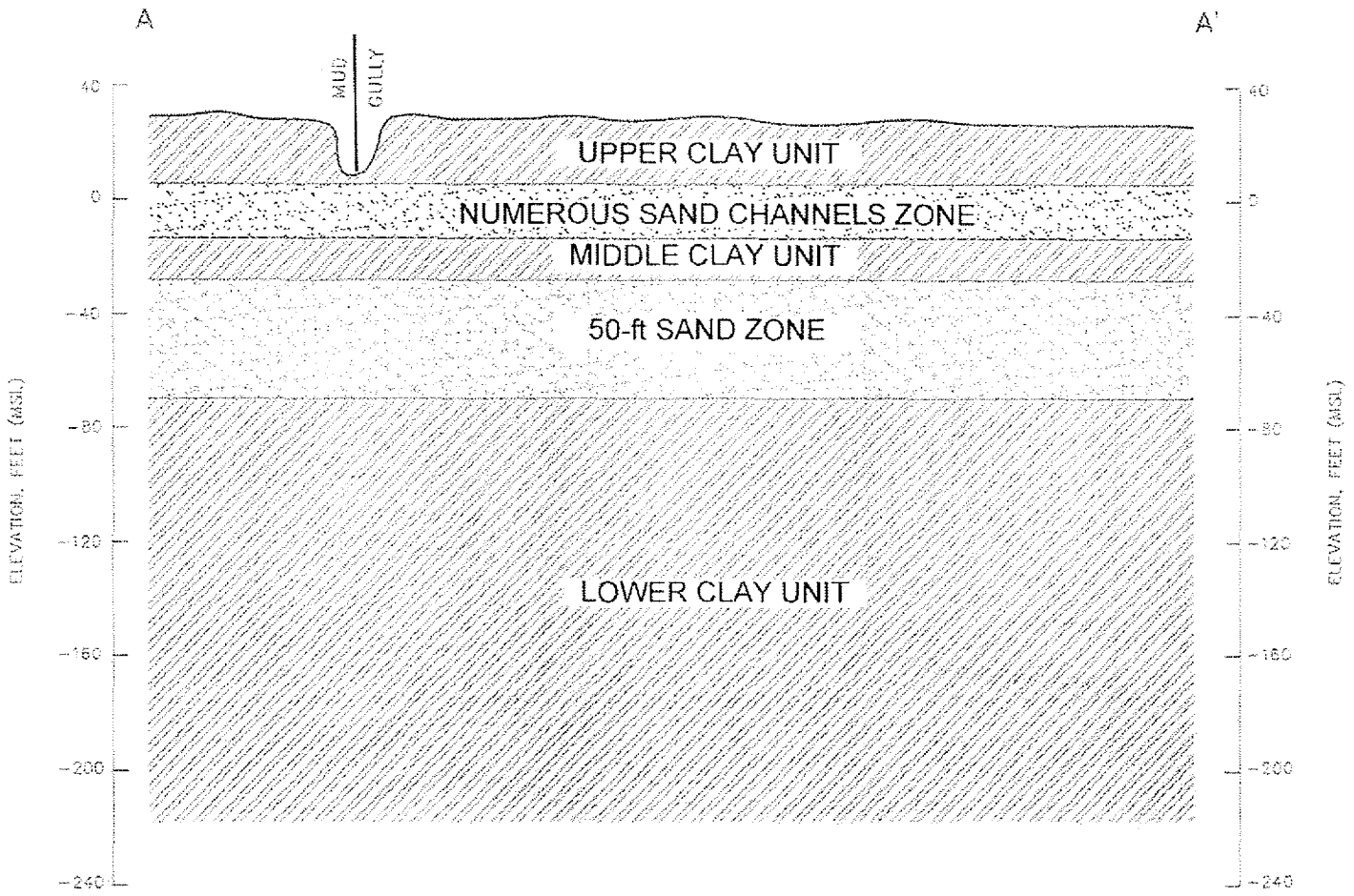


Figure 2
Brio Site Plan

FIGURE 3
GEOLOGIC CROSS-SECTION



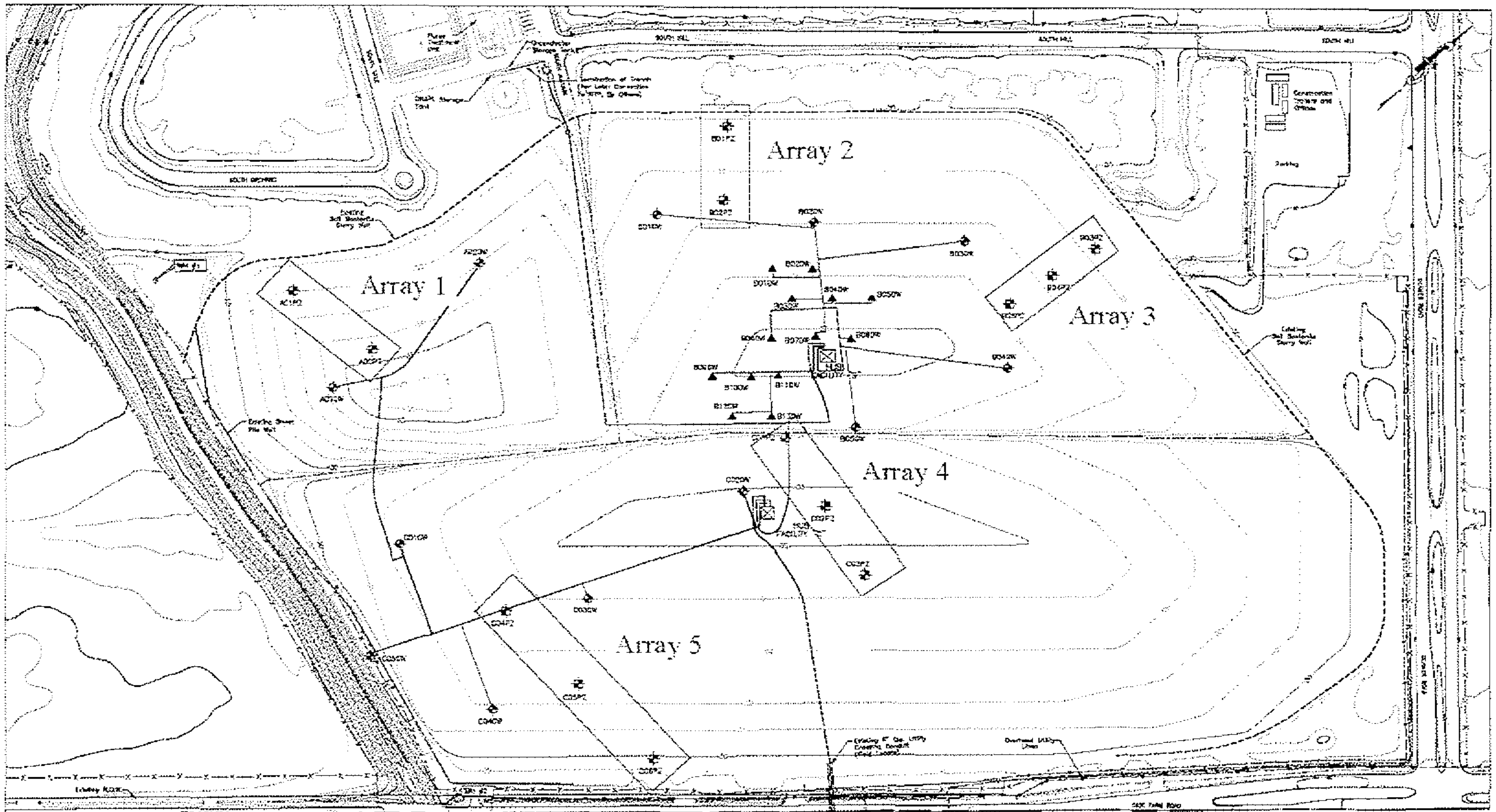
USGS RESPONSE PROJECT

Woodward-Clyde Consultants
Engineering & Sciences applied to the earth & its environment
Houston, Texas

BRIO SITE TASK FORCE
HOUSTON, TEXAS

SCALE	DRAWN BY SJ	10/07/93	FILE NO.
NOTED	CHECKED BY	DATE	9213.10

GENERALIZED GEOLOGIC CROSS-SECTION A-A'



MATCH LINE (CENTERLINE DIXIE FARM ROAD) SEE SHEET P4-04

NOTES

1. SEE DRAWING P4-01 FOR TEMPORARY BENCHMARK (TBM) DESCRIPTIONS.
2. WELL AND PIEZOMETER INSTALLATION WILL TAKE PLACE BETWEEN THE ROUGH GRADING AND FINAL GRADING PHASES OF THE COVER CONSTRUCTION (BY OTHERS). WELL COMPLETION, PIPING RUNS AND HUB FACILITY CONSTRUCTION WILL OCCUR AFTER COVER PLACEMENT.
3. GROUND SURFACE CONTOURS REFLECT THE ROUGH GRADING ELEVATIONS AT THE TIME OF WELL INSTALLATION. GEOSYNTHETIC MATERIAL AND FINAL GRADING SOILS WILL BE PLACED (BY OTHERS) PRIOR TO TRENCHING AND PIPING INSTALLATION.
4. COLLECTION/TRANSFER TRENCHES SHOWN REPRESENT THE GENERAL ALIGNMENT RELATED TO THE WELLS, HUB FACILITIES AND THE WTP PLANT. DETAILED TRENCH PIPING IS INCLUDED ON DRAWINGS P4-10 TO P4-15.
5. DRILL CUTTINGS SHALL BE COLLECTED AND STABILIZED WITH FLYASH OR PORTLAND CEMENT UNTIL A FIRM TO STIFF CONSISTENCY IS REACHED. THE BSTF WILL IDENTIFY ONSITE STOCKPILE AREAS (WITHIN THE VERTICAL BARRIER WALL) FOR PLACEMENT OF STABILIZED DRILL CUTTINGS.
6. CAP WELLS AT COMPLETION OF INSTALLATION AND WELL DEVELOPMENT ACTIVITIES. WELLS SHALL REMAIN CAPPED UNTIL COLLECTION PUMPS ARE INSTALLED.

LEGEND

- ELEVATION CONTOUR
- DEPRESSION
- FENCE
- EASEMENTS
- EXISTING SOIL BENTONITE SLURRY WALL
- EXISTING SHEET PILE WALL
- OVERHEAD UTILITY LINES
- SWBT FIBER TRANSMISSION LINE
- WATER LINE
- COLLECTION/TRANSFER PIPING TRENCH
- UNDERGROUND CONDUIT
- STRUCTURES
- PIEZOMETERS
- GROUNDWATER COLLECTION WELLS
- DNAPL COLLECTION WELLS
- HUB FACILITY

HUB A

ID No.	DESCRIPTION	COORDINATES	
		NORTHING	EASTING
HUB A	NOT INSTALLED	---	---
HUB A	NOT INSTALLED	---	---
A01GW	GW WELL	651,153.28	3,206,457.53
A02GW	GW WELL	651,518.18	3,206,466.45
A01PZ	PIEZOMETER	651,318.71	3,206,268.65
A02PZ	PIEZOMETER	651,257.20	3,206,453.85

HUB B

ID No.	DESCRIPTION	COORDINATES	
		NORTHING	EASTING
HUB B	NE CORNER OF BLDG	651,911.25	3,207,040.21
HUB B	SW CORNER OF BLDG	651,874.41	3,207,038.55
B01GW	GW WELL	651,831.75	3,206,623.47
B02GW	GW WELL	652,043.95	3,206,833.31
B03GW	GW WELL	650,230.89	3,207,051.28
B04GW	GW WELL	652,131.80	3,207,293.10
B05GW	GW WELL	651,841.38	3,207,175.51
B01PZ	PIEZOMETER	652,044.26	3,206,897.20
B02PZ	PIEZOMETER	651,944.23	3,206,697.34
B03PZ	PIEZOMETER	652,405.69	3,207,227.16
B04PZ	PIEZOMETER	652,312.10	3,207,209.84
B05PZ	PIEZOMETER	652,216.25	3,207,196.10
B01DW	DNAPL WELL	651,925.14	3,206,846.78
B02DW	DNAPL WELL	651,950.67	3,206,895.20

HUB B(CONT'D)

ID No.	DESCRIPTION	COORDINATES	
		NORTHING	EASTING
B03DW	DNAPL WELL	651914.30	3206913.26
B04DW	DNAPL WELL	651971.20	3206963.25
B05DW	DNAPL WELL	652027.43	3207013.38
B06DW	DNAPL WELL	651836.83	3206942.91
B07DW	DNAPL WELL	651901.42	3206997.58
B08DW	DNAPL WELL	651947.37	3207043.15
B09DW	DNAPL WELL	651704.50	3206942.32
B10DW	DNAPL WELL	651756.35	3206974.10
B11DW	DNAPL WELL	651798.24	3207005.81
B12DW	DNAPL WELL	651661.51	3207006.14
B13DW	DNAPL WELL	651736.50	3207054.41

HUB C

ID No.	DESCRIPTION	COORDINATES	
		NORTHING	EASTING
HUB C	NE CORNER OF BLDG	651,625.34	3,207,163.13
HUB C	SW CORNER OF BLDG	651,592.46	3,207,165.13
C01GW	GW WELL	651,249.19	3,206,761.55
C02GW	GW WELL	651,852.47	3,207,123.65
C03GW	GW WELL	651,245.34	3,207,050.29
C04GW	GW WELL	650,570.09	3,207,114.35
C05GW	GW WELL	650,865.13	3,206,890.82
C01PZ	PIEZOMETER	651,729.17	3,207,101.85
C02PZ	PIEZOMETER	651,699.00	3,207,246.01
C03PZ	PIEZOMETER	651,686.82	3,207,384.33
C04PZ	PIEZOMETER	651,114.30	3,206,952.15
C05PZ	PIEZOMETER	651,123.48	3,207,157.37
C06PZ	PIEZOMETER	651,133.76	3,207,356.94

* EXISTING WELL ALIGNMENT OF COLLECTION PIPING TO BE FIELD DETERMINED.

REV	DESCRIPTION OF REVISION	BY	DATE
	AS-BUILT	DH	08/26/04
	AS-BUILT	DH	05/19/04
	ISSUED FOR BID	SAB	05/30/01
	FOR CPA REVIEW	TEP	10/20/00

BRIO SITE TASK FORCE

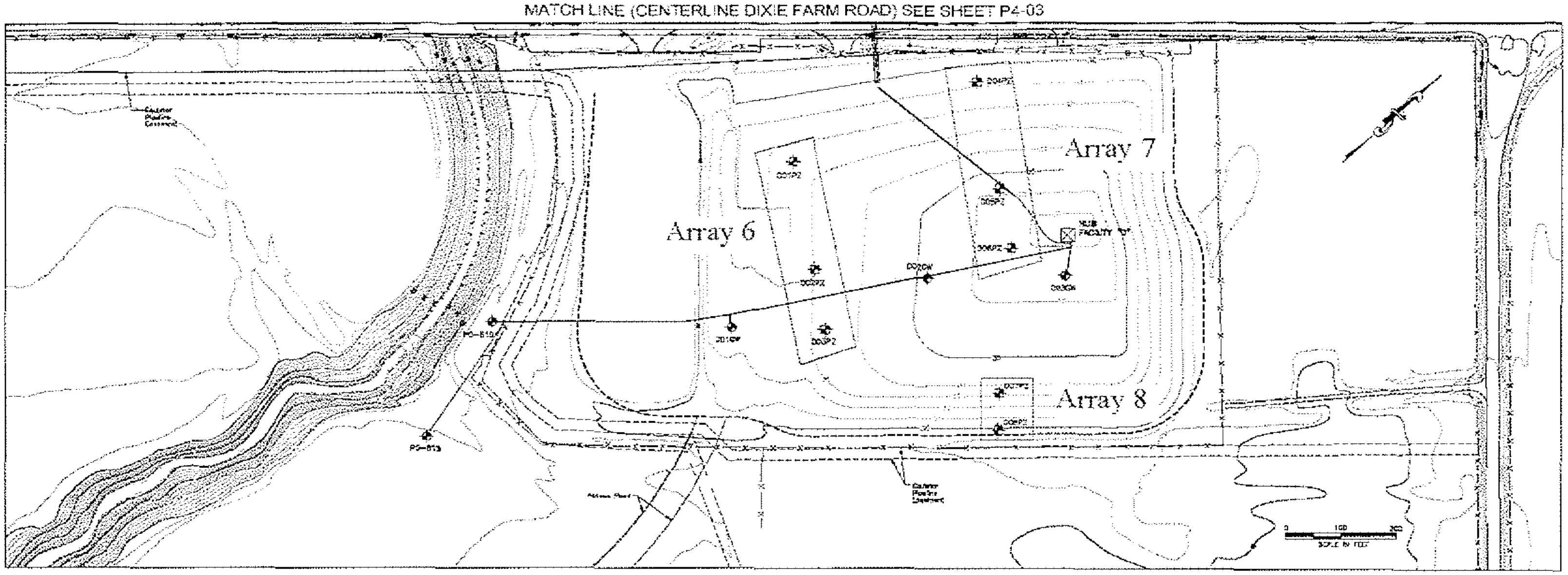
2501 DIXIE FARM ROAD
HOUSTON, TEXAS 77089

Brio North
Groundwater, DNAPL and
Piezometer Locations

Figure 4

SHEET 4 OF 22

MATCH LINE (CENTERLINE DIXIE FARM ROAD) SEE SHEET P4-03



HUB D			
ID No.	DESCRIPTION	COORDINATES	
		NORTHING	EASTING
HUB D	NE CORNER OF BLDG	651,240.73	3,208,210.35
HUB D	SW CORNER OF BLDG	651,326.85	3,208,212.35
001GW	GW WELL	650,758.74	3,207,530.21
002GW	GW WELL	651,062.25	3,208,206.50
003GW	GW WELL	651,271.12	3,208,252.94
001PZ	PIEZOMETER	651,044.36	3,207,760.60
002PZ	PIEZOMETER	650,940.74	3,207,951.88
003PZ	PIEZOMETER	650,862.65	3,208,048.04
004PZ	PIEZOMETER	651,337.04	3,207,862.07
005PZ	PIEZOMETER	651,287.71	3,208,066.40
006PZ	PIEZOMETER	651,251.57	3,208,160.82
007PZ	PIEZOMETER	651,040.22	3,208,341.90
008PZ	PIEZOMETER	650,993.72	3,208,396.65

NOTES

1. SEE DRAWING P4-01 FOR TEMPORARY BENCHMARK (TBM) DESCRIPTIONS.
2. WELL AND PIEZOMETER INSTALLATION WILL TAKE PL BETWEEN THE ROUGH GRADING AND FINAL GRADING PHASES OF THE COVER CONSTRUCTION (BY OTHERS WELL COMPLETION, PIPING RUNS AND HUB FACILITY CONSTRUCTION WILL OCCUR AFTER COVER PLACEME
3. GROUND SURFACE CONTOURS REFLECT THE ROUGH GRADING ELEVATIONS AT THE TIME OF WELL INSTALLATION. GEOSYNTHETIC MATERIAL AND FINAL GRADING SOILS WILL BE PLACED (BY OTHERS) PRIO TO TRENCHING AND PIPING INSTALLATION.
4. COLLECTION/TRANSFER TRENCHES SHOWN REPRESENT THE GENERAL ALIGNMENT RELATED TO T WELLS, HUB FACILITIES AND THE WTP PLANT. DETAI TRENCH PIPING IS INCLUDED ON DRAWING P4-15.
5. DRILL CUTTINGS SHALL BE COLLECTED AND STABILIZ WITH FLYASH OR PORTLAND CEMENT UNTIL A FIRM STIFF CONSISTENCY IS REACHED. THE BSTF WILL IDENTIFY ONSITE STOCKPILE AREAS (WITHIN THE VER BARRIER WALL) FOR PLACEMENT OF STABILIZED DRI CUTTINGS.
6. CAP WELLS AT COMPLETION OF INSTALLATION AND DEVELOPMENT ACTIVITIES. WELLS SHALL REMAIN CAP UNTIL COLLECTION PUMPS ARE INSTALLED.

LEGEND

- ELEVATION CONTOUR
- DEPRESSION
- FENCE
- EASEMENTS
- EXISTING SOIL BENTONITE SLURRY
- EXISTING SHEET PILE WALL
- OVERHEAD UTILITY LINES
- SWBT FIBER TRANSMISSION LINE
- WATER LINE
- COLLECTION/TRANSFER PIPING TREN
- UNDERGROUND CONDUIT
- STRUCTURES
- PIEZOMETERS
- GROUNDWATER COLLECTION WELLS
- HUB FACILITY

REV	DESCRIPTION OF REVISION	BY	DATE
4	AS-BUILT		
3	AS-BUILT		
2	ISSUED FOR BID	TAB	
1	FOR QA REVIEW	TEF	

BRIO SITE TASK FORCE
2501 DIXIE FARM ROAD
HOUSTON, TEXAS

Brio South
Groundwater, DNAPL and
Piezometer Locations

IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE

Figure 5

P4-04
SHEET 5 OF

Figure 6
Number of Piezometer Arrays with Inward Gradients

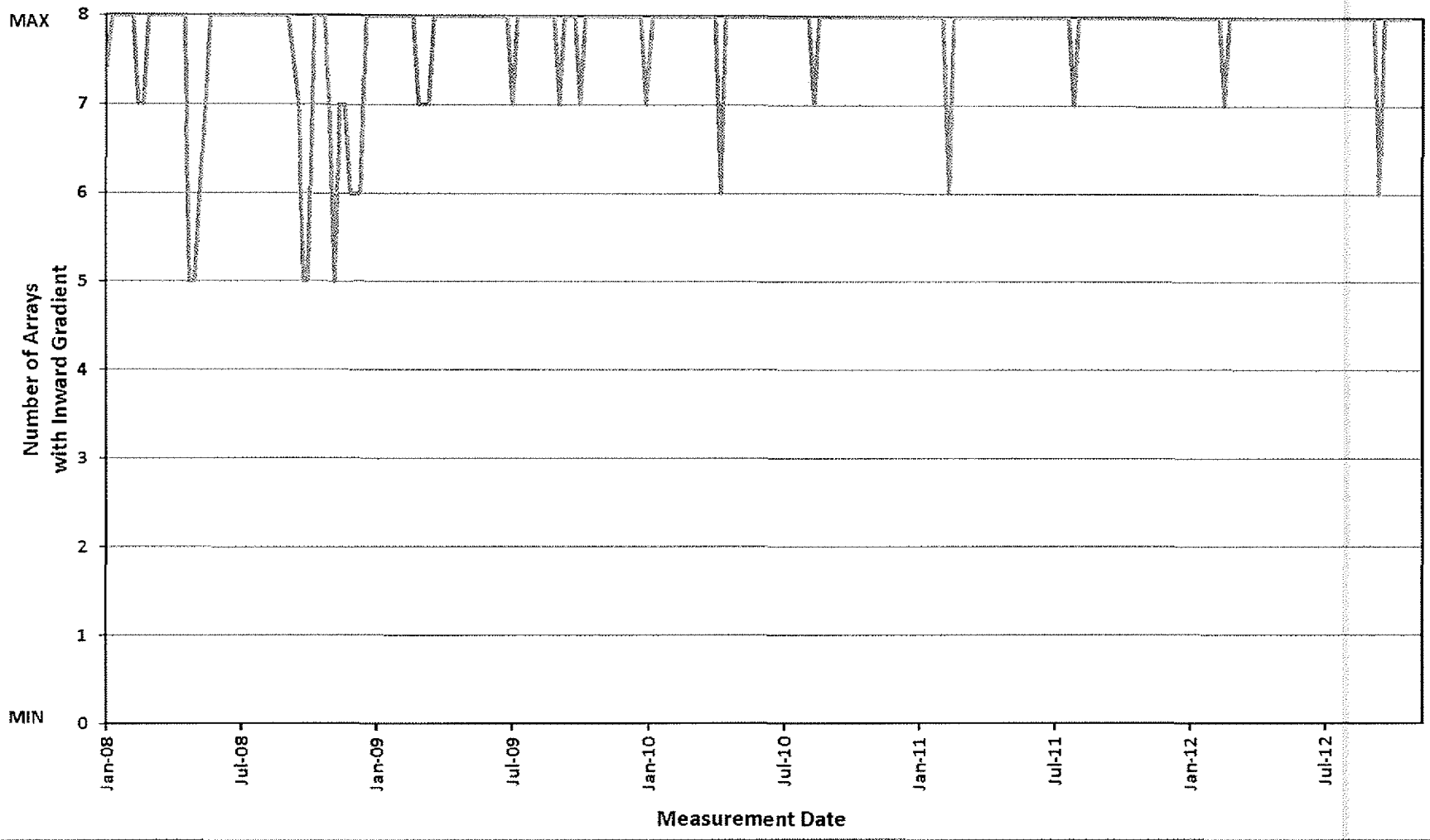
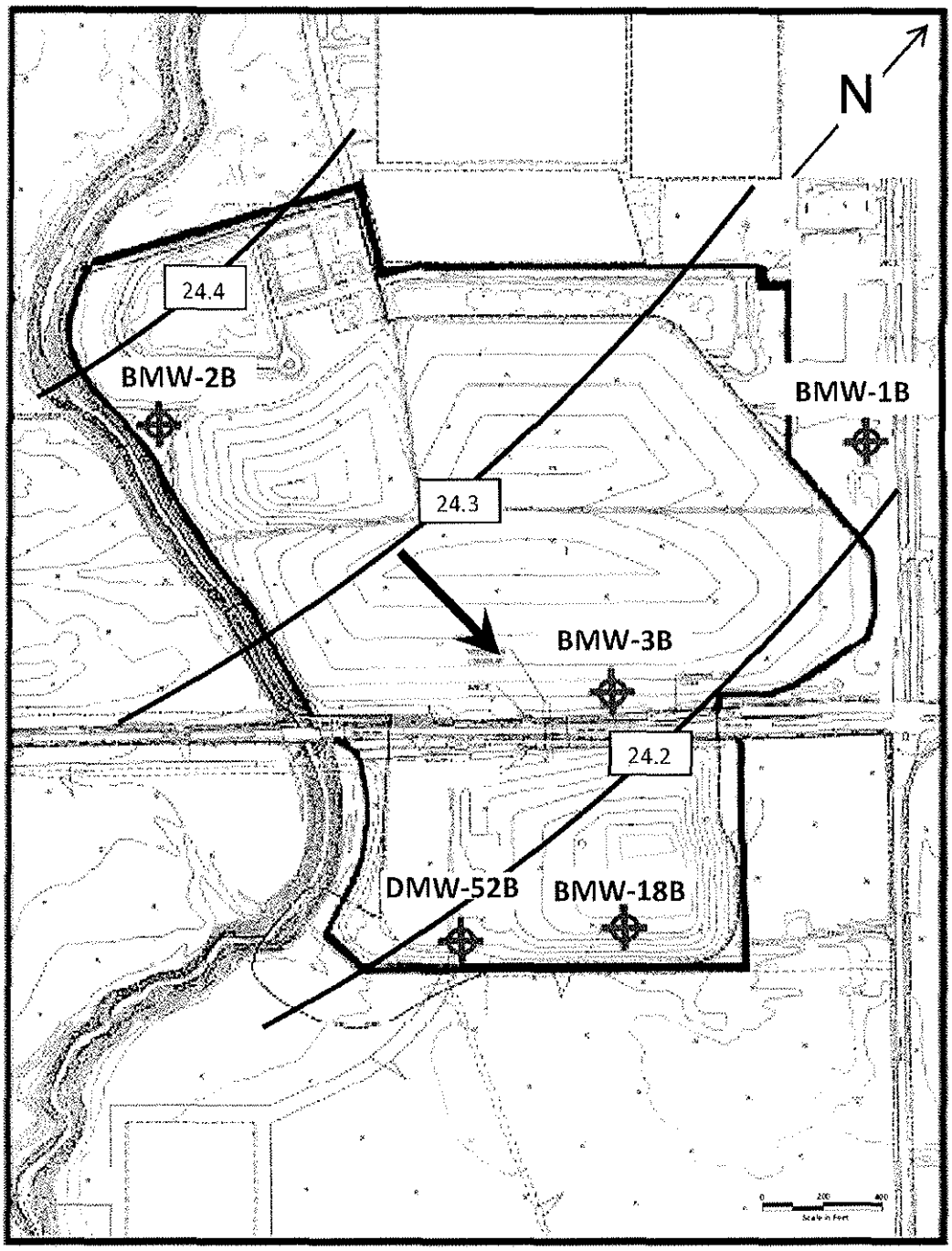


Figure 7

Brio Site

FFSZ Monitoring Wells



Approximate Location of FFSZ Monitoring Well

Generalized Groundwater Flow Direction

Approximate Potentiometric Surface Contour

Groundwater contours were approximated using the average water level data measured Feb. 17, 2010 to May 12, 2010 at six permanent monitoring wells screened in the FFSZ.

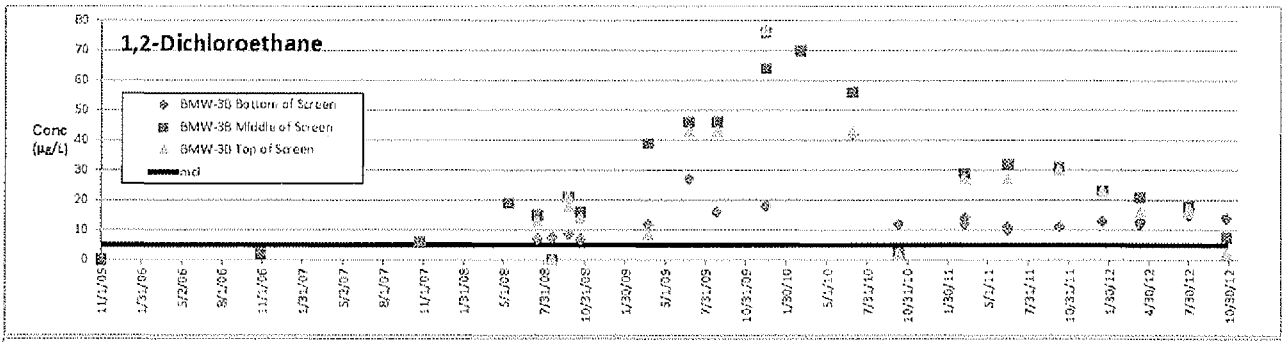
Figure 8
Affected FFSZ Monitoring Well BMW-3B

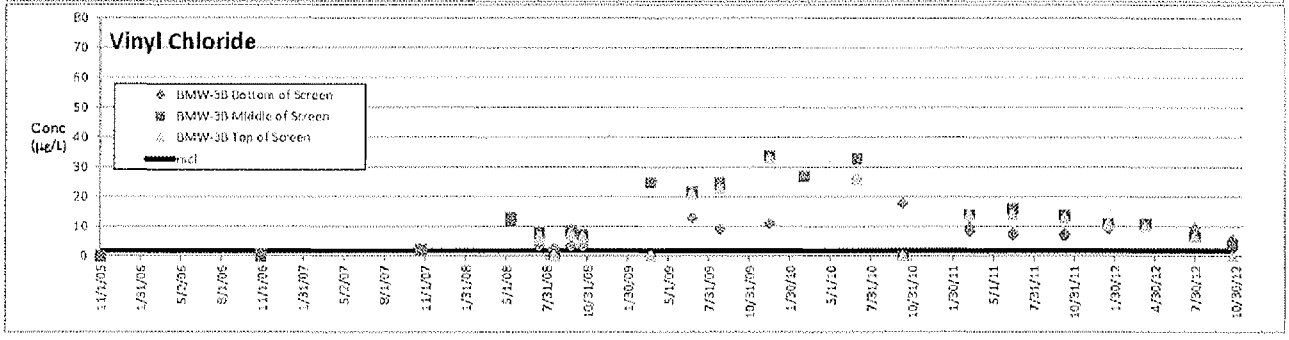
1,2-DICHLOROETHANE - mcl = 5
All units in ug/L

DATE	BMW-3B Bottom of Screen	BMW-3B Middle of Screen	BMW-3B Top of Screen
11/1/2005		ND	
10/30/2006		2.4	
10/30/2006		1.9	
10/24/2007		5.7	
10/24/2007		5.9	
5/13/2008		19	
5/13/2008		19	
7/17/2008	7.1	15	13
7/17/2008	7.0		
8/19/2008	7.5	ND	ND
8/19/2008		ND	
9/25/2008	8.6	21	18
9/25/2008			21
10/22/2008	7	16	14
10/22/2008	7		
3/24/2009	12	39	8.6
3/24/2009			
6/25/2009	27	46	43
6/25/2009			
8/27/2009	16	46	43
8/27/2009		46	
12/16/2009	18	76	77
12/16/2009		64	
3/4/2010		70	
6/30/2010	42	56	43
6/30/2010			
10/11/2010	12	2	2
10/11/2010			2.1
3/10/2011	12	29	27
3/10/2011	14		
6/15/2011	11	32	27
6/15/2011	10		
10/10/2011	11	31	30
10/10/2011	11		
1/17/2012	13	23	23
1/17/2012		23	
4/11/2012	13	21	16
4/11/2012	12		
7/31/2012	15	18	16
7/31/2012			17
10/24/2012	14	7.5	9.4
10/24/2012	14		

VINYL CHLORIDE mcl = 2
All units in ug/L

	BMW-3B Bottom of Screen	BMW-3B Middle of Screen	BMW-3B Top of Screen
11/1/2005		ND	
10/30/2006		0.82	
10/30/2006		ND	
10/24/2007		2.1	
10/24/2007		2.3	
5/13/2008		13	
5/13/2008		12	
7/17/2008	3.6	7.7	6.5
7/17/2008	3.6		
8/19/2008	2.7	ND	ND
8/19/2008		ND	
9/25/2008	3.6	8.7	7.4
9/25/2008			7.5
10/22/2008	3.5	7.1	6.4
10/22/2008			
3/24/2009	ND	25	ND
3/24/2009			
6/25/2009	15	22	21
6/25/2009			
8/27/2009	9.1	25	22
8/27/2009		24	
12/16/2009	11	34	33
12/16/2009		34	
3/4/2010		27	
6/30/2010	26	33	26
6/30/2010			
10/11/2010	18	ND	ND
10/11/2010			
3/10/2011	8.5	14	14
3/10/2011	9.8		
6/15/2011	7.8	16	14
6/15/2011	7.1		
10/10/2011	7.6	14	13
10/10/2011	7.0		
1/17/2012	9.3	13	11
1/17/2012		11	
4/11/2012	10	11	10
4/11/2012	10		
7/31/2012	9.5	6.7	6.5
7/31/2012			6.6
10/24/2012	9.4	3.9	ND
10/24/2012	9.3		





121031 FFSZ GW Comparison.xls

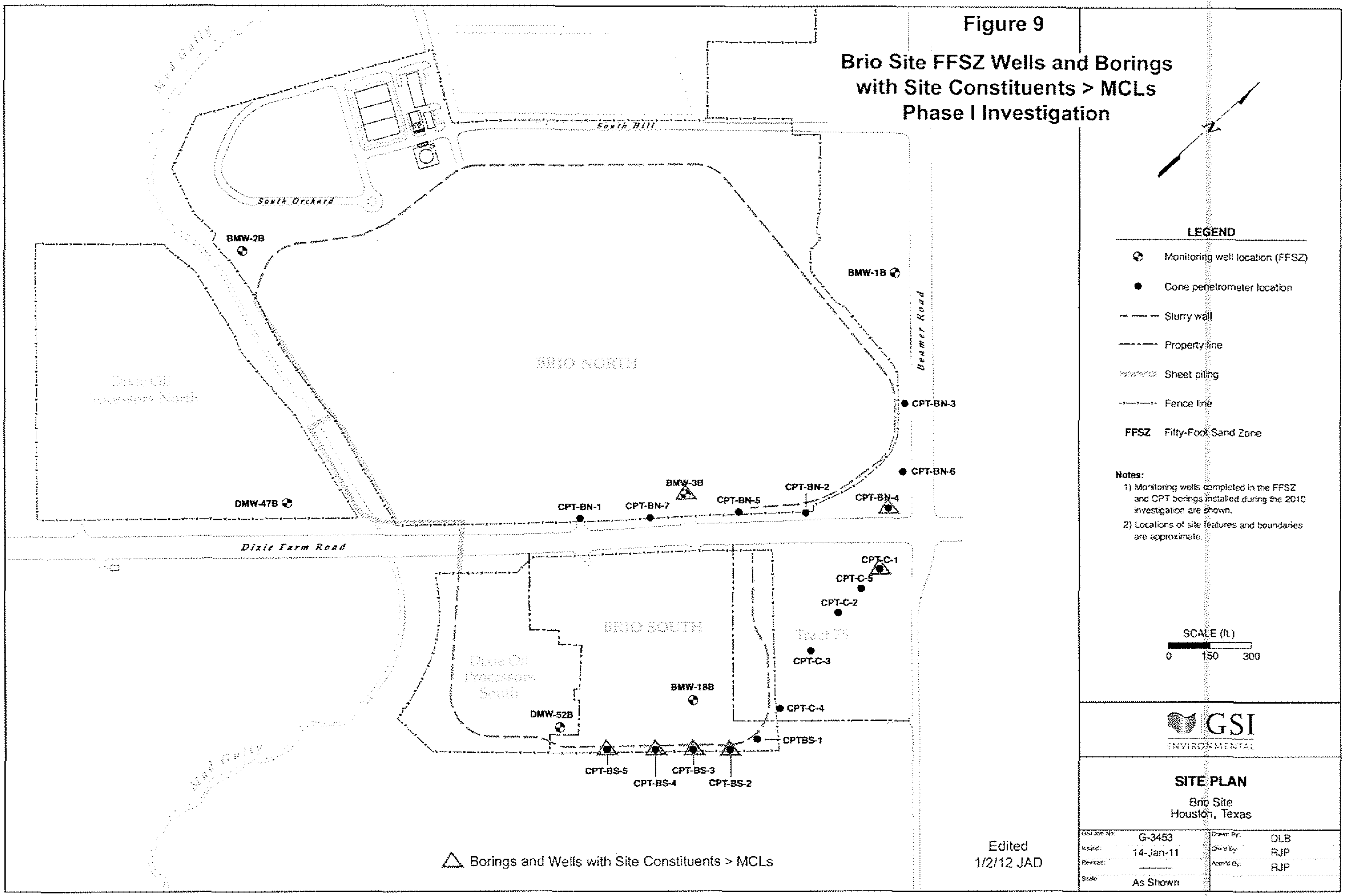


Figure 9
Brio Site FFSZ Wells and Borings
with Site Constituents > MCLs
Phase I Investigation
South Hill
South Orchard
BRIO NORTH
Dixie Oil Processors North
BMW-2B
BMW-1B
Beamer Road
CPT-BN-3
CPT-BN-6
BMW-3B
CPT-BN-1
CPT-BN-7
CPT-BN-5
CPT-BN-2
CPT-BN-4
DMW-47B
Dixie Farm Road
BRIO SOUTH
Dixie Oil Processors South
Tract 75
CPT-C-1
CPT-C-5
CPT-C-2
CPT-C-3
CPT-C-4
BMW-18B
DMW-52B
CPTBS-1
CPT-BS-5
CPT-BS-4
CPT-BS-3
CPT-BS-2
Mud Gully
LEGEND
Monitoring well location (FFSZ)
Cone penetrometer location
Slurry wall
Property line
Sheet piling
Fence line
FFSZ Fifty-Foot Sand Zone
Notes:
1) Monitoring wells completed in the FFSZ and CPT borings installed during the 2010 investigation are shown.
2) Locations of site features and boundaries are approximate.
SCALE (ft.)
0 150 300
GSI ENVIRONMENTAL
SITE PLAN
Brio Site
Houston, Texas
G-3453
14-Jan-11
As Shown
DLB
RJP
RJP
Borings and Wells with Site Constituents > MCLs
Edited
1/2/12 JAD

Figure 10
Surface Water Analytical Results: 1,1,2-TCA

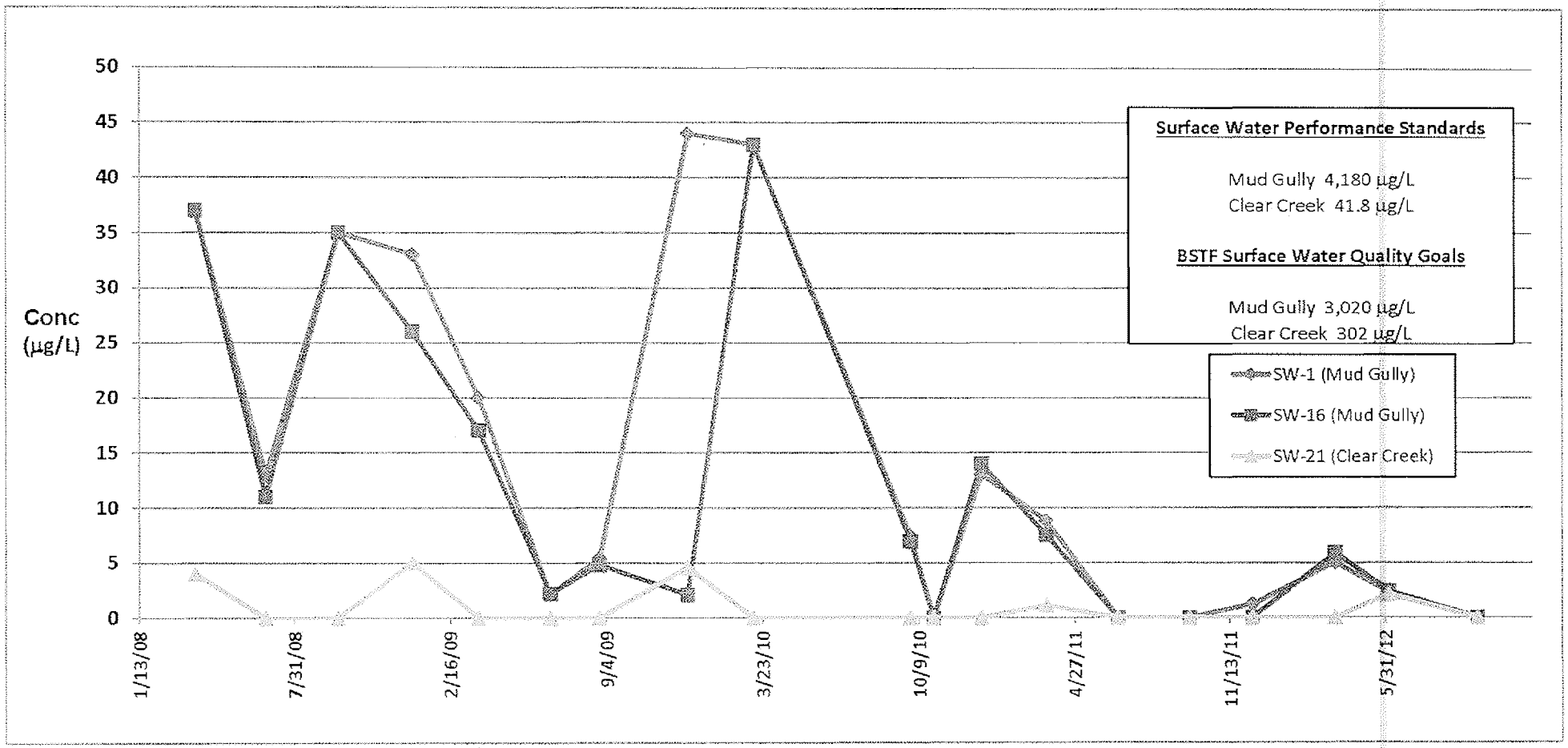


Figure 11
Surface Water Results: 1,1-DCE

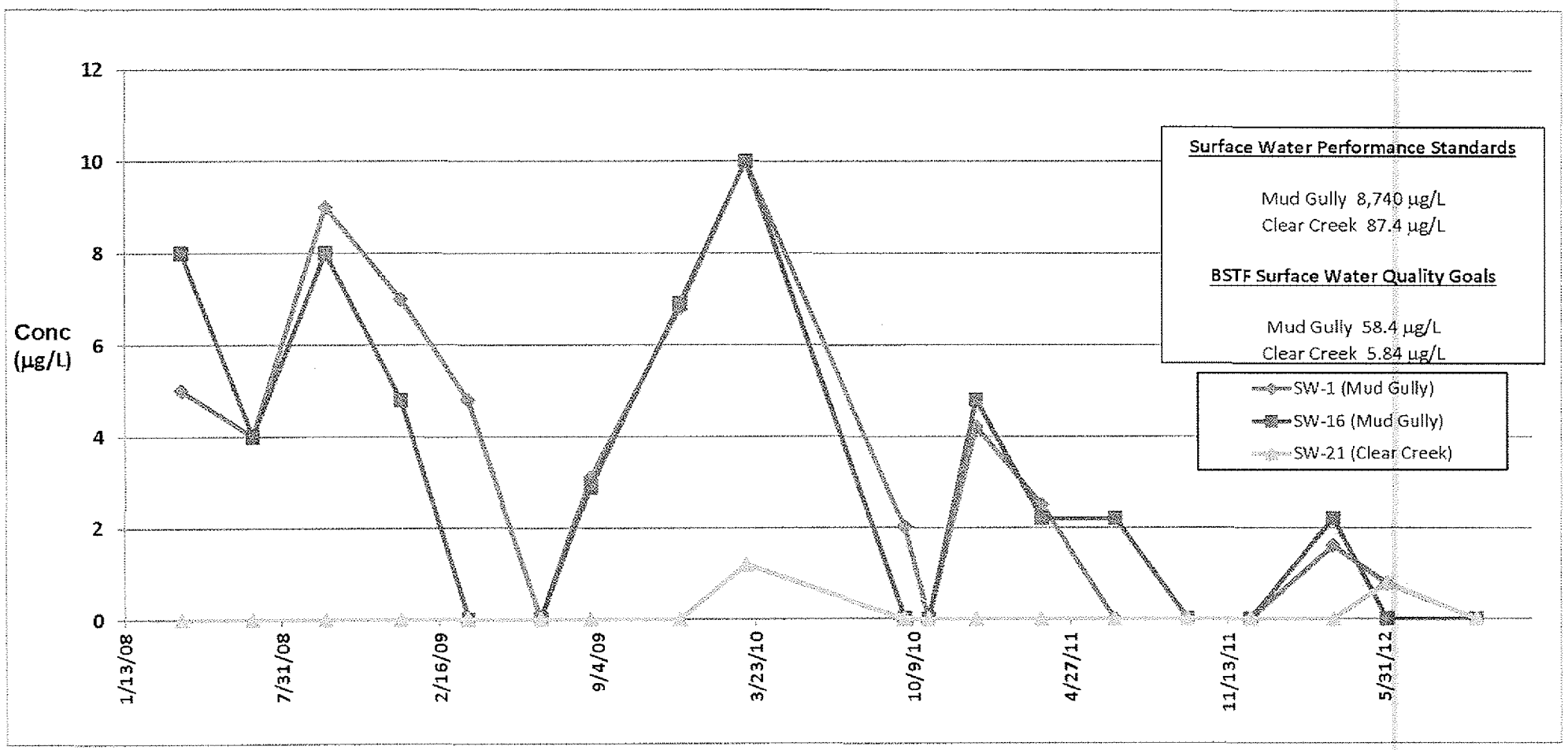


Figure 12
Surface Water: 1,2-DCA

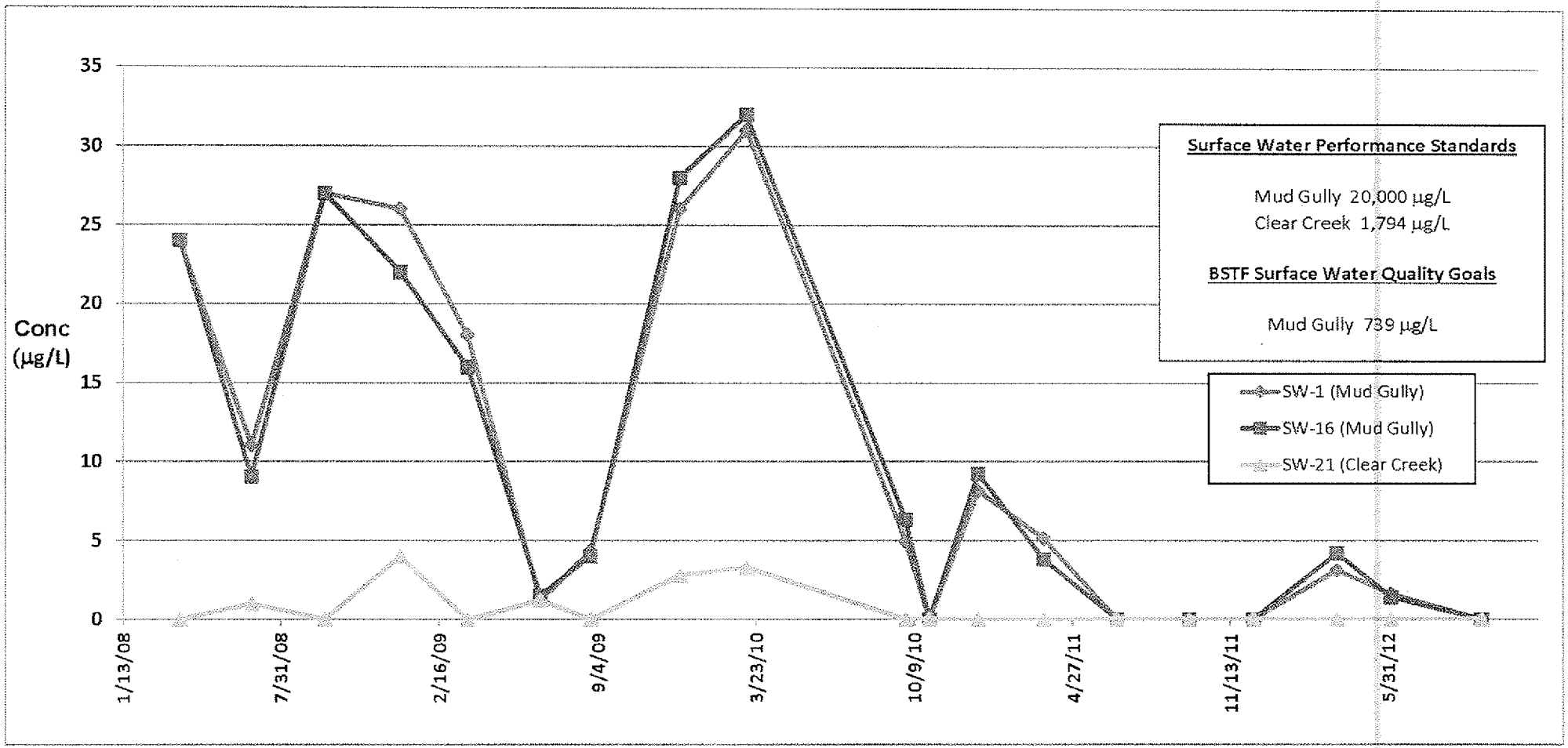
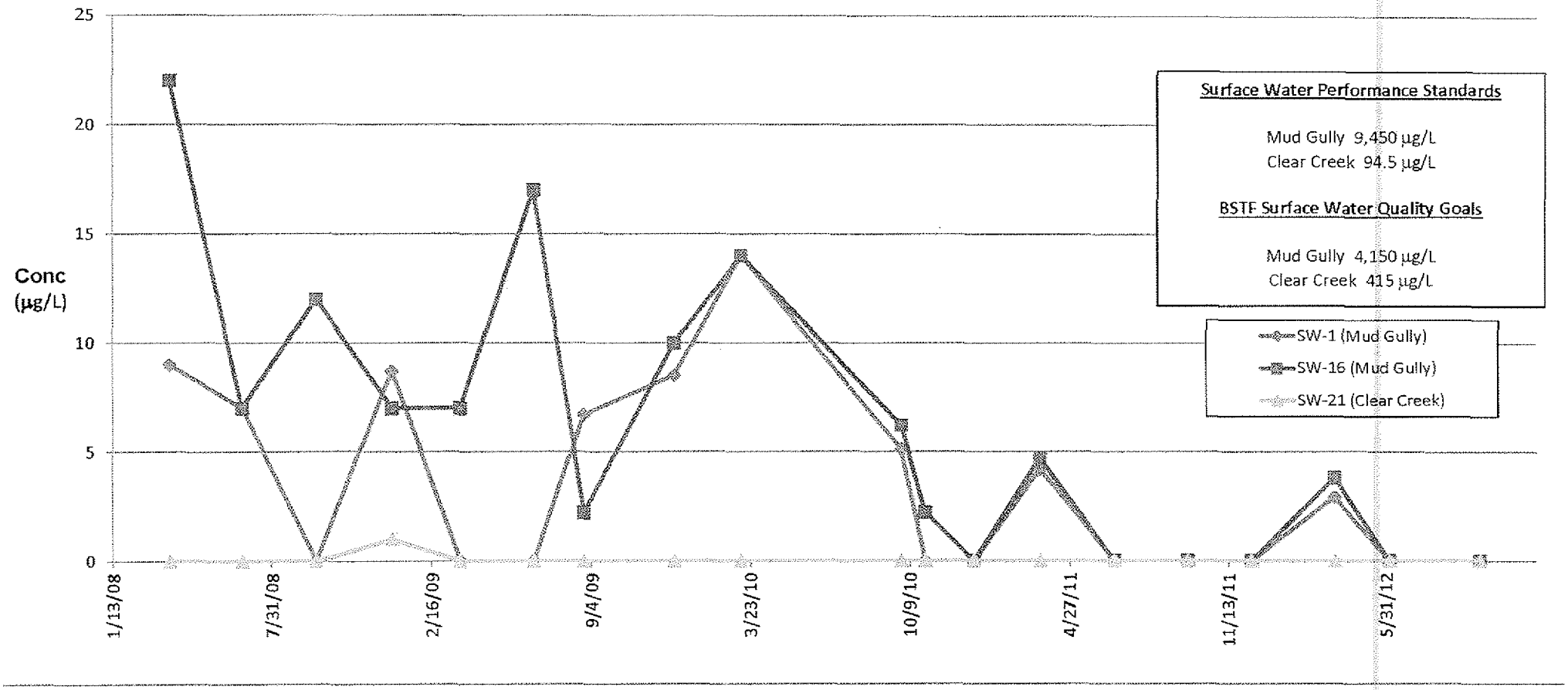


Figure 13
Surface Water: Vinyl Chloride



ATTACHMENT 2

List of Documents Reviewed

Attachment 2

List of Documents Reviewed

Brio Refining Site Amended Record of Decision, July 2, 1997

Brio Refining Site Third Five-Year Review Report, April 25, 2008

Brio Site Task Force Fourth Annual Effectiveness Report, July 8, 2009 (April 2007-March 2008)

Institutional Control Plan for the Brio Refining Superfund Site, April 2006

Brio Refining Site Maintenance, Operations, and Monitoring Plan, February 2004 (Rev. 4, January 31, 2011)

Brio Site Task Force Fifth Annual Effectiveness Report, February 15, 2012 (April 2008-March 2009)

Brio Site Task Force Sixth Annual Effectiveness Report, February 15, 2012 (April 2009-March 2010)

Phase I Fifty-Foot Sand Zone (FFSZ) Groundwater Investigation [Report], Brio Refining Superfund Site, Harris County, Texas, January 14, 2011

Phase II Fifty-Foot Sand Zone (FFSZ) Groundwater Investigation Work Plan, Brio Refining Superfund Site, Harris County, Texas, June 29, 2011

ATTACHMENT 3

Site Monitoring Criteria

TREATED WATER DISCHARGE CRITERIA
(Table 2 of MOM Plan)

PARAMETER	DISCHARGE LIMIT (mg/l)	PQL (mg/l)
General Chemistry		
pH	6.0-9.0 (no units)	n/a
BOD	81	5
COD	568	20
Sulfur (Sulfide)	0.6	0.2
Phosphorus	4	0.1
Ammonia as N	23	4
Oil and Grease	31	10
Phenolics	0.7	0.2
TSS	62	5
Metals		
Copper	0.093	0.010
Volatiles		
1, 1, 2-Trichloroethane	0.054	0.010
1, 2-Dichloroethane	0.211	0.010
Vinyl Chloride	0.268	0.010
Methylene Chloride	0.089	0.010
Semivolatiles		
Bis(2-chloroethyl)ether	0.757	0.020
Total Carcinogenic PNAs[1]	0.350 (total)	0.020 (each)
Total Noncarcinogenic PNAs[2]	0.470 (total)	0.020 (each)

1. Benzo(a)anthracene
   Benzo(b)fluoranthene
   Benzo(k)fluoranthene
   Benzo(a)pyrene
   Dibenzo(a,h)anthracene
   Indeno(1,2,3,c,d)pyrene
   Chrysene

2. Acenaphthene
   Anthracene
   Pyrene
   Fluoranthene
   Fluorene
   Naphthalene
   Phenanthrene

SURFACE WATER PERFORMANCE STANDARDS AND QUALITY GOALS
(Table 4 of MOM Plan)

	SURFACE WATER PERFORMANCE STANDARDS		BSTF SURFACE WATER QUALITY GOALS*	
Compound	Mud Gully (µg/ l)	Clear Creek (µg/ l)	Mud Gully (µg/ l)	Clear Creek (µg/ l)
1, 1, 2-Trichloroethane	4,180	41.8	3,020	302
1, 2-Dichloroethane	20,000	1,794	739	73.9
1, 1-Dichloroethene	8,740	87.4	58.4	5.84
Vinyl Chloride	9,450	94.5	4,150	415

*These levels are based on the Texas Commission on Environmental Quality (TCEQ) surface water quality standards as adopted in August 2002, and based on calculations presented in the Texas Total Maximum Daily Load (TMDL) Program.

FENCE LINE AMBIENT AIR QUALITY STANDARDS
(FLAAQS)
(Table 3C of MOM Plan)

COMPOUND	FLAAQS (24-HOUR AVERAGE-ppb)
Benzene	50
1, 2-Dichloroethane (Ethylene Dichloride)	200
Methylene Chloride	1,100
1, 1, 2-Trichloroethane	656
Vinyl Chloride	690

NSCZ GROUNDWATER
PERFORMANCE STANDARDS
(Table 5 of MOM Plan)

PARAMETER	CRITERIA (mg/l)
1, 1, 2-Trichloroethane	4.18
1, 2-Dichloroethane	20.00
1, 1-Dichloroethene	8.74
Vinyl Chloride	9.45

FFSZ GROUNDWATER DRINKING WATER LIST AND MAXIMUM CONTAMINANT LEVELS (MCL) (Table 6 of MOM Plan)

DRINKING WATER VOLATILE LIST	MCL (µg/l)
Benzene	5
Carbon Tetrachloride	5
Chlorobenzene	100
1, 2-Dichlorobenzene (o-dichlorobenzene)	600
1, 4-Dichlorobenzene (p-dichlorobenzene)	75
1, 2-Dichloroethane	5
1, 1-Dichloroethene	7
cis-1, 2-Dichloroethene	70
trans-1, 2-Dichloroethene	100
Methylene Chloride (Dichloromethane)	5
1, 2-Dichloropropane	5
Ethylbenzene	700
Styrene	100
Tetrachloroethene	5
Toluene	1,000
1, 2, 4-Trichlorobenzene	70
1, 1, 1-Trichloroethane	200
1, 1, 2-Trichloroethane	5
Trichloroethene	5
Vinyl Chloride	2
Xylenes (Total)	10,000
Total Trihalomethanes (TTHMs) *	100

* Total Trihalomethanes = Chloroform, Bromodichloromethane, Bromoform, and Dibromochloromethane

ATTACHMENT 4

Site Inspection Checklist

Five-Year Review Site Inspection Checklist

I. SITE INFORMATION	
Site name: Brio Refining Superfund Site	**Date of inspection: December 13, 2012**
Location and Region: Harris Co., TX; Region 6	**EPA ID: TXD980625453**
Agency, office, or company leading the five-year review: BSTF for the U.S. Environmental Protection Agency	**Weather/temperature: Sunny with a temperature in the 60's.**

Remedy Includes: (Check all that apply)

- ☒ Landfill cover/containment
- ☒ Access controls
- ☒ Institutional controls
- ☒ Groundwater pump and treatment
- ☐ Surface water collection and treatment
- ☒ Other DNAPL collection system, air monitoring, long-term groundwater monitoring, cover gas collection and treatment
- ☐ Monitored natural attenuation
- ☒ Groundwater containment
- ☒ Vertical barrier walls

Attachments: ☒ Inspection team roster attached (Section 4 of this checklist)

☒ Site map attached (See Figure 2 of Attachment 1 of main report)

II. INTERVIEWS (Check all that apply)

1. **O&M site manager** John Danna (Name) Site Manager (Title) December 13, 2012 (Date)
   Interviewed ☐ at site ☐ at office ☐ by phone Phone no. 281-922-1054
   Problems, suggestions; ☐ Report attached _____

2. **O&M staff** _____ (Name) _____ (Title) _____ (Date)
   Interviewed ☐ at site ☐ at office ☐ by phone Phone no. _____
   Problems, suggestions; ☐ Report attached _____

3. **Local regulatory authorities and response agencies** (i.e., State and Tribal offices, emergency response office, police department, office of public health or environmental health, zoning office, recorder of deeds, or other city and county offices, etc.) Fill in all that apply.

Agency TCEQ
Contact Fay Duke | Project Manager | January 7, 2013 | 512-239-2443
Name | Title | Date | Phone no.
Problems; suggestions; ☒ Report attached _____

Agency _____
Contact _____ _____ _____ _____
Name | Title | Date | Phone no.
Problems; suggestions; G Report attached _____

Agency _____
Contact _____ _____ _____ _____
Name | Title | Date | Phone no.
Problems; suggestions; G Report attached _____

Agency _____
Contact _____ _____ _____ _____
Name | Title | Date | Phone no.
Problems; suggestions; G Report attached _____

4. **Other interviews** (optional) ☒ Report attached.

Chris Clark – Clear Brook City Municipal Utility District

Marie Flickinger - South Belt-Ellington Leader News, San Jacinto College Board of Regents, Brio Site Community Advisory Group (CAG)

Participants in site visit (12/13/12)

Gary Miller – USEPA

John Danna-BSTF

Lawrence Engle-BSTF

Stephanie Phillips-Celanese (BSTF PRP)

Brad Weaver-Celanese (BSTF PRP)

Roger Pokluda-GSI Environmental (BSTF Consultant)

Fay Duke-TCEQ

Sherell Heidt-TCEQ

Matthew Foresman-Monsanto (BSTF PRP Site Coordinator)

Paul Clark-BSTF

III. ON-SITE DOCUMENTS & RECORDS VERIFIED (Check all that apply)

1. **O&M Documents**
   - ☒ O&M manual — ☒ Readily available — ☒ Up to date — ☐ N/A
   - ☒ As-built drawings — ☒ Readily available — ☒ Up to date — ☐ N/A
   - ☒ Maintenance logs — ☒ Readily available — ☒ Up to date — ☐ N/A

   Remarks_____

2. **Site-Specific Health and Safety Plan** — ☒ Readily available — ☒ Up to date — ☐ N/A
   - ☒ Contingency plan/emergency response plan — ☒ Readily available — ☒ Up to date — ☐ N/A

   Remarks_____

3. **O&M and OSHA Training Records** — ☒ Readily available — ☒ Up to date — ☐ N/A

   Remarks_____

4. **Permits and Service Agreements**
   - ☐ Air discharge permit — ☐ Readily available — ☐ Up to date — ☒ N/A
   - ☐ Effluent discharge — ☐ Readily available — ☐ Up to date — ☒ N/A
   - ☐ Waste disposal, POTW — ☐ Readily available — ☐ Up to date — ☒ N/A
   - ☐ Other permits_____ — ☐ Readily available — ☐ Up to date — ☒ N/A

   Remarks Actions performed under CERCLA and ARARs listed in Attachment 6 of the main report.

5. **Gas Generation Records** — ☐ Readily available — ☐ Up to date — ☒ N/A

   Remarks_____

6. **Settlement Monument Records** — ☐ Readily available — ☐ Up to date — ☒ N/A

   Remarks_____

7. **Groundwater Monitoring Records** — ☒ Readily available — ☒ Up to date — ☐ N/A

   Remarks_____

8. **Leachate Extraction Records** — ☐ Readily available — ☐ Up to date — ☒ N/A

   Remarks_____

9. **Discharge Compliance Records**
   - ☒ Air — ☒ Readily available — ☒ Up to date — ☐ N/A
   - ☒ Water (effluent) — ☒ Readily available — ☒ Up to date — ☐N/A

   Remarks_____

10. **Daily Access/Security Logs** — ☒ Readily available — ☒ Up to date — ☐ N/A

    Remarks_____

IV. O&M COSTS

1. **O&M Organization**

☐ State in-house ☐ Contractor for State
☐ PRP in-house ☒ Contractor for PRP
☐ Federal Facility in-house ☐ Contractor for Federal Facility
☐ Other

2. **O&M Cost Records**

☒ Readily available ☒ Up to date
☒ Funding mechanism/agreement in place (PRP Trust Agreement)
Original O&M cost estimate ☐ Breakdown attached

Total annual cost by year for review period if available

From 1/1/2008	To 12/31/2008	$757k	☐ Breakdown attached
From 1/1/2009	To 12/31/2009	$833k	☐ Breakdown attached
From 1/1/2010	To 12/31/2010	$1.6M	☐ Breakdown attached
From 1/1/2011	To 12/31/2011	$1.1M	☐ Breakdown attached
From 1/1/2012	To 12/31/2012	$1.3M	☐ Breakdown attached

Total cost for review period

From 1/1/2008 To 12/31/2012 $5.6M

3. **Unanticipated or Unusually High O&M Costs During Review Period**

Describe costs and reasons:
$600k-Phase I FFSZ groundwater investigation during 2010 and 2011.
$250k-Legal costs to prevent new pipeline on NRD conservation easement during 2011-2012.
$50k-Repair two treated water holding tanks during 2012.

V. ACCESS AND INSTITUTIONAL CONTROLS ☒ Applicable ☐ N/A

A. Fencing

1. **Fencing damaged** ☐ Location shown on site map ☒ Gates secured ☐ N/A
Remarks Fences well maintained. Gates secured and locked.

B. Other Access Restrictions

1. **Signs and other security measures** ☐ Location shown on site map ☐ N/A
Remarks Signs posted on main entrance and other access points. Additional measures implemented for security and deterrence of trespassers.

C. Institutional Controls (ICs)

1. **Implementation and enforcement**

Site conditions imply ICs not properly implemented ☐ Yes ☒ No ☐ N/A

Site conditions imply ICs not being fully enforced ☐ Yes ☒ No ☐ N/A

Type of monitoring (*e.g.*, self-reporting, drive by) Self reporting

Frequency Daily informal and monthly formal inspections

Responsible party/agency BSTF

Contact John Danna (Name) Site Manager (Title) 12/13/12 (Date) 281-831-2107 (Phone no.)

Reporting is up-to-date ☒ Yes ☐ No ☐ N/A

Reports are verified by the lead agency ☒ Yes ☐ No ☐ N/A

Specific requirements in deed or decision documents have been met ☒ Yes ☐ No ☐ N/A

Violations have been reported ☐ Yes ☐ No ☒ N/A

Other problems or suggestions: ☐ Report attached

Inspection reports are available on-site and are discussed with the USEPA project manager.

2. **Adequacy** ☒ ICs are adequate ☐ ICs are inadequate ☐ N/A

Remarks Deed restrictions and deed notices have been executed for the entire Superfund properties. Certified copies were obtained from the Harris County Clerk's Office and are maintained on-site.

D. General

1. **Vandalism/trespassing** ☐ Location shown on site map ☒ No vandalism evident

Remarks _____

2. **Land use changes on site** ☒ N/A

Remarks _____

3. **Land use changes off site** ☒ N/A

Remarks _____

VI. GENERAL SITE CONDITIONS

A. Roads ☒ Applicable ☐ N/A

1. **Roads damaged** ☐ Location shown on site map ☒ Roads adequate ☐ N/A

Remarks _____

B. Other Site Conditions

Remarks _____

VII. LANDFILL COVERS ☒ Applicable ☐ N/A

A. Landfill Surface

1. **Settlement** (Low spots) ☐ Location shown on site map ☒ Settlement not evident
   Areal extent_____ Depth_____
   Remarks_____

2. **Cracks** ☐ Location shown on site map ☒ Cracking not evident
   Lengths_____ Widths_____ Depths_____
   Remarks_____

3. **Erosion** ☐ Location shown on site map ☐ Erosion not evident
   Areal extent_____ Depth_____
   Remarks Minor erosion has been observed during routine inspections.

4. **Holes** ☐ Location shown on site map ☒ Holes not evident
   Areal extent_____ Depth_____
   Remarks_____

5. **Vegetative Cover** ☒ Grass ☒ Cover properly established ☒ No signs of stress
   ☐ Trees/Shrubs (indicate size and locations on a diagram)
   Remarks_____

6. **Alternative Cover (armored rock, concrete, etc.)** ☒ N/A
   Remarks_____

7. **Bulges** ☐ Location shown on site map ☒ Bulges not evident
   Areal extent_____ Height_____
   Remarks_____

8. **Wet Areas/Water Damage** ☒ Wet areas/water damage not evident
   ☐ Wet areas ☐ Location shown on site map Areal extent_____
   ☐ Ponding ☐ Location shown on site map Areal extent_____
   ☐ Seeps ☐ Location shown on site map Areal extent_____
   ☐ Soft subgrade ☐ Location shown on site map Areal extent_____
   Remarks_____

9. **Slope Instability** ☐ Slides ☐ Location shown on site map ☒ No evidence of slope instability
   Areal extent_____
   Remarks_____

B. Benches ☐ Applicable ☒ N/A
(Horizontally constructed mounds of earth placed across a steep landfill side slope to interrupt the slope in order to slow down the velocity of surface runoff and intercept and convey the runoff to a lined channel.)

1.	**Flows Bypass Bench** Remarks_____	☐ Location shown on site map	☒ N/A or okay
2.	**Bench Breached** Remarks_____	☐ Location shown on site map	☒ N/A or okay
3.	**Bench Overtopped** Remarks_____	☐Location shown on site map	☒ N/A or okay

C. Letdown Channels ☒ Applicable ☐ N/A

(Channel lined with erosion control mats, riprap, grout bags, or gabions that descend down the steep side slope of the cover and will allow the runoff water collected by the benches to move off of the landfill cover without creating erosion gullies.)

1.	**Settlement** Areal extent_____ Depth_____ Remarks_____	☐Location shown on site map	☒ No evidence of settlement
2.	**Material Degradation** Material type_____ Areal extent_____ Remarks_____	☐ Location shown on site map	☒ No evidence of degradation
3.	**Erosion** Areal extent_____ Depth_____ Remarks_____	☐ Location shown on site map	☒ No evidence of erosion
4.	Undercutting Areal extent_____ Depth_____ Remarks_____	☐ Location shown on site map	☒ No evidence of undercutting

5. **Obstructions** Type_____ ☒ No obstructions
☐ Location shown on site map Areal extent_____
Size_____
Remarks_____

6. **Excessive Vegetative Growth** Type_____
☒ No evidence of excessive growth
☒ Vegetation in channels does not obstruct flow
☐ Location shown on site map Areal extent_____
Remarks_____

D. Cover Penetrations ☒ Applicable G N/A

1. **Gas Vents** ☐ Active ☒ Passive
☐ Properly secured/locked ☒ Functioning ☒ Routinely sampled ☒ Good condition
☐ Evidence of leakage at penetration ☐ Needs Maintenance
☐ N/A
Remarks_____

2. **Gas Monitoring Probes**
☐ Properly secured/locked ☐Functioning ☐ Routinely sampled ☐ Good condition
☐ Evidence of leakage at penetration ☐ Needs Maintenance ☒ N/A
Remarks Gas vents and carbon scrubbers routinely monitored with hand-held PID.

3. **Monitoring Wells** (within surface area of landfill)
☒ Properly secured/locked ☒ Functioning ☒ Routinely sampled ☒ Good condition
☐ Evidence of leakage at penetration ☐ Needs Maintenance ☐ N/A
Remarks_____

4. **Leachate Extraction Wells**
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ Evidence of leakage at penetration ☐ Needs Maintenance ☒ N/A
Remarks_____

5. **Settlement Monuments** ☐ Located ☐ Routinely surveyed ☒ N/A
Remarks_____

E. Gas Collection and Treatment ☒ Applicable ☐ N/A

1. **Gas Treatment Facilities**
   ☐ Flaring ☐ Thermal destruction ☐ Collection for reuse
   ☒ Good condition ☐ Needs Maintenance
   Remarks Passive with carbon canisters

2. **Gas Collection Wells, Manifolds and Piping**
   ☒ Good condition ☐ Needs Maintenance
   Remarks Four local collection points-no manifolds or piping are used.

3. **Gas Monitoring Facilities** (*e.g.*, gas monitoring of adjacent homes or buildings)
   ☐ Good condition ☐ Needs Maintenance ☒ N/A
   Remarks _____

F. Cover Drainage Layer ☐ Applicable ☒ N/A

1. **Outlet Pipes Inspected** ☐ Functioning ☒ N/A
   Remarks _____

2. **Outlet Rock Inspected** ☐ Functioning ☒ N/A
   Remarks _____

G. Detention/Sedimentation Ponds ☒ Applicable ☐ N/A

1. **Siltation** Areal extent _____ Depth _____ ☒ N/A
   ☐ Siltation not evident
   Remarks _____

2. **Erosion** Areal extent _____ Depth _____
   ☒ Erosion not evident
   Remarks Detention ponds owned and maintained by Harris County Flood Control District.

3. **Outlet Works** ☒ Functioning ☐ N/A
   Remarks _____

4. **Dam** ☐ Functioning ☒ N/A
   Remarks _____

H. Retaining Walls ☐ Applicable ☒ N/A

1. **Deformations** ☐ Location shown on site map ☐ Deformation not evident
   Horizontal displacement_____ Vertical displacement_____
   Rotational displacement_____
   Remarks_____

2. **Degradation** ☐ Location shown on site map ☐ Degradation not evident
   Remarks_____

I. Perimeter Ditches/Off-Site Discharge ☒ Applicable ☐ N/A

1. **Siltation** ☐ Location shown on site map ☒ Siltation not evident
   Areal extent_____ Depth_____
   Remarks_____

2. **Vegetative Growth** ☐ Location shown on site map ☐ N/A
   ☒ Vegetation does not impede flow
   Areal extent_____ Type_____
   Remarks_____

3. **Erosion** ☐ Location shown on site map ☒ Erosion not evident
   Areal extent_____ Depth_____
   Remarks_____

4. **Discharge Structure** ☒ Functioning ☐ N/A
   Remarks_____

VIII. VERTICAL BARRIER WALLS ☒ Applicable ☐ N/A

1. **Settlement** ☐ Location shown on site map ☒ Settlement not evident
   Areal extent_____ Depth_____
   Remarks_____

2. **Performance Monitoring** Type of monitoring_____
   ☒ Performance not monitored
   Frequency_____ ☐ Evidence of breaching
   Head differential_____
   Remarks_____

IX. GROUNDWATER/SURFACE WATER REMEDIES ☒ Applicable ☐ N/A

A. Groundwater Extraction Wells, Pumps, and Pipelines ☒ Applicable ☐ N/A

1. **Pumps, Wellhead Plumbing, and Electrical**
   ☒ Good condition ☒ All required wells properly operating ☒ Needs Maintenance ☐ N/A
   Remarks_____

2. **Extraction System Pipelines, Valves, Valve Boxes, and Other Appurtenances**
   ☒ Good condition ☐ Needs Maintenance
   Remarks_____

3. **Spare Parts and Equipment**
   ☒ Readily available ☒ Good condition ☐ Requires upgrade ☐ Needs to be provided
   Remarks_____

B. Surface Water Collection Structures, Pumps, and Pipelines ☐ Applicable ☒ N/A

1. **Collection Structures, Pumps, and Electrical**
   ☐ Good condition ☐ Needs Maintenance
   Remarks_____

2. **Surface Water Collection System Pipelines, Valves, Valve Boxes, and Other Appurtenances**
   ☐ Good condition ☐ Needs Maintenance
   Remarks_____

3. **Spare Parts and Equipment**
   ☐ Readily available ☐ Good condition ☐ Requires upgrade ☐ Needs to be provided
   Remarks_____

C. Treatment System ☒ Applicable ☐ N/A

1. **Treatment Train** (Check components that apply)
   ☐ Metals removal ☒ Oil/water separation ☐ Bioremediation
   ☒ Air stripping ☒ Carbon adsorbers
   ☒ Filters
   ☒ Additive (*e.g.*, chelation agent, flocculent)
   ☐ Others
   ☒ Good condition ☐ Needs Maintenance
   ☒ Sampling ports properly marked and functional
   ☒ Sampling/maintenance log displayed and up to date
   ☒ Equipment properly identified
   ☒ Quantity of groundwater treated annually 3-million gallons average per year
   ☐ Quantity of surface water treated annually
   Remarks

2. **Electrical Enclosures and Panels** (properly rated and functional)
   ☐ N/A ☒ Good condition ☐ Needs Maintenance
   Remarks

3. **Tanks, Vaults, Storage Vessels**
   ☐ N/A ☒ Good condition ☒ Proper secondary containment ☐ Needs Maintenance
   Remarks

4. **Discharge Structure and Appurtenances**
   ☐ N/A ☒ Good condition ☐ Needs Maintenance
   Remarks

5. **Treatment Building(s)**
   ☐ N/A ☒ Good condition (esp. roof and doorways) ☐ Needs repair
   ☒ Chemicals and equipment properly stored
   Remarks

6. **Monitoring Wells** (pump and treatment remedy)
   ☒ Properly secured/locked ☒ Functioning ☒ Routinely sampled ☒ Good condition
   ☒ All required wells located ☐ Needs Maintenance ☐ N/A
   Remarks

D. Monitoring Data

1. Monitoring Data
   ☒ Is routinely submitted on time ☒ Is of acceptable quality
   Monitoring data is provided and discussed with EPA and TCEQ during quarterly meetings. EPA is notified immediately by email and phone for any issues requiring a regulatory or community response. Annual effectiveness reports should be brought up to date.

2. Monitoring data suggests:
   ☒ Groundwater plume is effectively contained ☐ Contaminant concentrations are declining

D. Monitored Natural Attenuation

1. **Monitoring Wells** (natural attenuation remedy)
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
☐All required wells located ☐ Needs Maintenance ☒ N/A
Remarks FFSZ MNA assessment is currently underway.

X. OTHER REMEDIES

If there are remedies applied at the site which are not covered above, attach an inspection sheet describing the physical nature and condition of any facility associated with the remedy. An example would be soil vapor extraction.

DNAPL recovery using extraction wells targeting areas of highest DNAPL concentrations has successfully removed a large quantity of high-concentration liquid. Through December 2012, 230,820 gallons of recovered product have been sent off-site for thermal treatment.

XI. OVERALL OBSERVATIONS

A. Implementation of the Remedy

Describe issues and observations relating to whether the remedy is effective and functioning as designed. Begin with a brief statement of what the remedy is to accomplish (i.e., to contain contaminant plume, minimize infiltration and gas emission, etc.).

The overall goal of site operations is the containment of groundwater and air emissions from the site. The vertical barrier wall consisting of the soil bentonite wall and sheet pile wall prevents the downgradient lateral movement of contaminated groundwater. The natural horizontal barrier provided by the Middle Clay Unit, combined with a natural upward pressure differential and an artificial upward pressure differential provided by extracting the NSCZ groundwater, prevents or greatly inhibits the downward movement of contaminants. The flexible membrane layer of the cap system prevents the infiltration of surface water and the escape of volatile gases from the contaminated soil. During this inspection, it was assessed that the remedy remains protective, consistent with the remedial action objectives of the response action.

B. Adequacy of O&M

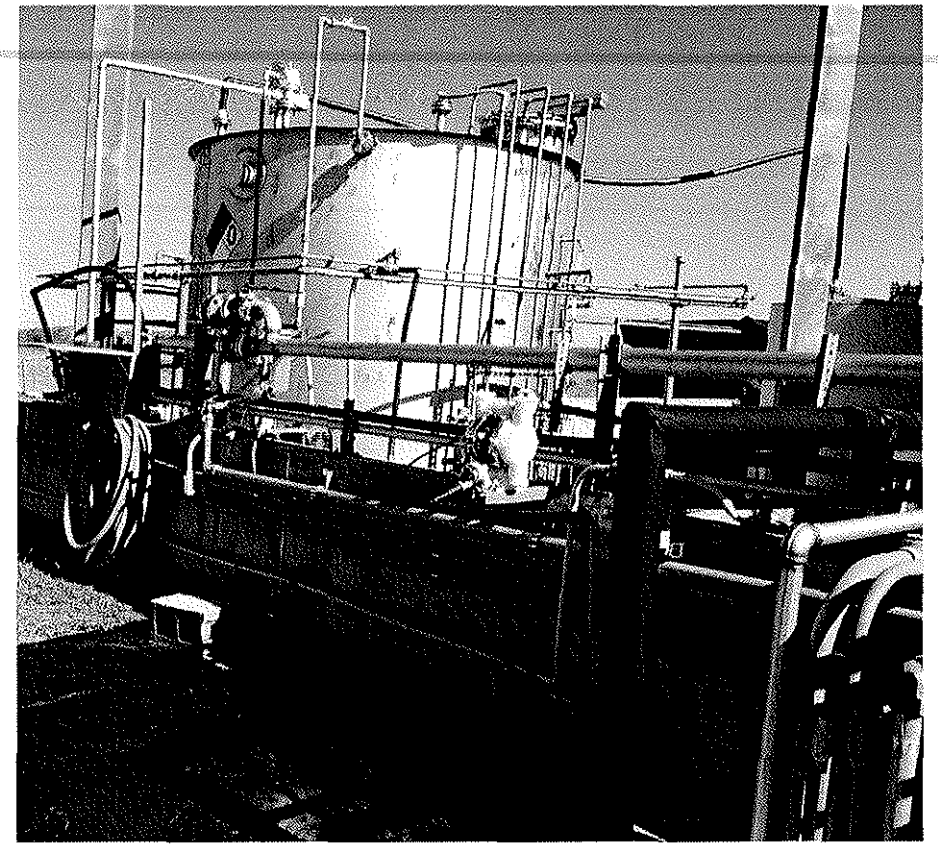
Describe issues and observations related to the implementation and scope of O&M procedures. In particular, discuss their relationship to the current and long-term protectiveness of the remedy.

Groundwater pumping and treatment is critical to the long-term effectiveness of the remedy. Groundwater extraction controls the groundwater gradient at the site and provides support to the containment measures provided by the vertical barrier wall. Maintenance of the cover and perimeter surface ditches prevents infiltration of surface water into the containment area.

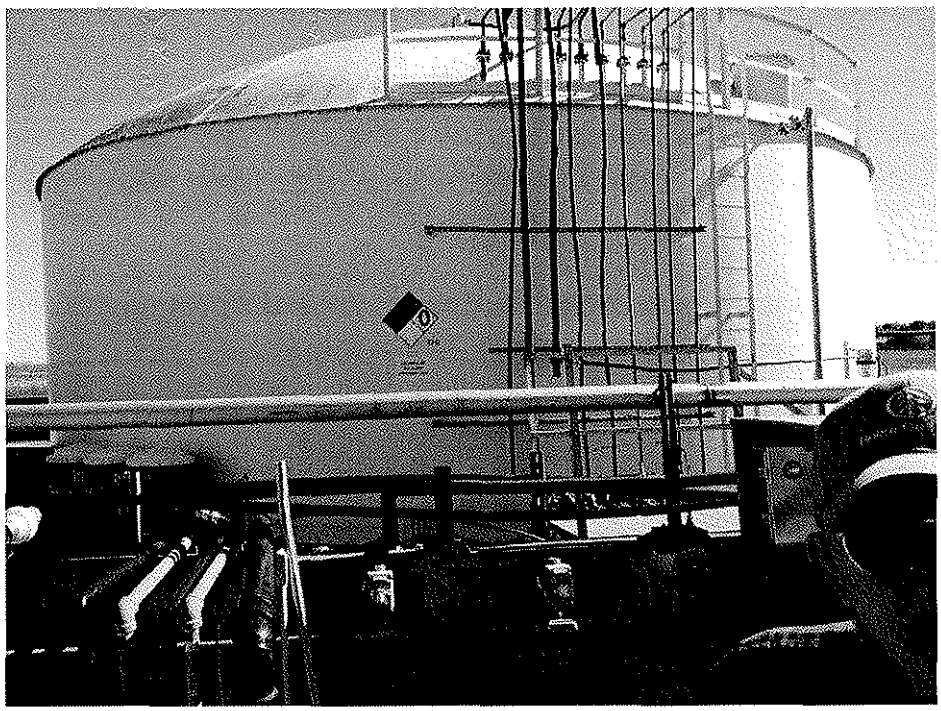
C.	**Early Indicators of Potential Remedy Problems**
	Describe issues and observations such as unexpected changes in the cost or scope of O&M or a high frequency of unscheduled repairs that suggest that the protectiveness of the remedy may be compromised in the future. While the remedy remains protective, consistent with the remedial action objectives of the response action, the groundwater monitoring and an investigation conducted during the review period detected affected groundwater in the FFSZ. The groundwater investigation will continue into the next review period.
D.	Opportunities for Optimization
	Describe possible opportunities for optimization in monitoring tasks or the operation of the remedy. No recommendations at this time.

ATTACHMENT 5

Photos



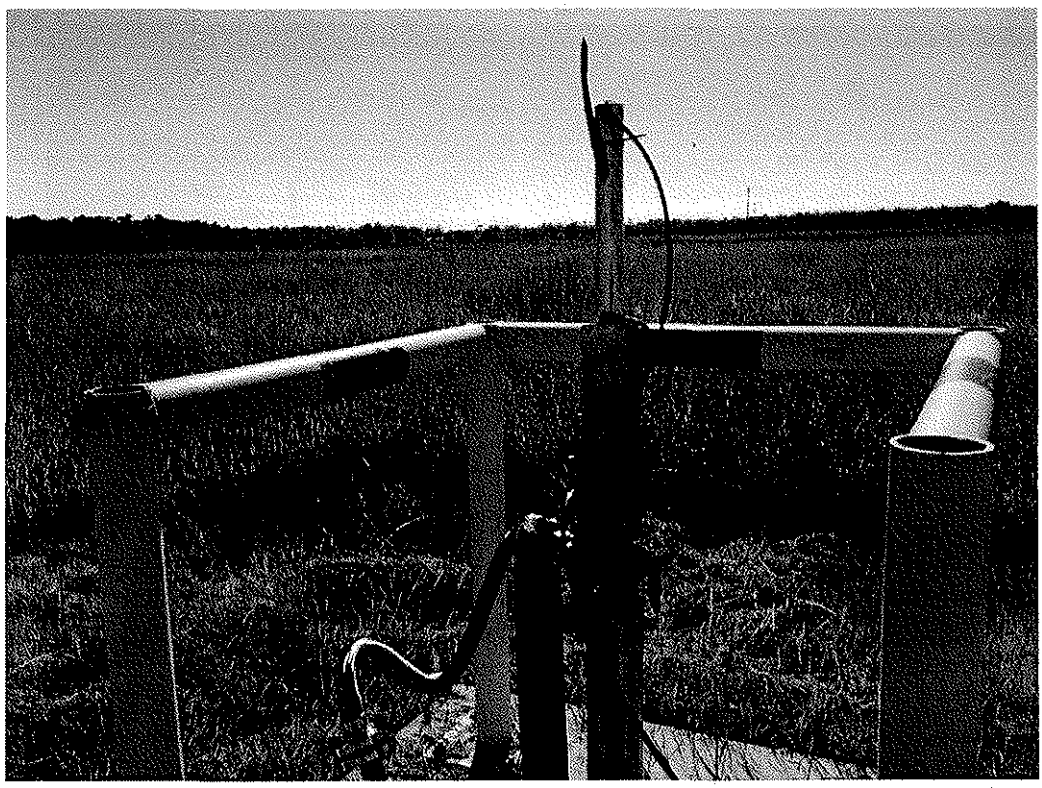
DNAPL Storage Tank T-218



Recovered Groundwater Storage Tank T-212

Photos taken December 12, 2013

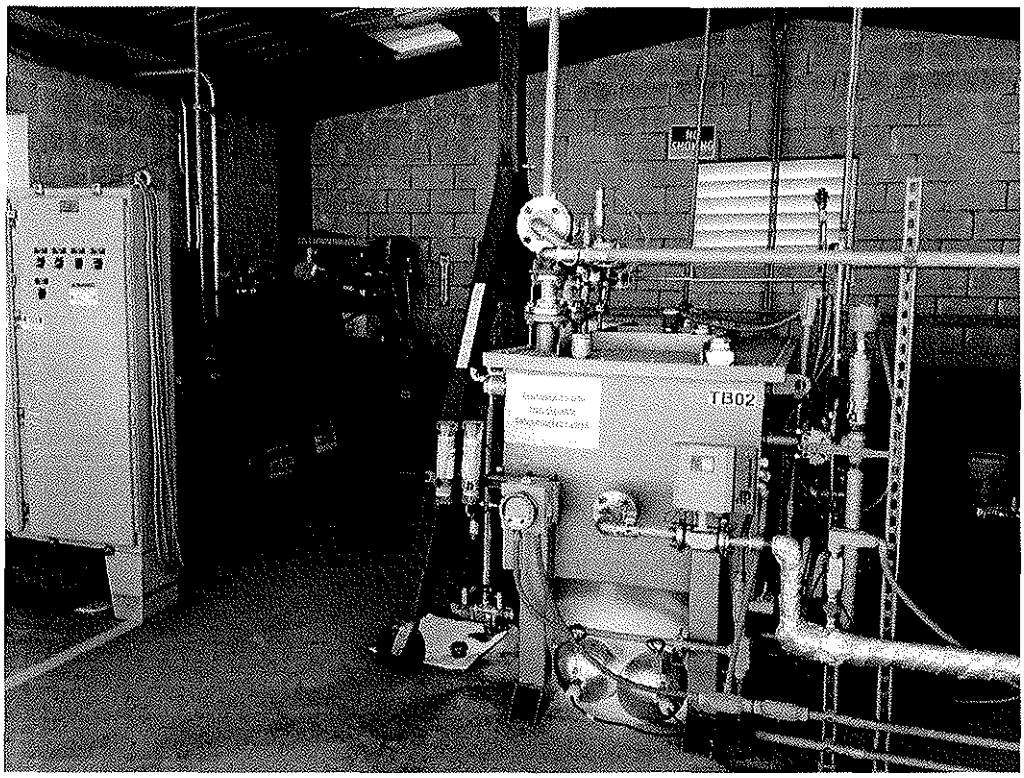
Treated Groundwater Storage Tanks T-213A and T-213B



DNAPL Recovery Well B01-DW

Photos taken December 12, 2012

Hub B Gas Collection System



Hub B Groundwater/DNAPL Separator

Photos taken December 12, 2012

FFSZ Groundwater Monitoring Well BMW-3B

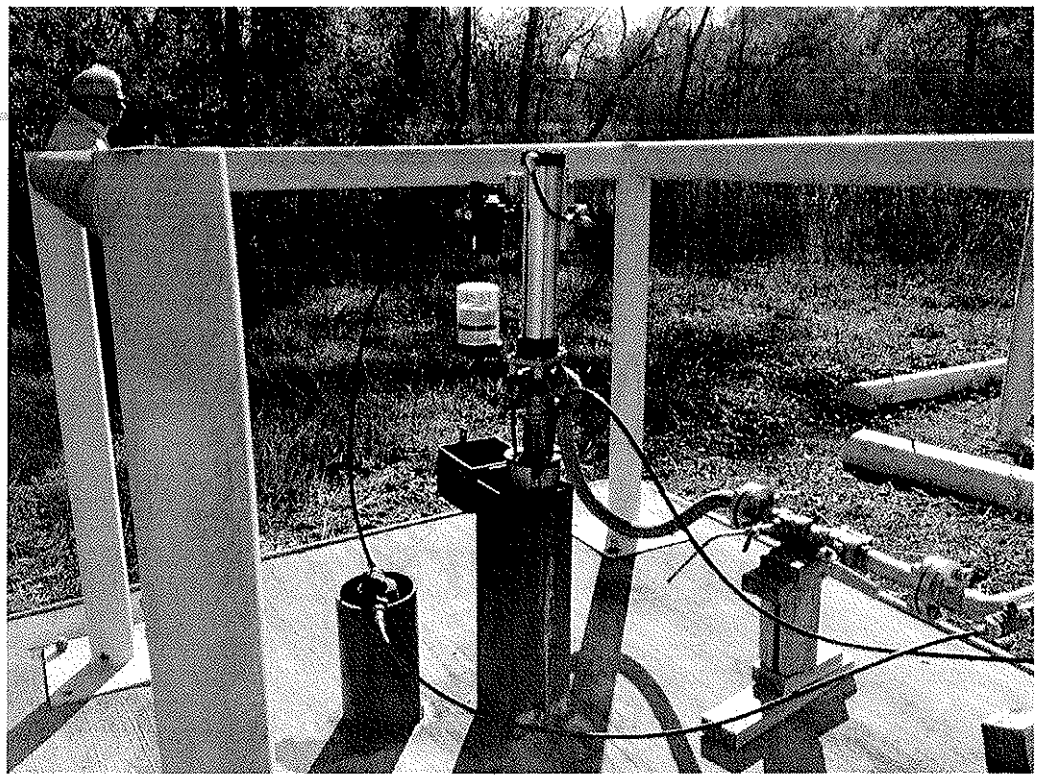
Typical Piezometer Surface Completion with ID Pipe

Photos taken December 12, 2012

Typical Piezometer Surface Completion with ID Pipe

Typical Piezometer Surface Completion and Well Casing

Photos taken December 12, 2012



South Plume Recovery Well PO-610R

Surface Water Letdown Structure from Perimeter Ditch to Mud Gully

Photos taken December 12, 2012

ATTACHMENT 6

Applicable, Relevant and Appropriate Regulations (ARARs)

ATTACHMENT 6

Applicable or Relevant and Appropriate Requirements (ARARs)

Medium/Authority	ARAR	Status	Requirement Synopsis	Action to be Taken to Attain ARAR
Groundwater/Federal	Federal SDWA – Maximum Contaminant Levels (MCLs; 40 CFR §141.61)	Relevant and Appropriate	Federal standards (MCLs) have been adopted as enforceable standards for public drinking water systems. Appendix C of the 1988 ROD states that since the FFSZ is not likely to serve as a public water system, MCLs are not applicable but "may be considered relevant." MCLs are being used for evaluation of monitoring results.	Operate groundwater and DNAPL recovery system and maintain composite cap system, in accordance with the MOM. Conduct annual groundwater monitoring in the FFSZ in accordance with the MOM to confirm compliance with established standards. Continue evaluation of contamination in the FFSZ.
Surface Water/State	Texas Surface Water Quality Standards, 30 TAC Chapter 307* Amended ROD (EPA, 7/2/97)- Adopts Texas Surface Water Quality Standards, 30 TAC Chapter 307* as NSCZ groundwater standards.	Applicable	Surface water quality standards have been developed to be protective of an incidental fishery.	Contain contaminated groundwater plumes in accordance with the MOM. Conduct quarterly monitoring of Mud Gully and Clear Creek in accordance with the MOM Plan to confirm compliance with established standards.
Air/Federal	Amended ROD (EPA, 7/2/97)- Federal limits established for Site to insure air quality does not contribute to air pollution; Statement of Work (Brio, 3/6/98) contained within the 1999 Amended Consent Decree; and MOM Plan, Rev. 4 (Brio, original submittal date February 2004).	Applicable	Fence Line Ambient Air Quality Standards (FLAAQS) and cover gas collection system standards have been established. Event-based protocols have been developed should a release to the environment occur.	Conduct ambient air and gas vent monitoring in accordance with the MOM to confirm compliance with established standards.

Notes:
1) Brio = Brio Site Task Force.
2) SDWA = Safe Drinking Water Act; ROD = Record of Decision; MOM Plan = Maintenance, Operations and Management Plan.
3) FFSZ = Fifty-Foot Sand Zone; NSCZ = Numerous Sand Channel Zone; DNAPL = Dense Non-Aqueous Phase Liquid.
* Note: The 30 TAC Chapter 307 standards that were in place at the time of the 1997 Amended ROD continue as standards as required by EPA. The standards were revised during the last review period and are used as surface water goals as required by EPA.

ATTACHMENT 7

Interview Record

The following is a list of individuals interviewed for this five-year review. See the attached contact records for a detailed summary of the interviews.

Name	Title/Position	Organization	Date
Mr. Chris Clark	General Manager	Clear Brook City MUD	1/2/13
Ms. Marie Flickinger	Publisher/Owner Chair Trustee	South Belt-Ellington Leader News Brio Community Advisory Group San Jacinto College South	1/4/13
Ms. Fay Duke	Project Manager	Texas Commission on Environmental Quality (TCEQ)	1/7/13

INTERVIEW RECORD			
Site Name: Brio Refining Superfund Site		**EPA ID No.: TXD980625453**	
Subject: Fourth Five-Year Review		**Time: 10 a.m.**	**Date: 1/2/13**
Type: ☒ Telephone Visit Other **Location of Visit:**		Incoming Outgoing	
Contact Made By:			
Name: Judi Martin	**Title: Community Relations**	**Organization: BSTF/JM Group**	
Individual Contacted:			
Name: Mr. Chris Clark	**Title: General Manager**	**Organization: Clear Brook City Municipal Utility District (MUD)**	
Telephone No: 281-484-1562 **Fax No:** **E-Mail Address:**		**Street Address: 11911 Blackhawk Blvd.** **City, State, Zip: Houston, TX 77089**	

Summary Of Conversation

Introduced the purpose of the Five-Year Review to Mr. Chris Clark and asked him several questions about its status and impact on the community. Mr. Clark said that the Brio Site is purely a historic situation and is cleaned up, tested regularly and does not impact the community. He said there is not much heard or seen about Brio and the average person does not know about it. He is not aware of any community concerns regarding the site or its operation and administration. He is not aware of any events or incidents at the site, such as vandalism and trespassing. When asked if he felt well informed about the site's activities and progress, he responded that there is nothing to be informed about because the administration is "doing its job." Mr. Clark had no further comments or suggestions. He drives past the property daily and offered that it is out of sight and out of mind.

INTERVIEW RECORD			
Site Name: Brio Refining Superfund Site		**EPA ID No.: TXD980625453**	
Subject: Fourth Five-Year Review		**Time: 10 a.m.**	**Date: 1/4/13**
Type: ☒ Telephone Visit Other **Location of Visit:**		Incoming Outgoing	
Contact Made By:			
Name: Judi Martin	**Title: Community Relations**	**Organization: BSTF/JM Group**	
Individual Contacted:			
Name: Ms. Marie Flickinger	**Title: Publisher/Owner**	**Organization: South Belt Ellington Leader Newspaper**	
Telephone No: 281-481-5656 **Fax No:** **E-Mail Address:**		**Street Address: 11555 Beamer Road** **City, State, Zip: Houston, TX 77089**	

Summary Of Conversation

Introduced the purpose of the five-year review. Ms. Flickinger offered her insights both by telephone and email. She believes the current operators are doing a good, conscientious job. Under the circumstances, she believes the remedy was the only choice. Still, after all these years she still supports the remedy. She said that in its current state, Brio does not have much effect on the community and she hopes it will remain as such. She offered that the only real concern during the past five years was caused by the media report indicating the site "was leaking". A comment which was thought by many to be putting toxics into the air, when actually was talking about movement 50+ feet underground. She is aware of some minor activities at the site, such as vandalism and trespassing, which were resolved. She supports the way things has been handled and does not feel there has been any serious situation that would give the community concern. Ms. Flickinger said she is informed about the site, and if anything were to incur, she believes she would be told. She would like more communication, even during the quiet times when there is nothing occurring at the site.

INTERVIEW RECORD			
Site Name: Brio Refining Superfund Site		**EPA ID No.: TXD980625453**	
Subject: Fourth Five-Year Review		**Time:**	**Date: 1/7/13**
Type: Telephone Visit ☒Other (Email) **Location of Visit:**		Incoming Outgoing	
Contact Made By:			
Name: Judi Martin	**Title: Community Relations**	**Organization: BSTF/JM Group**	
Individual Contacted:			
Name: Ms. Fay Duke	**Title: Project Manager**	**TCEQ**	
Telephone No: 512-239-2443 **Fax No:** **E-Mail Address:**		**Street Address: 12100 Park 35 Circle** **City, State, Zip: Austin, TX 78753**	

Summary Of Conversation

(Via Email)

1. What is your overall impression of the project? (general sentiment)
   The implemented remedy seems to be functioning well. The site is well maintained.

2. Have there been routine communications or activities (site visits, inspections, reporting activities, etc.) conducted by your office regarding the site? If so, please give purpose and results.
   Other than attending the EPA quarterly progress meeting, there are no routine activities performed by TCEQ.

3. Have there been any complaints, violations, or other incidents related to the site requiring a response by your office? If so, please give details of the events and results of the responses. **I am not aware of any problems requiring responses by TCEQ.**

4. Do you feel well informed about the site's activities and progress?
   Yes.

5. Do you have any comments, suggestions, or recommendations regarding the site's management or operation?
   No.