Board of County Commissioners

Hernando County

Public Works Department – Engineering Division

1525 East Jefferson Street
Brooksville, Florida 34601
(352) 754-4062
Fax: (352) 754-4423

October 7, 2010

Mr. William Kutash, PG
Waste Administrator
Florida Department of Environmental Protection
Southwest District Office
13051 North Telecom Parkway
Temple Terrace, FL 33637-0926

Subject: Remedial Action Plan
Hernando County DPW Former Fleet Maintenance Facility
201 West Martin Luther King Boulevard
Brooksville, Hernando County, Florida 34601
FAC ID # 27/8520223
FDEP Site No. COM – 65033/Project # 65840

Dear Mr. Kutash:

Hernando County is pleased to submit the enclosed Remedial Action Plan for the above referenced site pursuant to the extended deadline of October 7, 2010 approved by DEP. Enclosed please find three (3) signed and sealed hard copies and one (1) electronic pdf copy on CD.

Thank you for all of your assistance regarding this project. If you have any questions, please feel free to contact this office.

Sincerely,

Susan Goebel, P.E.
Hernando County Director of Public Works

Pc: David Hamilton, County Administrator
file

REMEDIAL ACTION PLAN

HERNANDO COUNTY DEPARTMENT OF PUBLIC WORKS
FORMER FLEET MAINTENANCE FACILITY
HERNANDO COUNTY, FL

201 West Martin Luther King Boulevard, Brooksville, FL

Prepared for:

Hernando County Department of Public Works
1525 East Jefferson Street
Brooksville, FL 34601

Prepared by:

Cardno TBE
20203 Cortez Blvd.
Brooksville, FL 34601

October 2010

EXECUTIVE SUMMARY

This Remedial Action Plan (RAP) has been prepared by Cardno TBE for Hernando County to address soil and groundwater impacts at the Hernando County Department of Public Works (DPW) Former Fleet Maintenance Facility site and adjoining properties. The Former Fleet Maintenance Facility site is located at 201 West Martin Luther King Boulevard, Brooksville, Hernando County, Florida. This site is not eligible for State funded underground storage tanks reimbursement programs. Remediation of the site is being fully funded by the County. The Florida Department of Environmental Projection (FDEP) has assigned facility identification number 278520223 to the site. Due to the mix of both petroleum and non-petroleum contaminants of concern (COC) at the site, remedial planning and implementation will proceed under criteria specified in both Chapter 62-770 (Petroleum Contamination Site Cleanup Criteria) and Chapter 62-780 (Contaminated Site Cleanup Criteria), Florida Administrative Code (FAC).

A February 10, 2009 Site Assessment Report (SAR) Addendum IV prepared by Creative Environmental Solutions, Inc. (CES) was approved by the FDEP on June 22, 2009. Petitions filed to appeal the approval were dismissed on January 9, 2010. The deadline for appeal for the petition ended on February 4, 2010. No further appeals were submitted and a final approval letter was issued February 8, 2010. Per Contaminated Site Cleanup Criteria Rule subsection 62-780.780(1), FAC, and Petroleum Contaminated Site Cleanup Criteria Rule subsection 62-770.700(1), FAC, a RAP was to be submitted within 90 days (May 10, 2010). Subsequently, FDEP approved extensions to this deadline until October 7, 2010.

On June 17, 2010, Hernando County, through the existing Continuing Civil Engineering Service Agreement, authorized Cardno TBE to prepare a RAP. This RAP proposes both primary and complementary remedial approaches allowing for the potential use of multiple technologies to achieve specific remedial cleanup targets for impacted media present on-site and on adjacent properties. The proposed technologies and milestones are presented as a decision tree to allow flexibility of the remedial approaches necessary to remediate the site as well as support future site redevelopment activities.

The approach for off-site soil impacts will be excavation and off-site disposal and restoration with clean backfill. The objective of this effort would be to obtain a No Further Action ruling.

The approach to addressing on-site soil impacts, including “petroleum”/“non-petroleum” and “shallow”/ “deep” is through site-wide risk management applying Engineering Controls that prevent human exposure (i.e. capping), thereby resulting in a No Further Action with Conditions scenario under Risk Management Option Level II (RMOII).

On-site perched “non-petroleum” groundwater impacts (Western Plume) meet the criteria for No Further Action through RMOII. For the perched “petroleum impacted” (Eastern Plume) groundwater, one year of monitoring is proposed to demonstrate the criteria for No Further Action by RMOII is also met.

Upper Floridan petroleum impacted groundwater is limited to a single monitor well. However, because the Floridan aquifer is a major source of potable water throughout central Florida, active remediation is proposed via gravity feed of a chemical oxidant product(s) directly into the monitor well to remediate petroleum constituents.

Additional complementary remedial approaches are included in the RAP and may be utilized as necessary to meet the ultimate goal of site closure and/or to facilitate site redevelopment.

The proposed schedule includes up to 24 months for active remediation from the time of RAP approval and site closure within approximately 40 months (3 ½ years) from RAP approval.

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Acronyms, Abbreviations, and Units of Measure

ACTL	Alternative Cleanup Target Level
AS	Air Sparging
bls	Below Land Surface
CES	Creative Environmental Solutions, Inc.
COC	Chemicals of Concern
CTL	Cleanup Target Level
DPT	Direct Push Technology
DPW	Department of Public Works
DTW	Depth to Water
EPA	Environmental Protection Agency
ETA	Engineering Technology of America
FAC	Florida Administrative Code
FDEP	Florida Department of Environmental Protection
ft	Feet
ft-bls	Feet Below Land Surface
GW	Groundwater
ISR	Interim Source Removal
ISCO	In-Situ Chemical Oxidation
LNAPL	Light non-aqueous phase liquid
MPE	Multi-Phase Extraction
MTBE	Methyltertbutylether
MW	Monitor Well
NADC	Natural Attenuation Default Concentration
NAM	Natural Attenuation Monitoring
NFA	No Further Action
PCB	Poly Chlorinated Biphenyl
PE	Professional Engineer
PG	Professional Geologist
pH	Scale of Acidity or Alkalinity
ppm	Parts Per Million
PQL	Practical Quantitative Limit
PARM	Post Active Remedial Monitoring
RAP	Remedial Action Plan
RMO	Risk Management Option
RMOII	Risk Management Option Level II
SAR	Site Assessment Report
SARA	Site Assessment Report Addendum
SB	Soil Boring
SCTL	Soil Cleanup Target Level
SRCO	Site Rehabilitation Completion Order
SVE	Soil Vapor Extraction
SVOC	Semi Volatile Organic Compound
TCLP	Toxicity Characteristic Leaching Protocol
TDS	Total Dissolved Solids
TMB	Trimethyl Benzene
TRPH	Total Recoverable Petroleum Hydrocarbon

µg/L	Micrograms per Liter
UIC	Underground Injection Control
UST	Underground Storage Tank
VOA	Volatile Organic Aromatic
VOC	Volatile Organic Compound
WWTF	Wastewater Treatment Facility

Remedial Action Plan Summary

DEP Form # 62-770.900(4)
Form Title: Remedial Action Plan Summary
Effective Date: September 23, 1997

Site Name Former Fleet Maintenance Facility
Location 201 West MLK, Brooksville, FL
Media Contaminated: ☒ Groundwater ☒ Soil

FDEP Facility ID No. 278520223
Current Date 10/07/10
Date of Last GW Analysis 4/20/10

Type(s) of Product(s) Discharged:

☒ Gasoline Analytical Group
☒ Kerosene Analytical Group (Diesel)
- Estimated Petroleum Mass (lbs):
  Groundwater 0.132kg
  Saturated Zone Soil Incl. In Groundwater
  Vadose Zone Soil 4,200kg
- Area of Plume 14,200 (ft^2)
- Thickness of Plume 10 ft perched (ft)

Groundwater Recovery and Specifications:

- No. of Recovery Wells _____
  ☐ Vertical ☐ Horizontal
- Design Flow Rate/Well _____ (gpm)
- Total Flow Rate _____ (gpm)
- Hydraulic Conductivity _____ (ft/day)
- Recovery Well Screen Interval _____ (ft)
- Depth to Groundwater _____ (ft)

Method of Groundwater Remediation:

☐ Pump-and-Treat
☐ Air Stripper
☐ Low Profile ☐ Packed Tower
☐ Diffused Aerator
☐ Activated Carbon
☐ Primary Treatment ☐ Polishing
☐ In Situ Air Sparging
- No. of Sparge Points _____
  ☐ Vertical ☐ Horizontal
- Pressure _____ (psi)
- Design Air Flow Rate/Well _____ (cfm)
- Total Air Flow Rate _____ (cfm)

☐ Biosparging
- No. of Sparge Points _____
  ☐ Vertical ☐ Horizontal
- Design Air Flow Rate/Well _____ (cfm)

☐ Bioremediation
☐ In Situ ☐ Ex Situ
☒ Other Chem Ox (Floridan) & RMOII for perched gw

Method of Groundwater Disposal:

☐ Infiltration Gallery ☐ Sanitary Sewer
☐ Surface Discharge/NPDES ☐ Injection Well
☐ Other _____

Free Product Present: ☐ Yes ☒ No
- Estimated Volume _____ (gal)
- Maximum Thickness _____ (in)
- Method of Recovery (check all that apply):
  ☐ Manual Bailing ☐ Skimming Pump
  ☐ Other _____

Method of Soil Remediation:

☒ Excavation
Volume to be Excavated 48 (yds^3)
☐ Thermal Treatment ☐ Land Farming On-site
☐ Landfill ☐ Bioremediation
☐ Other _____
☐ Vapor Extraction System (VES)
- No. of Venting Wells _____
  ☐ Vertical ☐ Horizontal
- SVE - Applied Vacuum _____ (in H_2O)
- Design Air Flow Rate _____ (cfm)
- Design Radius of Influence _____ (ft)
- Air Emissions Treatment
  ☐ Thermal Oxidizer ☐ Catalytic Converter
  ☐ Carbon ☐ Other _____

☐ Soil Bioventing
- No. of Venting Wells _____
  ☐ Vertical ☐ Horizontal
- Design Air Flow Rate _____ (cfm)

☐ In Situ Bioremediation _____
☒ Other Capping (RMOII)

Natural Attenuation:

- Method of Evaluation
  ☐ Rule 62-770.690(1)(e), F.A.C.
  ☐ Rule 62-770.690(1)(f), F.A.C.

Estimated Time of Cleanup: 1,200 (~3.5 yrs) (days)
- Method of Estimation
  ☐ Pore Volumes (no. of pore vols. = _____)
  ☐ Exponential Decay (Decay Rate) ____ (day^{-1})
  ☐ Groundwater Model
  ☒ Other 1 year to demonstrate RMOII

Estimated Cost:

- Est. Capital Cost (incl. install.) $ NA
- Est. O & M Cost (per year) $ NA
- Est. Total Cleanup Cost $ up to 400,000

1.0 INTRODUCTION AND BACKGROUND

1.1 Purpose and Scope

This Remedial Action Plan (RAP) has been prepared by Cardno TBE for Hernando County (the County) to address soil and groundwater impacts at the Hernando County Department of Public Works (DPW) Former Fleet Maintenance Facility site and impacted adjoining properties. The Former Fleet Maintenance Facility site is located at 201 West Martin Luther King Boulevard, Brooksville, Hernando County, Florida.

The objective of this RAP is to design an efficient, cost-effective remedial action program that will meet the following applicable criteria:

1. No Further Action criteria of 62-770.680(2) Florida Administrative Code (FAC) for petroleum related soil and groundwater impacts, with conditions (Risk Management Option II);
2. No Further Action criteria of 62-780.680(2) FAC for non-petroleum related soil and groundwater impacts, with conditions (Risk Management Option II).

1.2 Site Location and Description

The subject site, located at 201 West Martin Luther King (MLK) Boulevard, Brooksville, Florida, totals 5.46 acres (238,096 square feet) is located on the south side of West MLK Boulevard, approximately 0.25 mile west of Main Street and 1.0 mile east of Broad Street in Hernando County, Florida. The site contains four total parcels with the primary parcel fronting MLK Boulevard and three (3) ancillary, adjacent parcels to the south of the primary parcel having access to A Street. According to the Hernando County Property Appraiser, the four (4) parcels have following individual Parcel Identification Numbers and land areas:

- R27 422 19 0000 0010 0000 – 217,800 square feet in area
- R27 222 19 2730 00A0 0100 – 7,596 square feet in area
- R27 222 19 2730 00A0 0110 – 6,235 square feet in area
- R27 222 19 2730 00A0 0120 – 6,465 square feet in area

The property is currently used for storage of County voting machines. The property is situated in the southwest ¼ of the northeast ¼ of Section 27, Township 22 South, Range 19 East. Hernando County purchased three adjoining residential/ vacant properties at the southeast corner of the facility (142 A Street, vacant lot, and 162 A Street), in March 2009. A facility vicinity map is included as **Figure 1**. A current site plan is included as **Figure 2**.

1.3 Existing Utilities

Potable water and sanitary sewer service is available through the City of Brooksville. A below grade stormwater collection system exists consisting of inlets and culverts. The site includes both overhead and below grade electric service.

1.4 Surrounding Uses

Land uses adjacent to the subject site include single-family residential to the north, south and east and warehouse and vacant uses to the west. Property to the south, east and west of the subject site are located in the jurisdiction of Hernando County, while property to the north is located in the jurisdiction of the City of Brooksville. This area of the County is generally comprised of medium density single-family residential uses, low density multifamily residential uses, and a mix of commercial uses including: warehouse, distribution, light manufacturing, flex warehouse, office and retail, as well as numerous vacant undeveloped parcels of land. The site is bounded to the north by MLK Boulevard and to the west and south by drainage ditches. The site (including the three properties at the southeast corner of the facility) is enclosed by a chain link fence to restrict access to the public. The topography in the area generally slopes to the south. The site appears to have historically received significant fill as evidenced by an elevation change of 6 to 10 feet at the southern property line relative to surrounding properties.

1.5 Potable Well Survey

Potable water is supplied to the site and surrounding area by the City of Brooksville Department of Public Works (municipal water supply). Based on a Florida Department of Health Bureau of Water Programs Potable Well Survey dated August 15, 2005, and associated documentation, the SAR/SARA documents indicate there are no potable wells located within a ¼ mile of the site and two potable wells located within ½ mile of the site. There have been no known documented impacts to the potable wells. Related documentation is included in **Appendix A**.

1.6 Historical Use of Site

Previous assessment documents indicate that the site was privately owned from 1885 to 1955. Hernando County has owned the property since 1955. The County utilized the property as its public works maintenance facility shortly until 2003. The site contains two one-story buildings located in the southwest corner of the property.

1.7 Summary of Previous Assessment Work Conducted

Groundwater and soil concentrations have been documented above applicable cleanup target levels (CTLs) specified in Chapter 62-777 FAC, Tables 1 and 2, respectively. Previous site assessment activities conducted include efforts by Engineering Technology of America, Inc. (ETA) and most recently by Creative Environmental Solutions, Inc. (CES). Interim source (contaminated soil) removal activities were conducted onsite by CES as a precursor to full scale site remediation. An Interim Source Removal (ISR) Report dated October 28, 2008, was prepared by CES for the facility and was submitted to the FDEP on behalf of the County. Because no confirmatory soil sampling was conducted during the activities to document the effectiveness of the ISR activities, FDEP has indicated during a recent meeting with County Staff and Cardno TBE personnel that they will not be providing review comments associated with ISR activities.

This RAP is based upon the FDEP-approved site assessment data generated by others, as reported in the site assessment documentation described below.

A Site Assessment Report Addendum IV (SARA IV) dated February 10, 2009, was prepared by CES and submitted to the Florida Department of Environmental Protection (FDEP) on behalf of the County. In correspondence dated June 22, 2009, FDEP provided SAR approval and recommended the preparation of a RAP pursuant to Chapter 62-780.700, FAC, and Chapter 62-770.700 FAC.

Although the SAR was approved by FDEP, additional data and/or corrections were requested by the Department to be submitted in the form an Errata document. A Site Assessment Report Errata dated August 7, 2009 was submitted to FDEP.

1.8 Site Hydrogeology

1.8.1 Lithology

Based on the SARA IV, surficial sands are generally underlain by clayey sands and sandy clays, which in turn are underlain by limey clays and eventually limestone. Perched groundwater is observed as shallow as 4 feet. The Floridan aquifer was detected at approximately 113 ft-bls during drilling of a vertical extent well as identified in previous SARA documents. Geologic cross-sections and their relative locations presented as Figures 3A to 3D from the CES SARA IV is included in **Appendix B**. Cardno TBE has not performed additional subsurface investigations.

1.8.2 Groundwater Flow

The depth to groundwater at this site is typically less than 4 to 8 ft below land surface (bls) for the perched groundwater and approximately 113 ft bls for the Floridan groundwater. A summary of historical water level data is provided in **Table 1** located at the end of the text. Water table elevation contour maps from previous assessment documents are included in **Appendix C**. Prior assessments have documented the general perched groundwater flow direction to be south/southeast while the Floridan aquifer flow direction has been documented to be generally north/northwest.

1.9 Summary of Soil and Groundwater Impacts

Table 2 summarizes the assessed impacts to soil and groundwater both on-site and off-site. There has been no documented free product (i.e. light non-aqueous phase liquid (LNAPL)) either on-site or off. Comprehensive groundwater quality data is included in **Tables 3 and 4** at the end of the text. Soil and groundwater impacts based on the previous CES SARA IV data are also included as **Figures 3 through 6**.

Table 2: Summary of Soil and Groundwater Impacts

	Impacted Soils (0-6 ft bls) Onsite	Impacted Soils (25-115 bls) Onsite	Impacted Soil (0-6 ft bls) Offsite	Impacted Perched Groundwater Onsite	Impacted Floridan Groundwater Onsite	Impacted Groundwater Offsite
Arsenic	Yes	No	Yes	No	NA	No
Barium	Yes	NA	Yes	No	NA	No
Chromium	Yes	No	No	No	No	No
Lead	Yes	No	No	No	No	No
Selenium	Yes	No	No	No	NA	NA
VOAs	Yes	Yes	No	Yes	Yes	No
SVOAs	Yes	No	No	Yes	No	No
TRPH	Yes	No	No	Yes	No	No
Pesticides /PCBs	No	No	No	No/NA	No/NA	No

1.9.1 Impacted Soils On-Site

As will be presented in subsequent sections, the approach to impacted on-site soils, both petroleum and non-petroleum will be through a site-wide risk management remedial approach. Therefore, detailed soil assessment data can be referenced from the approved SARA IV and Errata documents previously submitted.

1.9.2 Pre-RAP Confirmatory Groundwater Sampling

CES conducted Pre-RAP confirmatory groundwater sampling from January 18 to January 21, 2010 and again on April 20 and April 21, 2010. The data from these sampling events has not been submitted to date to FDEP. Samples from the January sampling event were laboratory analyzed by EPA Method 8260B, 8270C, and FL-PRO. Samples from the April sampling event were laboratory analyzed by EPA Method 8260B. Pre-RAP groundwater sampling data obtained from CES including field notes, field instrument calibration records, groundwater sampling logs, and laboratory analytical reports inclusive of chain of custody records are included in **Appendix D.**

1.9.3 Petroleum Groundwater Impacts (Eastern Plume)

Dissolved petroleum groundwater impacts are present in the former underground storage tank (UST) area and remote gasoline pump dispenser area. The resultant groundwater plume is referred to as the “eastern plume”. The impacts in this area are governed by 62-770 FAC (Petroleum Contamination Site Cleanup Criteria).

Groundwater impacts in the eastern plume area are generally contained within the perimeter of the former dispenser island. Three monitor wells, MW-21-1, MW-21-2, and MW-22-1 were re-sampled by CES during January and April 2010 "pre-RAP" sampling events. The data indicates exceedances of groundwater cleanup target levels (GCTLs) for benzene, ethylbenzene, and isopropylbenzene but are below their respective natural attenuation default criteria (NADCs), 62-777 FAC, Table V. A single exceedance of the NADCs was observed for isopropylbenzene in MW-22-1 at a level of 174 ug/L. An excerpt from the groundwater summary table is included as **Table 2A** for reference.

1.9.4 Floridan Aquifer Impacts

Dissolved petroleum Floridan aquifer impacts have been documented in the previously approved SARA IV. Confirmatory Pre-RAP groundwater sampling results indicate that the levels and area of impact within the Floridan have reduced from previous assessments. Historical groundwater data including the most recent data from the Pre-RAP sampling are included in **Table 3**. The previously impacted DW-6-3 now has concentrations below GCTLs.

The following is a summary of the impacts (Exceedances are included in parentheses as (GCTLs/NADCs):

1. benzene with one NADC exceedance (DW-6-1) of 108 ug/L (1ug/100ug/L)
2. ethylbenzene with one GCTL exceedance (DW-6-1) with concentration of 38 ug/L (30 ug/300 ug/L)
3. isopropylbenzene with one NADC exceedances of 29 ug/L (0.8 ug/8 ug/L)

Table 2A: Petroleum Groundwater Impacts (Eastern Plume) – January/April 2010

Sample Location					MW-21-1		MW-21-2		MW-21-2		MW-22-1		MW-22-1	
Collect Date					1/19/2010		1/19/2010		4/20/2010		1/19/2010		4/20/2010	
Method	Parameter	Units	GCTLs	NADCs	Result	Qualifier	Result	Qualifier	Result	Qualifier	Result	Qualifier	Result	Qualifier
8260	Benzene	ug/L	1	100	**1.02**		<0.211		<0.211		<0.211		<0.211	
8260	Toluene	ug/L	40	400	<0.247		<0.247		**0.26**	I	<0.247		**0.65**	I
8260	Ethylbenzene	ug/L	30	300	<0.196		**1.05**		**7.45**		**59.9**		**125**	
8260	Total Xylenes	ug/L	20	200	<0.298		**0.71**		<0.696		<0.298		**0.43**	I
8260	MTBE	ug/L	20	200	**0.43**	I	<0.261		<0.261		<0.261		<0.261	
8260	Sec-Butyl-Benzene	ug/L	NE	NE	NA		NA		**1.24**	I	NA		**5.61**	
8260	Tert-Butly-Benzene	ug/L	NE	NE	NA		NA		<0.339		NA		**0.91**	I
8260	n-Butyl-Benzene	ug/L	NE	NE	NA		NA		<0.452		NA		<0.452	
8260	n-propyl-Benzene	ug/L	NE	NE	NA		NA		**4.8**		NA		**221**	
8260	isopropylbenzene	ug/L	0.8	8	NA		NA		**3.07**		NA		**174**	
8260	p-Cymene	ug/L	NE	NE	NA		NA		<0.353		NA		<0.353	
8260	Dichlorobenzene, 1,3-	ug/L	210	2100	NA		NA		<0.235		NA		<0.235	
8260	Trimethylbenzene, 1,2,4-	ug/L	10	100	NA		NA		<0.823		NA		**3.76**	I
8260	Trimethylbenzene, 1,3,5-	ug/L	10	100	NA		NA		<0.434		NA		**2.55**	

1.9.5 Non-Petroleum Groundwater Impacts (Western Plume)

Non-petroleum groundwater impacts are present in the former paint storage area. The resultant groundwater impacts are referred to as the "western plume". Although the documented impacts are chemicals of concern typically associated with petroleum hydrocarbons, the source was originally assessed to be from a non-petroleum source; therefore the impacts in this area are governed by 62-780 FAC (Contaminated Site Cleanup Criteria).

A summary of **Table 2B** is included below. Exceedances are included in parentheses as (GCTLs/NADCs).

1. benzene with six GCTL exceedances and one NADC exceedance with maximum concentration of 117 ug/L (1ug/100ug/L)
2. ethylbenzene with two NADC exceedances with maximum concentration of 392 ug/L (30 ug/300 ug/L)
3. total xylenes with two GCTL exceedances with maximum concentration of 69 ug/L (20 ug/200 ug/L)
4. isopropylbenzene with two GCTL exceedances and four NADC exceedance with maximum concentration of 116 ug/L (0.8 ug/8 ug/L)
5. trimethylbenzene 1,2,4- with one NADC exceedance of 157 ug/L (10 ug/100 ug/L)
6. trimethylbenzene 1,3,5- with one GCTL exceedance of 12.2 ug/L (10 ug/100 ug/L)

Table 2B: Non-petroleum related Groundwater Impacts (Western Plume) January/April 2010

Area of Interest				11		11		11		11		11		11		11		11		11		11		11	
Sample Location				MW-11-03		MW-11-03		MW-11-23		MW-11-23		MW-11-36		MW-11-36		MW-11-38		MW-11-38		MW-11-40		MW-11-40		MW-20-1		MW-20-1	
Collect Date				1/20/2010		4/20/2010		1/20/2010		4/20/2010		1/20/2010		4/20/2010		1/20/2010		4/20/2010		1/20/2010		4/20/2010		1/20/2010		4/20/2010	
Parameter	Units	GCTLs	NADCs	Result	Qualifier	Result	Qualifier	Result	Qualifier	Result	Qualifier	Result	Qualifier	Result	Qualifier	Result	Qualifier	Result	Qualifier	Result	Qualifier	Result	Qualifier	Result	Qualifier	Result	Qualifier
Benzene	ug/L	1	100	**2.51**		4.41		**117**		**95.1**		**3.53**	I	**1.99**		**2.97**		**5.26**		**13.6**		**13.6**		**50.9**		**41.6**	
Toluene	ug/L	40	400	<0.247		**0.3**	I	**1.38**	I	<1.24		<2.47		**1.04**		<0.247		**0.34**	I	**0.57**	I	**0.84**	I	**4.47**		**5.9**	I
Ethylbenzene	ug/L	30	300	**3.22**		**0.37**	I	**19.8**		**8.5**		**556**		**392**		**2.16**		**6.71**		**9.68**		**26.1**		**208**		**237**	
Total Xylenes	ug/L	20	200	**2.59**		**1.07**	I	**37.6**		**29.4**		**142**		**68.59**		**0.87**		**1.16**	I	**0.92**		**0.88**	I	**8.22**		**8.1**	I
MTBE	ug/L	20	200	<0.261		<0.261		<1.30		<1.3		<2.61		<0.261		<0.261		<0.261		<0.261		<0.261		<1.30		<2.61	
Sec-Butyl-Benzene	ug/L	NE	NE	NA		**1.49**	I	NA		<1.64		NA		**8.18**		NA		**11.3**		NA		**17.9**		NA		**8.4**	I
Tert-Butly-Benzene	ug/L	NE	NE	NA		<0.339		NA		<1.7		NA		<0.339		NA		**5.18**		NA		**1.74**	I	NA		<3.39	
n-Butyl-Benzene	ug/L	NE	NE	NA		**0.95**	I	NA		<2.26		NA		**9.45**		NA		**10.5**		NA		**20.7**		NA		**8.8**	I
n-proply-Benzene	ug/L	NE	NE	NA		**10.7**		NA		**6.75**	I	NA		**105**		NA		**83.7**		NA		**238**		NA		**230**	
isopropylbenzene	ug/L	0.8	8	NA		**6.84**		NA		**6.55**		NA		**42.9**		NA		**36.5**		NA		**110**		NA		**116**	
p-Cymene	ug/L	NE	NE	NA		<0.353		NA		<1.77		NA		**5.71**		NA		<0.353		NA		<0.353		NA		<3.53	
Dichlorobenzene, 1,3-	ug/L	210	2100	NA		<0.235		NA		<1.17		NA		<0.235		NA		<0.235		NA		**1.15**		NA		**11.7**	
Trimethylbenzene, 1,2,4-	ug/L	10	100	NA		**5.75**		NA		**9.25**	I	NA		**157**		NA		<0.823		NA		<0.823		NA		<10.9	
Trimethylbenzene, 1,3,5-	ug/L	10	100	NA		<0.434		NA		**3.8**	I	NA		**12.2**		NA		<0.434		NA		<0.434		NA		<4.34	

I = The reported value is between the laboratory limit of detection (MDL) and the laboratory limit of quantitation (PQL).
< = Indicates that a specific compound was analyzed for but not detected. The reported value shall be the MDL.
NE = Not Established
BDL = The values are from tables in a previous report by ETA; no lab data to review for actual detection limits
NA = Not Analyzed
D = Surrogate could not be calculated due to sample dilutions

1.9.6 Previous Contaminant Mass Estimations

Estimations of contaminant mass were included in the approved SARA IV as follows:

- Estimated 4,161 kilograms (4.6 tons) of petroleum hydrocarbon contaminants are present in perched zone vadose soils, based on contaminant concentrations exceeding the Leachability Based on Groundwater SCTL (LG-SCTL).
- Estimated 39.2 kilograms of petroleum hydrocarbon contaminants are present in vadose soils between the base of the perched zone and the top of the Floridan aquifer.
- Estimated 0.132 kilograms of petroleum hydrocarbon impacts are present in perched zone groundwater.

2.0 REMEDIAL TECHNOLOGIES EVALUATION AND SELECTION

2.1 Objective

The objective of this remedial alternatives evaluation is to identify and evaluate various remedial strategies (primary and complementary/follow-up approaches) that will accommodate an efficient, cost-effective remedial action program. The intent of the remedial action program will be to meet the Conditional No Further Action Criteria of 62-770.680(2) and 62-780.680(2) FAC, to not impede effective reuse of the site, and to be protective of human health and the environment. The primary purpose of identifying both primary and complementary remedial alternatives is to facilitate implementation of one or more pre-approved remedial options or alternatives giving the County flexibility of remedial action implementation with prior FDEP approval. The various remedial options are presented below and as a "remedial approach decision tree analysis" in Section 2.6.

Cardno TBE has evaluated numerous remedial alternatives for the site. The final remedial alternatives selection(s) are based on the flexibility of the design to accommodate site redevelopment activities, proven effectiveness of the selected remediation methods, as well as physical challenges related to the site's proximity to residential areas, extensive clayey soils with associated perched water table, and a considerable depth to impacted groundwater in the upper Floridan aquifer. The following **Worksheet 1: Assessment of Feasible Remedial Technologies** includes additional information on the review of available technologies. A brief discussion of various remedial alternatives evaluated is presented below.

2.2 Potential In-situ Technologies

In-situ treatment technologies utilize in-place treatment methodologies such as injection of air, biological augmentation products, chemical oxidation compounds, soil blending, thermal-resistive heating and others. Specific examples of FDEP-approved in-situ technologies include:

1. Bio-enhancement/Oxygen Enhancement (Petrox Plus, ORC, etc.)
2. Bio-augmentation (addition of microorganisms into subsurface)
3. Chemical oxidation (activated sodium persulfate and/or others)
4. Fixation, chemically binds contaminants to prevent migration or leaching to groundwater
5. Reactive Barriers to prevent migration
6. Air-sparge (AS/SVE)

WORKSHEET 1: ASSESSMENT OF FEASIBLE REMEDIAL TECHNOLOGIES

Facility Name: Herando County DPW Former Fleet Maintenance Facility
Facility Address: 201 West Martin Luther King Boulevard, Brooksville, FL

Medium	Technology	Description	Advantages	Disadvantages	Recommended	Remarks
Free Product	Manual Bailing	bailing from recovery or monitor well	low capital cost, requires little to no maintenance	labor intensive, intermittent	NA	No Free Product Documented
	Absorbent Socks	socks hung from recovery or monitor well	little capital investment, low maintenance	intermittent	NA	No Free Product Documented
	Product Pump or Skimmer	Mechanical system to skim/pump product from water surface	continuous recovery	moderate capital costs, required equipment handling/maintenance	NA	No Free Product Documented
Soil	**Capping**	**Placing an impermeable cover over contaminated materials**	**-Simple to install/implement -Effective in stopping rainwater from seeping to contaminated materials -Minimizes potential exposure**	**-Requires ongoing maintenance of Cap and institutional controls to limit disturbance of Cap**	**PRO**	**Proposed for on-site soils. Needs to be coordinated with any proposed redevelopment**
	In Situ Solidification / Stabilization	Mixing cement or similar binding agents or injecting chemical reagents that bind with the contaminants to render them immobile	eliminates needs for hauling and off site disposal	- effective on multiple contaminant types including those found on site	PNP	Not most cost effective alternative
	Landfarming	spreading excavated contaminated soils in a thin layer on the ground surface and stimulating aerobic microbial activity within the soils through aeration and/or the addition of minerals, nutrients, and moisture	low to moderate capital cost, low operating cost	requires large area; special permitting/approval	NA	Limits redevelopment during remediation; potential odors Does not address groundwater.
	Thermal Resistive Heating	Electric current applied to soils/water through electrode netwrok. Causes subsurface heating to destroy and volatilize contaminants which can be collected and treated at the surface through conventional means.	quick, complete	expensive, requires accessibility	NA	Too expensive. Does not address groundwater.
	Ex-Situ Bioremediation	heaping contaminated soils into piles (or "cells") and stimulating aerobic microbial activity within the soils through the aeration and/or addition of minerals, nutrients, and moisture	Low cost, better contact with remedial fluids/oxygen than in-situ application	limited performance data, accessibility to soil, long timeframe, large area needed for biopiles	NA	Limits redevelopment during remediation; potential odors. Does not address groundwater.
	Ex-Situ Soil Washing	Batch treatment of excavated soil with solvents/surfactants to liberate and collect adsorbed contaminants	wide applications; high removal efficiencies; minimal fire/explosion hazard	requires expensive treatability studies, limited to soil accessibility; no contamination destruction - collected rinsate requires disposal and may be hazardous.	NA	Active site, no excavation proposed Too expensive.
	Excavation/Disposal	**physical excavation and offsite disposal**	**removes contamination from site, no rebound concerns not limited by contact or lithology concerns**	**soil needs to be accessible; limited depth based on equipment**	**PRO**	**Most cost effective approach to addressing impacted soils**
	In-situ Bioventing	trenching of perforated piping to enhance oxygen levels and biodegradation	low capital, easy install. low maintenance	need suitable bacterial population; depends on soil characteristics	NA	Slow remedial progress, may limit redevelopment alternatives

WORKSHEET 1: ASSESSMENT OF FEASIBLE REMEDIAL TECHNOLOGIES

Facility Name: Herando County DPW Former Fleet Maintenance Facility
Facility Address: 201 West Martin Luther King Boulevard, Brooksville, FL

Medium	Technology	Description	Advantages	Disadvantages	Recommended	Remarks
	Soil Vacuum Extraction	removal of vapors from subsurface by placing vacuum on either vertical or horizontal vapor wells (perforated)	limited site disruption, easy; relatively quick; minimal maintenance. lower capital cost/operations.	soil characteristics may limit influence. depends on nature of contamination, ongoing maintenance of equipment May be equipment noise issues	NP	Requires active remediation system, ongoing electrical and operations costs
	Natural Attenuation	Allowing natural microorganisms to degrade impacted soils	no capital or operating cost; simple	slow clean-up	NP	Not acceptable to FDEP because of levels above Commercial/Industrial and NADCs
	Recovered Vapor Treatment Options					
	Vapor Phase Carbon Adsorption	treating recovered vapors with carbon cannisters prior to discharge to atmosphere	simple to operate; lower costs for lower concentrations.	cost per pound high for high volumes of contamination.	NP	no vapors anticipated after removal of petroleum impacted soils
	Thermal/Catalytic Oxidation	complete oxidation of vapors through mechanical means	complete contamination. destruction; high effluent.	requires fuel supply; noisy; complex; higher maintenance	NP	Expensive, O&M problems, fuel supply, complex.
	Biofiltration	treating recovered vapors with biofilter (biological treatment media)	simple to operate; lower maintenance; complete	only 60-75% efficient; need time to acclimate bacterial population; space	NP	Not recommened for higher concentrations.
Groundwater (In-Situ)	In-situ Air Sparging	injecting air into subsurace through pressurized sparge wells	simple to operate; low to moderate costs; quick; multi-process	sensitive to lithology; requires soil vapor extraction	NP	Not recommended based on site geology and pilot testing
	Biosparging (low-flow air sparging)	same as above at lower flowrates	simple to operate; lower install costs; enhances biodegradation; should not generate signficant vapors	sensitive to lithology and concentrations	PRO	Proposed for Floridan groundwater impacts if necessary
	In-situ Bioenhancement	injection of a number of market products to enhance indigenous microbial population	low capital; complete destruction	Need to have suitable indigenous bacertia to be effective. May need additional monitoring.	**PRO**	Proposed to enhance bioremediation
	In-situ Bioaugmentation	introducing laboratory developed microbes into the subsurface	complete destruction; faster than bioenchancement alone	Nutrient and oxygen levels need to be closely monitored to ensure bacterial colony propogation	**PNP**	Subject site likely to have indigenous populations
	Chemical Oxidation Fenton's Chemistry	**injection of a number of market products to chemicaly oxidize contaminants**	**complete destruction**	**can be costly; strict pH control; limited influence**	**PRO**	**Proposed for Floridan groundwater impacts**
	Natural Attenuation	allowing natural microorganisms to degrade impacted groundwater	no capital or operating cost	slow clean-up	NA	More aggressive approach desired. GW quality does not meet Cleanup Target Levels.
Groundwater (Ex-Situ)	Multi-Phase Extraction (MPE)	recover of both liquids and gas by applying high vacuum to subsurface	rapid recovery; low perm. soil; short remediation time	complex; high energy cost; high emissions; expensive	NP	AS/SVE less expensive; requires cost of groundwater treatment and discharge. Shown to be non-effective
	Pump and Treat	physical pumping of gw from recovery well using mechanical pump	exert hydraulic control; aquifer flushing	diffusion limited; prefer flow; higher maintenance	NA	Requires maintenance. Moderate costs. Longer term approach. Preferential flow.
	Recovered Groundwater Treatment Options					
	Liquid Phase Carbon Adsorption	treating recovered water with carbon cannisters prior to discharge to sewer	simple to operate; lower costs for lower concentrations.	cost per pound high for high volumes of contamination.	NP	Not recommended for anticiapated volume and flow rate from dewatering system
	Direct discharge to sanitary sewer	Pumping recovered water into sanitary sewer with no pretreatment	low cost	permit required, contaminant concentrations must meet influent criteria	**PRO**	Most cost effective alternative
	Air Stripping	physical removal of volatile organics through mechanical means	well established performance	moderate operating cost; may need iron treatment;	**PRO**	Proposed for dewatering activities associated with excavation and Floridan groundwater recovery
	Liquid Phase Carbon Adsorption	passing recovered groundwater through carbon media for adsorption of contaminants	simple to operate	cost per pound high; lower efficiencies; fouling	**PRO**	Proposed for dewatering activities associated with excavation and Floridan groundwater recovery
	Lead Filter	passing recovered groundwater through lead filter for adsorption of contaminants	simple to operate	expensive disposal	NA	No long-term groundwater recovery.
	Infiltration Gallery	Reinjecting recovered groundwater to redistribute into subsurface	no operating cost; hydraulic effect	higher capital cost; space consuming; strategic location	NA	No long-term groundwater recovery.
	Injection Well	Reinjecting recovered groundwater into injection well for redistribution into subsurface	lower operating costs	difficult permitting	NA	No long-term groundwater recovery.
	Storm Sewer		good when sanitary not an option or no gallery feasibility.	extra monitoring; disposal costs; higher treatment standards	NA	No long-term groundwater recovery.

Note:
PRO - Proposed Technology
PNP - Possible Technology but Not Proposed
NA - Not Applicable Technology
NP - Not Proposed

Remedial effectiveness with most in-situ technologies relies on effective contact of the chemical contaminant and treatment media, radius of influence if injecting air or liquid augmentation products, permeability of the soil and/or aquifer, viability of indigenous microbial populations, and compatibility of contaminants. Some of these technologies require permanent treatment systems and monitoring or multiple applications to be successful, which may hinder redevelopment alternatives.

2.3 Potential Ex-situ Technologies

Ex Situ technologies involve completion of remedial activities above grade, use of onsite or offsite treatment and disposal options, groundwater recovery/pump and treat technologies and many others. Specific examples of FDEP approved ex-situ technologies include:

1. Excavation and offsite disposal of impacted soils
2. Excavation, treatment, and replacement of soils onsite
3. Land farming and replacement of soils onsite
4. Groundwater Pump and Treat Systems with discharge of treated water to storm or sanitary sewer, or to on-site exfiltration system(s).
5. Soil vacuum extraction (SVE) or multi-phase extraction (MPE)

Remedial effectiveness with most ex-situ technologies relies on effective removal of contaminant mass prior to onsite treatment or offsite disposal. Mass removal via pump and treat can be limited by preferential groundwater flow pathways and by slow diffusion of contaminants in these pathways. Mass removal limitations for excavation are typically related to access, either due to structures or contaminant depth. Of these technologies, excavation, landfarming and soil blending operations can be very invasive for short periods of time and may disrupt site operational activities or impact site occupants. Groundwater recovery technologies may require semi-permanent treatment systems and monitoring that may impact redevelopment. However, given that the site is unoccupied, significant ex-situ remedial activities could be implemented and completed prior to or incorporated into site redevelopment planning and construction activities. This approach would mitigate many of the limitations associated with use of these technologies and should not delay redevelopment activities.

Early pilot testing activities (AS with SVE and MPE) conducted by Engineering Technology of America, Inc (ETA), as reported in the Pilot Test Field Report dated July 2000, indicated that the use of MPE would have limited influence, AS would not be feasible, and SVE (through a horizontal vapor well) was determined to be potentially effective. The application of MPE conducted by ETA proved to be relatively ineffective.

2.4 Institutional and Engineering Controls

Institutional Controls place a restriction on the use or access to a site to eliminate or minimize exposure to contaminants. Institutional Controls are non-engineering/non-physical measures and usually, but not always, are legal controls intended to affect human activities in such a way as to prevent or reduce exposure to contamination. The legal mechanism, the Institutional Control, contains restrictions or prohibitions such as land and resource use restrictions, and well-drilling prohibitions. Generally, the Institutional Control itself may be in the form of a restrictive covenant, modified consent order, or conservation easement. Each of these documents must be properly recorded with the appropriate county's land records to help ensure proper notice and effectiveness of the control.

Engineering controls such as impermeable barriers (i.e., caps, bentonite slurry walls, HDPE liners, etc.) or other physical controls are designed to limit access and exposure to contamination and/or are designed to eliminate further migration of the contamination. Where an engineering control is used, Institutional Controls must always be imposed to ensure that engineering controls are properly monitored and maintained, and that the FDEP has access to inspect the engineering control.

2.5 Selection of Primary Remedial Alternatives

Based upon the evaluation of the relevant remedial alternatives identified previously and the evaluation of various redevelopment alternatives, the proposed remedial methodologies are considered to be cost effective and proven technologies. Additionally, they provide for flexibility of implementation to accommodate a variety of potential end uses, while meeting the overall objective of not impeding the effective reuse of the site while being protective of human health and the environment. While the following alternatives have been identified as the "primary remedial strategy" for soil and ground impacts, alternative complimentary remedial approaches

have been selected and presented as “complimentary alternatives” giving the County flexibility of remedial implementation with FDEP approval. The purpose of identifying primary remedial approaches and complementary alternatives is to allow implementation of one or more pre-approved remedial options to facilitate a streamlined expeditious process.

2.5.1 Overview of Primary Remedial Strategy

The proposed approach for off-site soil impacts will be excavation and off-site disposal and restoration with clean backfill. The objective of this effort would be to obtain a No Further Action ruling for off-site impacts.

The general approach to addressing on-site soil impacts is to address “petroleum” and “non-petroleum”, “shallow” and “deep” impacts through a site-wide risk management approach of applying Engineering Controls that prevent human exposure (i.e. capping), thereby resulting in a No Further Action with Conditions scenario under Risk Management Option Level II (RMOII).

As suggested by FDEP at the Pre-RAP meeting on September 22, 2010, the proposed approach for the perched “non-petroleum” (Western Plume) groundwater impacts is a No Further Action through RMOII (62-780.680(2)(d)4. While Risk Management is the proposed remedial approach, the County may opt to excavate soils in the “non-petroleum” areas to facilitate site redevelopment only and not to remove soil impacts above SCTLs. The County may pursue conducting this impacted soils removal effort as an interim remedial action under 62-770.300 FAC, Interim Source Removal.

For the perched “petroleum” (Eastern Plume) groundwater impacts, one year of monitoring is proposed to demonstrate the criteria for No Further Action by RMOII (62-770.680(2)(d)4) is met; as with the “non-petroleum” groundwater impact area.

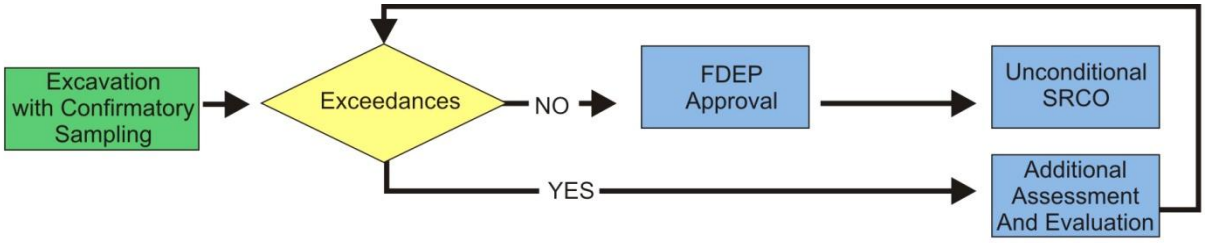
Upper Floridan petroleum impacted groundwater is limited to a single monitor well, DW-6-1. However, because the Floridan aquifer is a major source of potable water throughout central Florida, active remediation is proposed via gravity feed of a chemical oxidant product(s) directly into the monitor well to remediate petroleum constituents.

Additional details on proposed remedial approaches, including active remedial implementation, are outlined in the following sections.

2.5.2 Off-site Soil Arsenic Impacts

Three areas of off-site arsenic impacts were identified in the previous CES SARA IV document. Excavation with off-site disposal of impacted soils is proposed for Areas 1 and 2 below. Area 3, previously excavated during the interim remedial activities, will require confirmatory sampling. Dewatering to facilitate excavation of off-site arsenic impacted soils is not proposed. Off-site soil arsenic impacts as defined by the approved SARA IV are presented on **Figure 4.** Also, Figures 5A and 5E from the SARA IV are included in **Appendix C** for reference.

Impacted soil will be disposed of at an appropriate FDEP approved facility. Pre-disposal soil samples will be analyzed as required by the specific disposal facility permit. Clean backfill will be provided from an FDEP approved backfill pit and will be screened pursuant to recent FDEP Guidance entitled "Preapproval Program Backfill QA Procedure", effective August 1, 2010. Excavated areas will be brought to original grade and resurfaced in-kind.



Area 1 – Western Off-Site Soils

Deeper soil arsenic impacts were determined to extend slightly west of the western site boundary. This area is approximately 500 square feet (sf) and impacts were identified in soils from 6-8 ft below land surface (bls) only. While this area is shown to exist on the property line with portions of the area both on-site and off-site, the entire area is proposed for excavation. The estimated volume (tonnage) of soil for off-site disposal is 44 cubic yards (62 tons at 1.4 tons/cubic yard).

Due to the depth, steep soil angle of repose (ditch) and water table conditions likely to be encountered during excavation, pre-excavation direct push technology (DPT) soil delineation/confirmatory sampling will be conducted. Soil sampling for arsenic will be conducted at 0.5, 2.0, 4.0, 6.0, and 8.0 ft intervals approximately 5 ft outside of the current delineation provided in the approved SARA IV. Supplemental (step-out) borings and sampling will be

conducted at 10 ft beyond the currently approved SARA IV delineation and archived for subsequent analysis. The purpose of this process is to reduce safety hazards associated with confirmatory sampling of deep and steeply sloped excavations. Shoring will not be practical because the sidewalls of interest could not be sampled (shoring in the way); therefore the above sampling process will provide a "clean perimeter" to dig to. Following confirmatory "clean perimeter sampling", excavation and proper off-site disposal of impacted soil and backfilling will be conducted. Pre-excavation confirmatory sampling results and appropriate transportation and waste disposal documentation will be submitted to FDEP thereby achieving "No Further Action without Controls" for offsite soil. Excavation calculations are included as **Appendix E**.

Area 2 – Eastern Off-Site Soils

Off-site arsenic soils located east of the site boundary as identified in the approved SARA IV (0 to 0.5 ft interval only) will be excavated with proper off-site disposal of impacted soil. Confirmatory sampling and appropriate documentation will be submitted to FDEP thereby achieving "No Further Action without Controls" for offsite soils. The estimated volume (tonnage) of soil for off-site disposal is 4 cubic yards (6 tons at 1.4 tons/cubic yard).

Area 3 – Southern Off-Site Soils

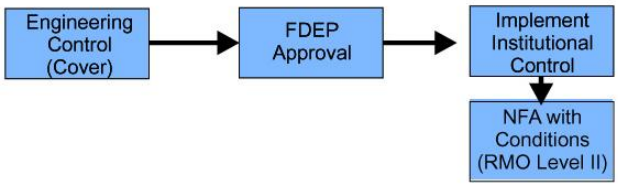
Confirmatory sampling will be conducted to document that the off-site soil arsenic impacts to the south were removed during the 2008 interim remedial action excavations. In conjunction with confirmatory arsenic sampling, confirmatory sampling for off-site soil TRPH impacts removed during the 2008 interim remedial action excavations will be performed. Figure 15A (TRPH) from the SARA IV is included in **Appendix C** for reference

2.5.3 On-site Soils

The proposed remedial action strategy for onsite soil impacts is as follows:

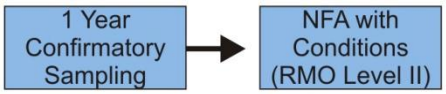
- The existing impervious cover, including asphalt pavement, concrete sidewalks, and concrete pads will be utilized as an engineering control (EC) that prevents human exposure to soils that exceed the direct exposure soil CTLs. An Institutional Control (IC) in the form of a restrictive covenant (deed restriction) will be created to restrict site uses and to ensure that the EC remains in place. The use of ICs and ECs is designed to support a "No Further Action with Controls" for soils by Risk Management Option Level

II, as defined in both Chapter 62-770.680(2) and 62-780.680(2) FAC. Alternatively, if redevelopment activities have the potential to impact contaminated media, source removal and/or on-site management activities may be necessary and notification provided to FDEP prior to implementation pursuant to IC/EC FDEP Guidance (November 2004 and June 1999, respectively).



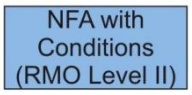
2.5.4 Perched Groundwater with "Petroleum Impacts" (Eastern Plume)

The proposed remedial strategy for shallow perched water table impacts is NFA Risk Management Option (RMO) II pending one year of monitoring data to substantiate.



2.5.5 Perched Groundwater with "Non-Petroleum" Impacts (Western Plume)

As previously discussed, these impacts will be also be addressed via NFA RMOII, as defined in Chapter 62-780.680(2)(d)4 FAC.



2.5.6 On-site Floridan Aquifer Impacts

The selected remedial action strategy for the limited on-site Floridan aquifer impacts consists of direct-feed via gravity of Regenox™ In-situ Chemical Oxidation reagent (120 lbs product and 269 gallons per event for 5% solution) directly into deep well DW-6-1. As discussed at the Pre-RAP meeting, groundwater geochemical data will be collected prior to introduction of reagent to establish "baseline" conditions. Following treatment, if and when groundwater quality returns to its baseline conditions, the monitor well can be utilized for Post Active Remediation Monitoring (PARM). It is anticipated that three treatment events (1 per month for 3 months) will be

necessary to reduce contaminant impacts to below NADCs. Then ACTLs will be established under NFA RMO II. If baseline conditions are not achieved, a replacement monitor well will be constructed.

If contaminant impacts persist or the County chooses to implement a more aggressive remedial approach, complementary remedial approaches may be applicable. These options are discussed further in Section 2.6, Remedial Approach Decision Tree Analysis.

2.6 Remedial Approach Decision Tree Analysis

To provide maximum flexibility in reaching cleanup targets, a decision tree analysis is included with alternative approaches to remedial action, should the primary approach not provide the desired results or if the County pursues more aggressive remediation to facilitate site redevelopment. Therefore, as recommended by the FDEP, we have proposed the following "decision tree" alternatives in the event that the primary remedial approaches presented do not result in the desired results.

2.6.1 Decision Tree Alternatives for On-Site Shallow Soil Impacts

To facilitate site redevelopment, the County may pursue source area excavation and off-site disposal of shallow "non-petroleum" impacted soils only (western plume area). This effort would be made in conjunction with short term active remediation via groundwater recovery/treatment (dewatering for 60 days) to additionally support active remediation of shallow non-petroleum impacted groundwater.

The source removal effort would consist of the following:

- Dewatering to approximately 15 ft bls, recovered groundwater treatment via portable air-stripper with discharge to sanitary sewer (City of Brooksville Cobb Road Wastewater Treatment Facility (WWTF)).
- Excavation and off-site disposal of soils to approximately 10 ft bls. The proposed excavation area of approximately 3,200 square feet is indicated on **Figure 7**. The estimated volume of soil to be excavated and disposed of off-site is approximately 1,422 cubic yards or approximately 1,991 tons (based upon a conversion of 1.4 tons/cubic yard).

2.6.2 Decision Tree Alternatives for Perched Groundwater with Petroleum Impacts (Eastern Plume)

Again to facilitate site redevelopment, the County may pursue the following complementary approaches:

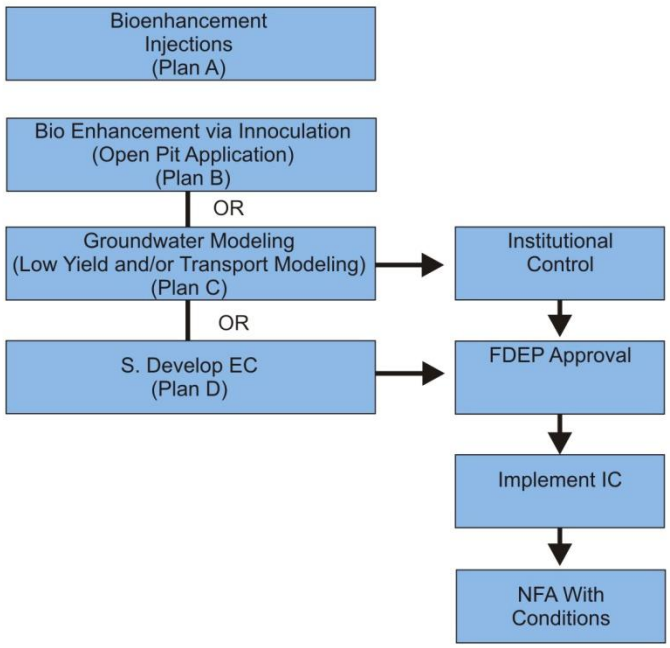
1. Bioenhancement Injections with ORC-A via DPT
2. Groundwater Modeling/Transport Modeling, then IC (no on site pumping), FDEP approval, Implement IC, NFA with Conditions.
3. Develop EC, with IC, FDEP approval, Implement IC, NFA with Conditions.

The decision tree is identical to that shown for Section 2.6.3 below minus the inoculation.

2.6.3 Decision Tree Alternatives for Perched Groundwater with Non-Petroleum Impacts (Western Plume)

Again to facilitate site redevelopment, the County may pursue the following complementary approaches:

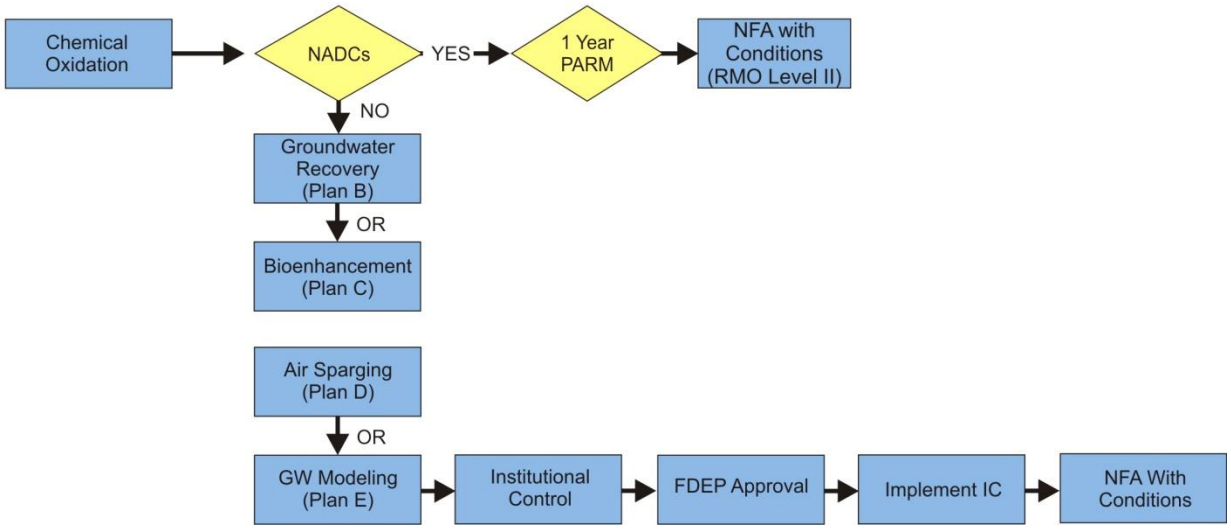
1. Bioenhancement Injections with ORC-A
2. Bioenhancement via Innoculation
3. Groundwater Modeling/Transport Modeling, then IC (no on site pumping), FDEP approval, Implement IC, NFA with Conditions.
4. Develop EC, with IC, FDEP approval, Implement IC, NFA with Conditions.



2.6.4 Decision Tree Alternatives for Floridan Aquifer Impacts

If NADCs are not achieved through the proposed chemical oxidation approach then the following is proposed:

1. Groundwater recovery for up to 6 months with an electric submersible Grundfos pump. Recovered groundwater to be treated via air stripper and/or granular activated carbon (GAC) with disposal to the City of Brooksville sewer system.
2. Bioenhancement via gravity feed of ORC-A in similar fashion to chemical oxidation implementation.
3. Episodic air sparging (AS) through installation of a single 1-inch sparge well in the immediate vicinity of the impacted well.
4. Groundwater Modeling/Transport Modeling, then IC (no on site pumping), FDEP approval, Implement IC, NFA with Conditions



3.0 REMEDIAL ACTION IMPLEMENTATION

3.1 Western Plume Source Area Dewatering/Treatment

3.1.1 Dewatering for Complementary Approaches as Necessary

Cardno TBE reviewed with City of Brooksville staff on September 23, 2010 the potential to utilize the City's existing sanitary sewer system for effluent discharge of treated groundwater during dewatering/groundwater recovery activities. The City indicated that this would be acceptable given that effluent quality from a groundwater recovery treatment system was consistent with the permit requirements of the Cobb Road WWTF.

To excavate soil below the water table and access the smear zone, a dewatering system will be set up along an extended perimeter from the proposed excavation area. The dewatering system will include up to 40 well points [approximately 0.5 gallons per minute flow (gpm) estimated per well point], installed to a depth of 15 feet bls and 10 feet apart. A sixty-foot opening in the dewatering system will be provided for equipment access to the excavation.

Each well point will be connected via flexible swing joints to 4-inch header piping, pumped with a 4-inch diesel pump. The groundwater recovered from the dewatering system will be treated with a portable shallow tray air stripper or granular activated carbon, prior to discharging to an on-site sanitary sewer manhole on the east end of the property. The discharge will occur for the duration of operation necessary to accomplish the soil removal and shall comply with applicable permit requirements per the City of Brooksville Cobb Road WWTF.

The water treatment system design will be based on estimated influent hydrocarbon concentrations and the dewatering system's design flow rate of 20 gpm. The maximum influent concentrations would be based on the highest concentrations of hydrocarbons historically observed in the groundwater.

3.2 Bioenhancement

3.2.1 Inoculation of Open Excavation Pit with Bioenhancer

Under the decision tree analysis for the western plume, this approach consists of applying product to the open pit after excavation activities are complete but prior to backfilling and while the dewatering system is still in operation. The bioenhancement product is physically broadcast

onto the floor and sidewalls of the open pit.

The application of this product will enhance in-situ bioremediation by the addition of an oxygen source to stimulate native petroleum-degrading microbes. ORC-A™, a FDEP accepted innovative technology, was chosen for bioaugmentation at this site. ORC-A is a calcium-based peroxygen containing 17% by weight active oxygen that slowly releases oxygen over a period of 9-12 months after application. It is the most widely applied oxygen release technology available in the marketplace with over 14,000 site applications to date.

The ORC-A™ will provide a long-lasting oxygen source, accelerating growth of indigenous aerobic petroleum degrading microbes.

3.2.2 Bioenhancer Injections

Bioenhancer injections have been included in the decision tree analysis for both the western and eastern plumes. The design was based on the areas and concentrations of the western plume. While overly conservative for the eastern plume, the same approach has been applied to both plumes. In the event that this approach is utilized for either plume, the following will apply:

In a one-time injection event, ORC-A™ will be added to water and mixed in a 500-gallon (truck-mounted) poly-tank. A direct-push technology (DPT) rig will inject a 30% slurry ORC-A™ (3,150 lbs lbs of ORC-A™ with 880 gallons of water) into 49 injection points. Injections will be on 10-ft spacing. Use of the DPT rig will eliminate the need for costly installation of permanent injection points.

To provide horizontal coverage of the estimated plume area, the injection point locations have been designed in a grid pattern with a 10 feet-on-center between rows. To provide vertical coverage of the estimated plume area, the ORC-A™ slurry will be applied in one-foot vertical intervals bls (4 lbs of ORC-A™ per foot) starting at 7 ft bls and terminating at 15 ft bls for the injections.

3.2.3 ORC-A Product Information

The FDEP acceptance letter for ORC-A™, Material Safety Data Sheet (MSDS), Excavation and Grid Application Design Worksheets, and installation instructions are provided in **Appendix F**.

The original ORC acceptance letter indicates that an existing Underground Injection Control (UIC) variance was granted to Regenesis by FDEP on January 4, 1999. The temporary zone of discharge for this variance is a 20-foot injection radius around each injection point (or 20 foot zone around limits of excavation), and the duration of time for which total dissolved solids (TDS) and pH may temporarily exceed their respective groundwater standards is one (1) year. This remedial design will propose application of ORC-A™ under the August 27, 2001, rule 62-522.300 (2)(c), FAC. Pursuant to this rule, TDS and pH in the ORC slurry have been identified to exceed the secondary drinking water standards and require groundwater monitoring. The temporary zone of discharge is designed with a 10-ft radius around the excavation application of ORC-A™ for one (1) year.

Prior to ORC-A™ applications, background concentrations of TDS and pH will be taken from applicable on site monitor wells. Following the event, TDS and pH will be monitored for one year following the application.

3.3 Chemical Oxidation for Floridan Aquifer Groundwater Impacts

The proposed chemical oxidation treatment for the Floridan groundwater impacts will utilize RegenOx Part A, a sodium percarbonate complex that slowly releases hydrogen peroxide over a period of approximately 3 weeks. The primary byproduct of the product is oxygen, which can help stimulate the aerobic bioremediation of petroleum hydrocarbons. Based on the longevity of RegenOx Part A and the need to attain good distribution of the oxidant solution, the recommended treatment will be a regimen of three (3) gravity feed “injection” events.

3.3.1 RegenOx Part A Product Information

The FDEP acceptance letter for RegenOx Part A, Material Safety Data Sheet (MSDS), Application Design Worksheet, and installation instructions are provided in **Appendix G**.

4.0 POST ACTIVE REMEDIATION MONITORING

A summary of active remediation and post active remediation monitoring is provided in **Worksheet 2**. Initial groundwater sampling will be performed as indicated on the attached worksheet (active remediation phase)based on historical groundwater analytical data from the site. As a result, the samples obtained from select monitor wells will be analyzed for COCs including benzene, toluene, ethylbenzene, total xylenes, etc. via United States Environmental Protection Agency (USEPA) Method 8260B. Groundwater monitoring will be conducted in accordance with groundwater sampling requirements established in Chapter 62-770 and 62-780, FAC and the applicable portions of the FDEP Standard Operating Procedures (DEP SOP-001/01).

A combination of historical groundwater data and PARM sample results will be used to demonstrate that residual groundwater impacts are not migrating, and/or that COC concentrations are stable or reducing. This information will be used to support a conditional SRCO under RMOII conditions.

WORKSHEET 2: REMEDIAL SYSTEM MONITORING SCHEDULE

Facility Name: **Herando County DPW Former Fleet Maintenance Facility**
Facility Address: **201 West Martin Luther King Boulevard, Brooksville, FL**

Well ID	K/P[1]	Quarterly	Annually
SAMPLING SCHEDULE			
MW-11-03		8260	8260/8270C
MW-11-23		8260	8260/8270C
MW-11-36		8260	8260/8270C
MW-11-38		8260	8260/8270C
MW-11-40		8260	8260/8270C
MW-11-28		8260	8260
MW-11-42		8260	8260
MW-11-29		8260	8260
MW-11-31		8260	8260
MW-27-1		8260	8260
MW-11-41		8260	8260
MW-11-47		8260	8260
MW-11-37		8260	8260
MW-21-1		8260	8260
MW-22-1		8260	8260
MW-10-3		TRPH	TRPH
DW-6-1		8260	8260
DW-6-2		8260	8260
DW-6-3		8260	8260

[1] Designates Key (K) or Perimeter (P) Monitoring Wells.

[2] Recovered vapors and post-treatment emissions shall be collected weekly for the first month next two months, and quarterly thereafter unit the mass of total petroleum hydrocarbons in the lbs/day. Emissions will be treated for at least the first 30 days if the mass of total petroleum hy does not exceed 13.7 lbs/day. Recovered vapors and post-treatment emissions shall be analy

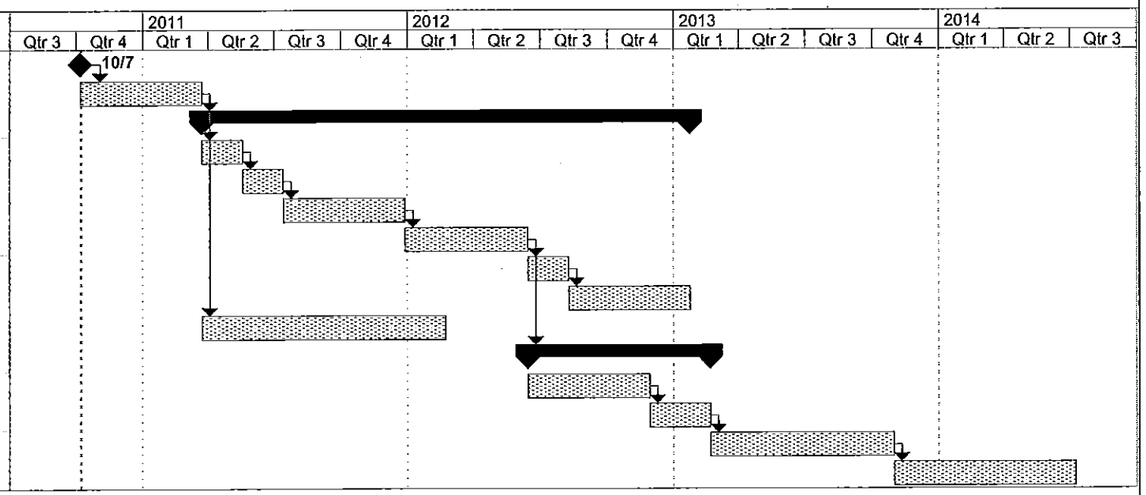
[3] Daily for first three days with 24-hour turnaround, monthly for the next two months, and quart

5.0 PROJECTED REMEDIATION SCHEDULE

A projected remediation schedule is provided on the following **Figure 8**.

Figure 8: Project Schedule

ID	Task Name	Duration	Start	Finish	Predecessors
1	Remedial Action Plan Submittal	0 mons	Thu 10/7/10	Thu 10/7/10	
2	FDEP Review and Approval of RAP	6 mons	Thu 10/7/10	Wed 3/23/11	1
3	**Remedial Action (On-Site Floridan/Off-site Arsenic)**	**24 mons**	**Thu 3/24/11**	**Wed 1/23/13**	**2**
4	Preparation of Plans/Specs	2 mons	Thu 3/24/11	Wed 5/18/11	2
5	Bidding and Award Phase	2 mons	Thu 5/19/11	Wed 7/13/11	4
6	Complete Active Remedial Actions	6 mons	Thu 7/14/11	Wed 12/28/11	5
7	Post Remedial Action Monitoring	6 mons	Thu 12/29/11	Wed 6/13/12	6
8	Develop ACTLs	2 mons	Thu 6/14/12	Wed 8/8/12	7
9	FDEP Review and Approval of ACTLs	6 mons	Thu 8/9/12	Wed 1/23/13	8
10	Confirmatory Monitoring	12 mons	Thu 3/24/11	Wed 2/22/12	2
11	**Engineering/Institutional Controls**	**9 mons**	**Thu 6/14/12**	**Wed 2/20/13**	**7**
12	Restrictive Covenent Prep	6 mons	Thu 6/14/12	Wed 11/28/12	
13	Restrictive Covenent Review and Approval	3 mons	Thu 11/29/12	Wed 2/20/13	12
14	SRCO with Conditions	9 mons	Thu 2/21/13	Wed 10/30/13	13
15	Closure	9 mons	Thu 10/31/13	Wed 7/9/14	14



Project: FleetMaintSched.mpp
Date: Thu 10/7/10

Task — Progress — Summary — External Tasks — Deadline

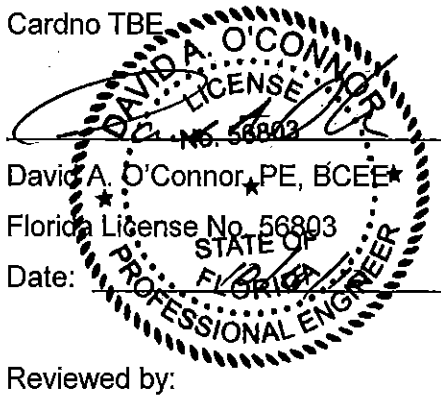
Split — Milestone — Project Summary — External Milestone

6.0 DOCUMENT CERTIFICATION

I, David O'Connor, P.E. # 56803, certify that I currently hold an active license in the state of Florida and am competent through education or experience to provide the engineering services contained in this report. I further certify that, in my professional judgment, this report meets the requirement of Sections 62-770 and 62-780 for Active Remediation, and was prepared by me or under my direct responsible charge. Moreover, I certify that Cardno TBE holds an active Certificate of Authorization #3843 to provide the engineering service.

Prepared by:

Cardno TBE



David A. O'Connor, PE, BCEE

Florida License No. 56803

Date: 10/6/10

Reviewed by:

Cardno TBE

Richard Hagberg, PG

Florida License No. 1956

Date: 10/6/10

7.0 REFERENCES CITED

Creative Environmental Solutions, February 10, 2009. Site Assessment Report Addendum (SARA IV). Prepared for Hernando County Public Works.

Creative Environmental Solutions, August 7, 2009. Site Assessment Report Errata, Prepared for Hernando County Public Works.

Creative Environmental Solutions, May 2010. Remedial Action Plan. Prepared for Hernando County Public Works.