Basis of Design Report
Site W Swale Treatment System
at
Aurora Facility
Army Adelphi Research Laboratory

Naval Surface Warfare Center
White Oak, Maryland

Engineering Field Activity Chesapeake
Naval Facilities Engineering Command
Contract Number N62472-90-D-1298
Contract Task Order 0284

July 1998

Brown & Root Environmental
A Division of Halliburton NUS Corporation

Section : 6.04
Site 20903-5640 (White Oak)
Doc. #: W/0004

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C-49-7-8-189

July 31, 1998

Project Number 7612

Ms. Kim Bellis
Department of the Navy
Engineering Field Activity Chesapeake
Washington Navy Yard, Building 212
901 M Street SE
Washington, D.C. 20374-5018

Reference: Clean Contract No. N62472-90-D-1298
Contract Task Order 0284

Subject: Basis of Design Report
Site W Swale Treatment System
Site 46 - Naval Surface Warfare Center, White Oak, Maryland

Dear Ms. Bellis:

Enclosed are 4 copies of the Basis of Design Report for the Site W Swale Treatment System associated with Site 46 at the Naval Surface Warfare Center, White Oak, Maryland. The treatment system is proposed in order to remove volatile organic contamination from groundwater currently discharged into the Site W Swale and nearby seeps.

The report provides performance-based specifications and flow diagram sketches describing the proposed treatment system.

Feel free to contact me at 412/921-8778 with any comments or questions regarding the information submitted.

Very truly yours,

Jeffrey P. Orient, PG.
Project Manager

JPO:lld

Enclosures

c: Mr. Roger Boucher (NORTHDIV) (w/o enclosure)
Mr. John Trepanowski, BRE
Mr. Matt Bartman, BRE (w/o enclosures)
Mr. Scott Nesbit, BRE
Ms. Yazime Yap-Deffler, EPA (5 copies)
Mr. Phil Tully, OHM (2 copies)
Mr. Steve Hughes, BRE
Mr. Steve Richard, GSA (2 copies)
Mr. John Fairbank, MDE (2 copies)
Mr. Gary Westermeyer, EFACHES (2 copies)

079821/P

BASIS OF DESIGN REPORT
SITE W SWALE TREATMENT SYSTEM
AT
AURORA FACILITY
ARMY ADELPHI RESEARCH LABORATORY

NAVAL SURFACE WARFARE CENTER
WHITE OAK, MARYLAND

COMPREHENSIVE LONG-TERM
ENVIRONMENTAL ACTION NAVY (CLEAN) CONTRACT

Submitted to:
Engineering Field Activity Chesapeake
Environmental Branch Code 18
Naval Facilities Engineering Command
Washington Navy Yard, Building 212
Washington, D.C. 20374-2121

Submitted by:
Brown & Root Environmental
600 Clark Avenue, Suite 3
King of Prussia, Pennsylvania 19406-1433

CONTRACT NUMBER N62472-90-D-1298
CONTRACT TASK ORDER 0284

JULY 1998

PREPARED BY:

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FIGURES

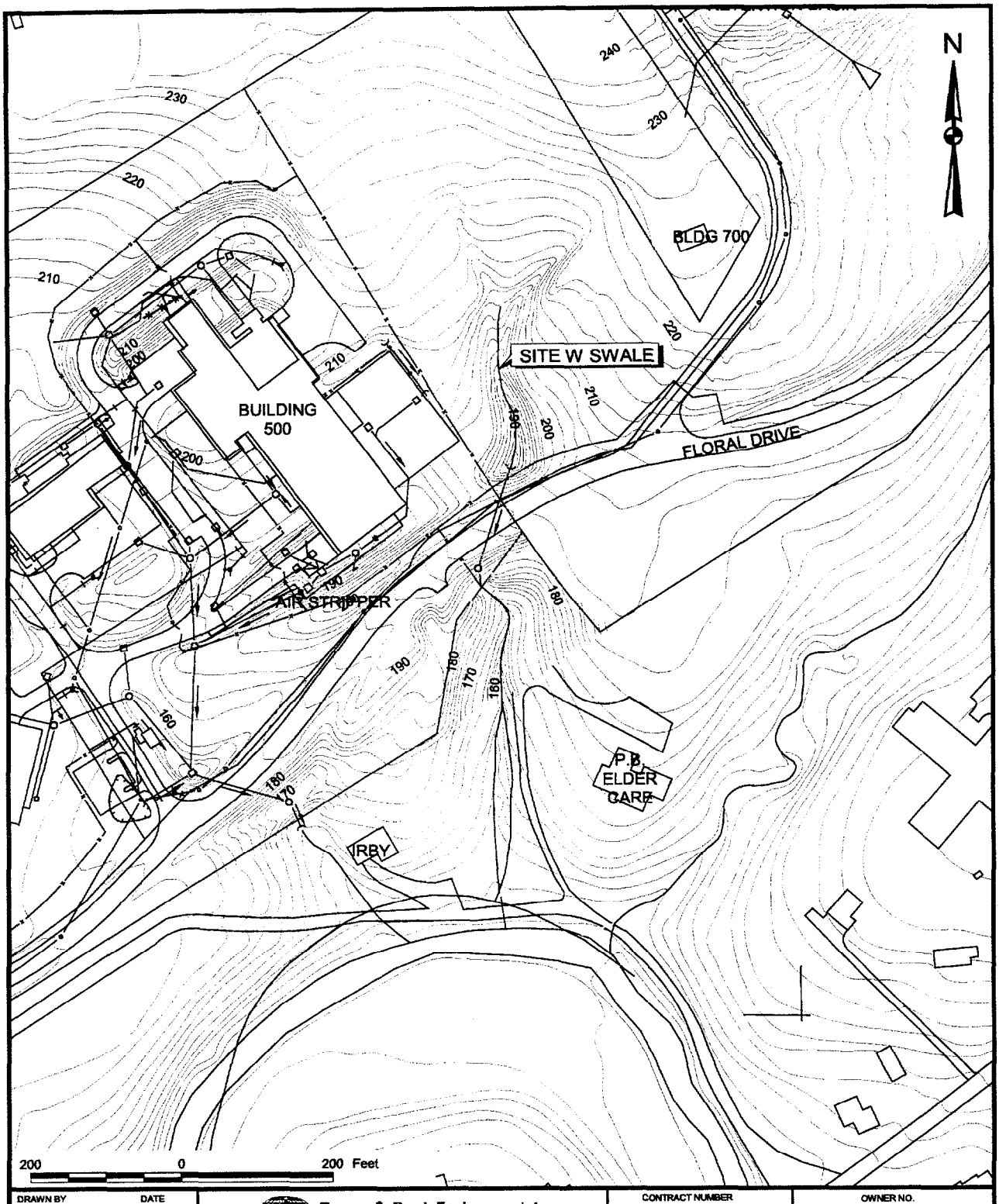
1.0 INTRODUCTION

1.1 AUTHORITY

Brown & Root Environmental (B&R Environmental) has prepared this design basis report as part of Contract Task Order (CTO) 284, under the Comprehensive Long-Term Environmental Action Navy (CLEAN) Contract Number N62472-90-D-1298. This work is part of the Navy's Installation Restoration (IR) Program, which is designed to identity contamination at Naval and Marine Corps facilities resulting from past operations and to institute corrective actions as necessary. The work completed under this task order is for the Naval Surface Warfare Center (NSWC), White Oak, Maryland.

1.2 OBJECTIVE

This report presents a Basis of Design for a treatment system that is proposed to remove the volatile organic compounds (VOCs), consisting primarily of trichloroethene (TCE), detected in a surface water stream historically known as the Site W swale located downstream of NSWC White Oak and Building 500 of the Army Adelphi Research Laboratory (ARL). Figure 1 shows the Site W swale location.



DRAWN BY: S. TABLER — DATE: 7/31/98	Brown & Root Environmental	CONTRACT NUMBER: 7612	OWNER NO.: —
CHECKED BY: JPO — DATE: 7/31/98	SITE W SWALE LOCATION NSWC, WHITE OAK, MARYLAND	APPROVED BY: JPO — DATE: 7/31/98	
COST/SCHEDULE-AREA		APPROVED BY: — — DATE: —	
SCALE: AS NOTED		DRAWING NO.: FIGURE 1	REV: 0

P:\GIS\WHITEOAK\APR 7/31/98 SMT FIGURE 1 LAYOUT

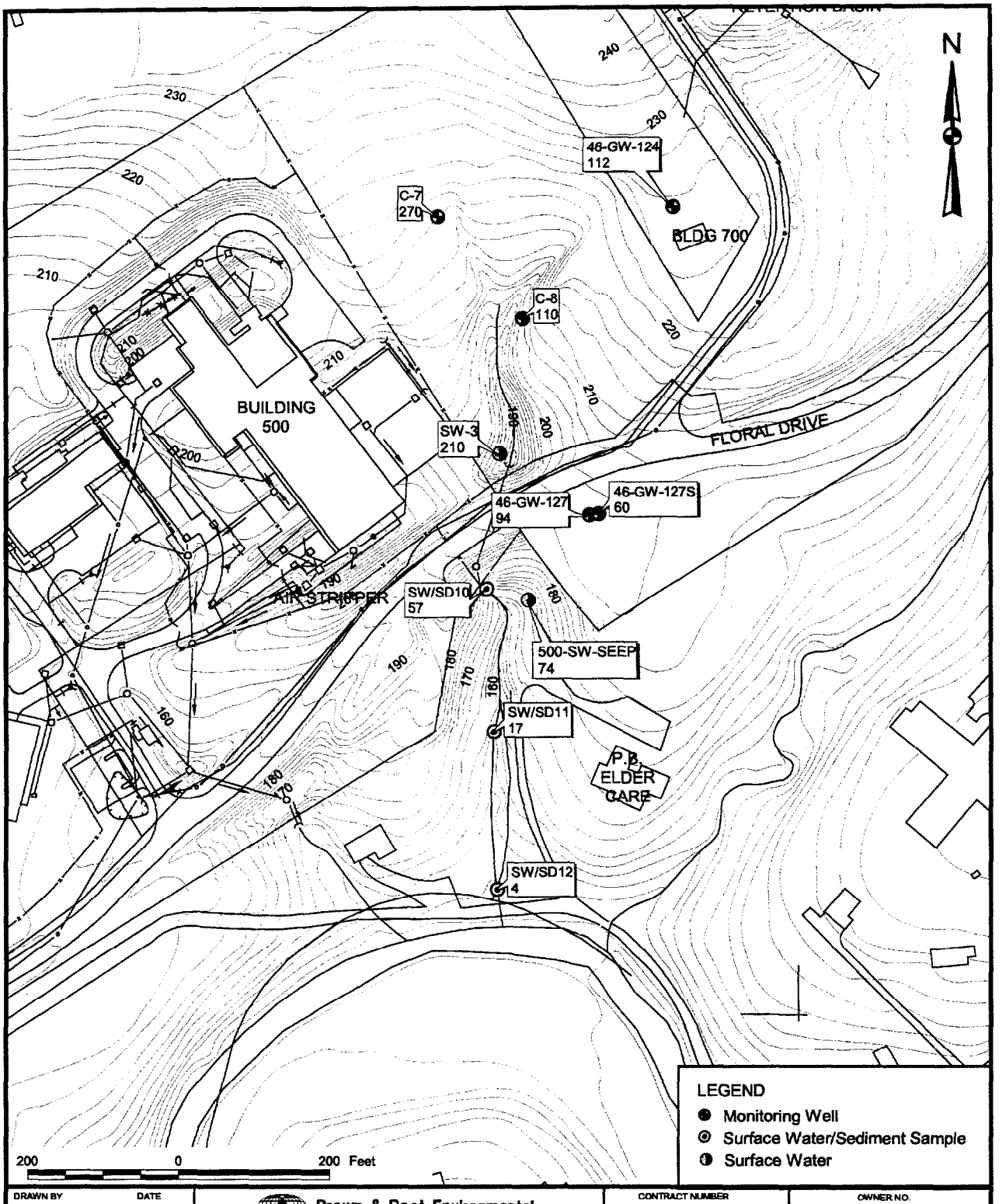
2.0 EXISTING CONDITIONS

The Site W swale is an intermittent stream located east of the ARL Building 500 complex. Base surface water flow within the swale consists predominantly of groundwater seepage into the swale. Little or no flow, 0-2 gallons per minute (gpm), is typically present within the swale upstream of Floral Drive. During storm events, surface runoff from the wooded areas east of Building 500 and NSWC White Oak Area 300 contribute to increased short-term surface water flow.

A groundwater seep is present along the east side of the small valley that is a southward extension of the Site W swale, at a point less than 100 feet south of Floral Drive. This seep, which emanates from the hillside at an elevation of approximately 14 feet above the stream level, is contaminated with VOCs, primarily TCE, which has been detected at a concentration of 74 micrograms/liter (μg/L). Investigations completed at Site 46 identified VOC-contaminated groundwater in areas immediately upgradient of the seep.

Flow within the stream along the reach south of Floral Drive has been estimated at 4 to 5 gpm during average conditions. The streambed is less steep downstream of Floral Drive and its flow near the confluence with Paint Branch has been observed to be negligible during dry weather periods. TCE contamination of the surface water decreases rapidly downstream of the Site W swale, with concentrations ranging from 210 μg/L at the swale to 4 μg/L immediately prior to confluence with Paint Branch. Figure 2 shows TCE concentrations detected in surface water/groundwater at various locations in the vicinity of the Site W swale.

An area of TCE-contaminated groundwater extends eastward from the Site W swale. The portion of this groundwater plume that discharges, or may potentially discharge to the Site W swale, is to be collected and treated by the Site W swale treatment system. The groundwater flow rate across the area that will be covered by the groundwater collection trench is expected to be 6 gpm (approximately), based upon data gathered during the Site 46 field investigation.



DRAWN BY: S. TABLER	DATE: 7/31/98	Brown & Root Environmental	CONTRACT NUMBER: 7612 / OWNER NO.: —
CHECKED BY: JPO	DATE: 7/31/98	TCE CONCENTRATIONS SITE W SWALE NSWC, WHITE OAK, MARYLAND	APPROVED BY: JPO / DATE: 7/31/98
COST/SCHEDULE-AREA			APPROVED BY: — / DATE: —
SCALE: AS NOTED			DRAWING NO.: FIGURE 2 / REV: 0

P:\GIS\WHITEOAK\APR 7/31/98 SMT FIGURE 2 LAYOUT

3.0 CHARACTERIZATION/TREATMENT STANDARDS

This section presents a chemical characterization of the surface water in the Site W swale and the quality requirements to be met by this water. Also presented are the air emission quality requirements for any off-gas streams that may be generated by a treatment system used to meet the water quality requirements.

3.1 SURFACE WATER CHARACTERIZATION/ AND QUALITY REQUIREMENTS

Results of recent investigations indicated a TCE concentration up to 210 µg/L in the surface water of the Site W swale. This concentration exceeds both the 5 µg/L level for human health protection, as mandated by the Safe Drinking Water Act Maximum Contaminant Level (MCL), and the 81 µg/L criterion for protection of human health from consumption of aquatic organisms. The surface water stream in the Site W swale is not a source of drinking water, nor is that stream significant enough to support recreational fishing. However, attainment of the MCL of 5 µg/L for TCE is being assumed as a conservative goal for protection of potential downstream receptors, and treatment of the surface water stream is required to meet this criterion.

3.2 AIR EMISSION STANDARDS

The State of Maryland air emission limit for small quantity generators is 0.5 pounds/hour (lbs/hr) VOC. Based on a flow rate of 5 gpm and design average TCE concentration of 210 µg/L, the total VOC emission rate from a treatment system that uses an air stripping (volatilization) process would be 0.0005 lbs/hr.

The OSHA 8-hour Time-Weighted-Average (TWA) concentration limits for TCE is 50 parts per million by volume (ppmv). The design average concentration of TCE in an off-gas emission stream from an air stripping process would be 0.066 ppmv.

Based on these estimated air emissions, the use of air stripping to remove TCE from the surface water stream to satisfy MCLs would not require off-gas treatment of the air stream emanating from the stripper unit. Details of the emission calculations and the regulatory standards used to demonstrate compliance are presented in Appendix A.

4.0 PROCESS DESIGN BASIS

Based on the information provided in the previous sections of this report, the process design basis for the Site W swale water treatment system that is to be added next to a new groundwater and surface water interception trench located along Floral Drive is as follows:

- **Flow Rate** - 10 gpm
- **TCE Concentration (Influent)** - 210 µg/L average
- **TCE Concentration (Effluent)** - 5 µg/L or less

5.0 PROCESS DESCRIPTION

Based on previous experience with the effectiveness of similar treatment systems and because such a system will become available as the Oil/Water Separator treatment system located next to Building 500 is decommissioned, a shallow-tray air stripping system has been selected as the most technically effective and cost-efficient process for consistently satisfying the requirements of the design basis. This section provides a brief description of this system and its operation, and an equipment list.

A new 400 feet long subsurface groundwater interception trench will be constructed, extending eastward from the Site W swale along the DOD property line in a direction generally perpendicular to groundwater flow upgradient of Floral Drive (Figure 3). This location was chosen at it serves as a centralized downgradient collection point and it does not require the construction of an excessively deep trench (approximately 20 feet average depth). The interception trench will convey the contaminated groundwater to a central collection sump (Figure 4). This sump will have a working capacity of approximately 375 gallons (e.g., 4 foot diameter and 4 foot depth below the lowest pipe invert elevation in the sump) and will be bedded in gravel to enhance groundwater capture.

The collection trench, approximately 400 feet long and 3 feet wide, will be extended vertically below the water table to the top of the saprolite which underlies the coastal plain deposits. At the trench location, the elevation of the water table is expected to range from approximately 186 to 212 feet above mean sea level (msl), the saprolite surface elevation is expected to range from approximately 184 to 194 feet msl, and the trench depth is expected to range from approximately 5 to 25 feet below ground surface. All depths should be verified by test borings prior to trench construction. The trench is to be backfilled with gravel with a hydraulic conductivity of at least 100 feet/day to provide enhanced drainage to the collection sump. As an option, a collection pipe can be installed at the bottom of the trench to further facilitate drainage to the sump - the decision regarding the collection pipe installation should be made as part of the final design.

The collection trench should be tied into the collection sump within the Site W swale. Free drainage into the sump should be provided through the use of permeable gravel backfill around and beneath the sump, the installation of an open-bottom sump (i.e., manhole sections) set on approximately 2.5 feet of permeable gravel base, and by the installation of one or more lateral inlets into the sump at elevations at least 2 feet below the existing floor of the Site W swale at the location of the sump. The water level within the sump is to be maintained at or below the bottom of the inlet pipe.

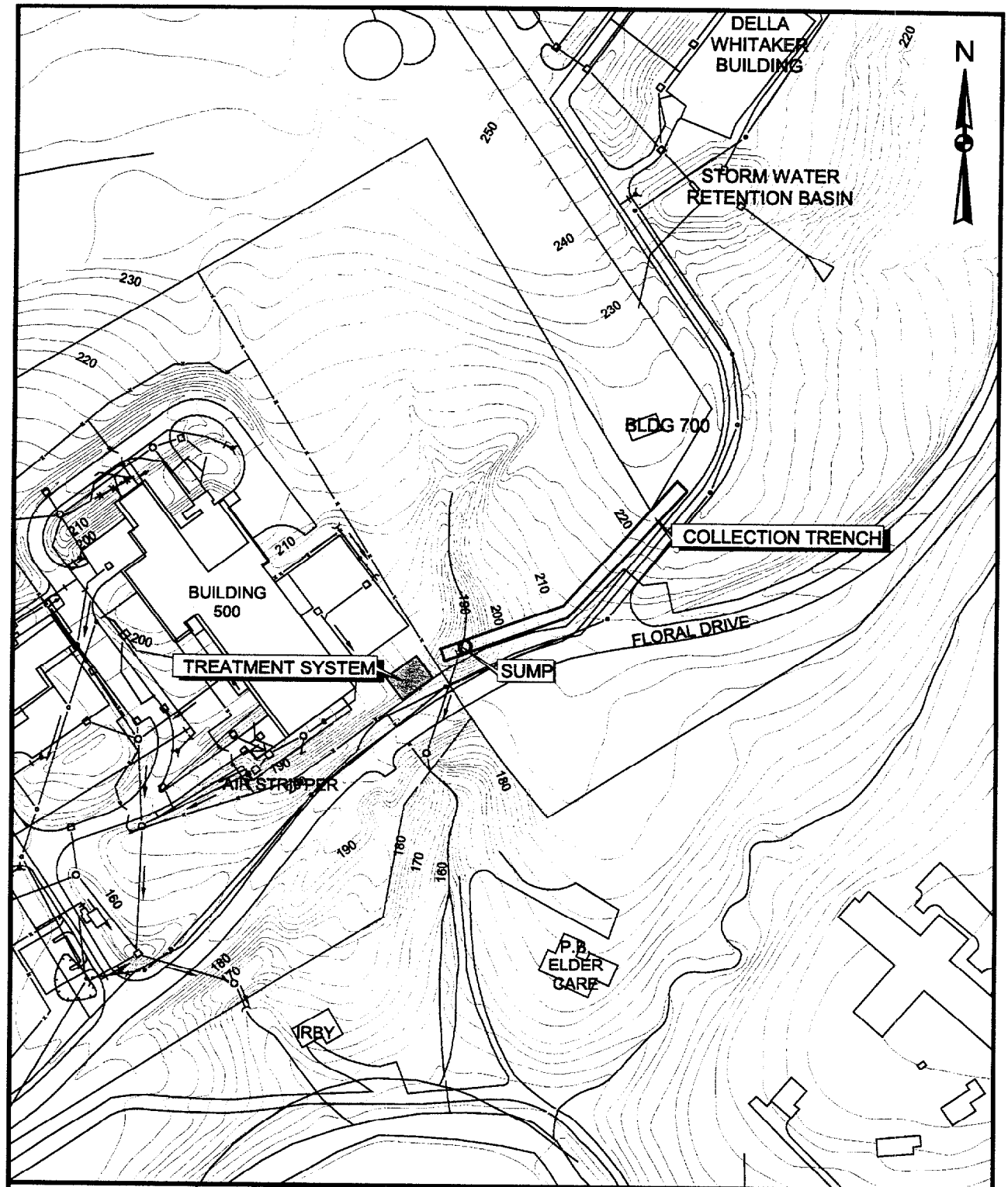
A submersible centrifugal pump, sized to discharge 10 gpm, will be placed in the collection sump and will transfer groundwater to the former Oil/Water Separator air stripping system, which will be re-located above ground next to the sump. The discharge rate of the pump will be controlled by a mechanical float valve that will maintain a constant water level that is to be slightly below the lowest invert elevation in the sump. Float switches will also be installed in the sump to activate an alarm in case of a high water level condition (i.e., the untreated contents of the sump are overflowing into the sump's effluent pipe), and turn off the pump and activate an alarm in case of a low water level condition. The pump's discharge pipe will also be fitted with a recycle pipe containing an orifice plate, which will keep the pump from deadheading during low flow conditions. A flow schematic of the treatment system is shown on Figure 5.

The pump discharge will flow through a membrane (bag or sock) filter to remove suspended solids, and then into the air stripper. As the water cascades down through the stripper's stack of shallow trays, TCE will be volatilized in the countercurrent of air that is generated by the stripper's air blower. The treated water will be collected in the bottom well of the stripper and drained by gravity to the culvert passing under Floral Drive. The air stream that contains the TCE removed from the sewer water will be vented to the atmosphere.

The air stripping system, including the membrane filter, is a fully assembled skid-mounted unit. The unit will be installed in a prefabricated shed that is insulated for winter operation and to minimize blower noise. The air blower is also be fitted with silencers to minimize noise. The air stripping system and the prefabricated shed will be placed on a reinforced concrete pad located next to the collection sump. The electric power requirements for the air stripping system, the submersible pump, and related instrumentation are to be satisfied by the available 220 Volt supply in Building 500, or by another nearby power source.

The system will require only intermittent operator attention when the membrane filter requires periodic cleaning or replacement, and the stripper trays need cleaning. It is estimated that an operator will require approximately 8 hours/week to perform these tasks.

Listed below is a preliminary equipment list for the treatment system. All equipment types and sizes are to be confirmed in the detailed design phase of the project.



DRAWN BY: S. TABLER — DATE: 7/31/98	Brown & Root Environmental	CONTRACT NUMBER: 7612	OWNER NO.: —
CHECKED BY: JPO — DATE: 7/31/98	COLLECTION/TREATMENT SYSTEM LAYOUT SITE W SWALE NSWC, WHITE OAK, MARYLAND	APPROVED BY: JPO — DATE: 7/31/98	
COST/SCHEDULE-AREA:		APPROVED BY: — — DATE: —	
SCALE: AS NOTED		DRAWING NO.: FIGURE 3	REV: 0

P:\GIS\WHITEOAK\APR 7/31/98 SMT FIGURE 3 LAYOUT

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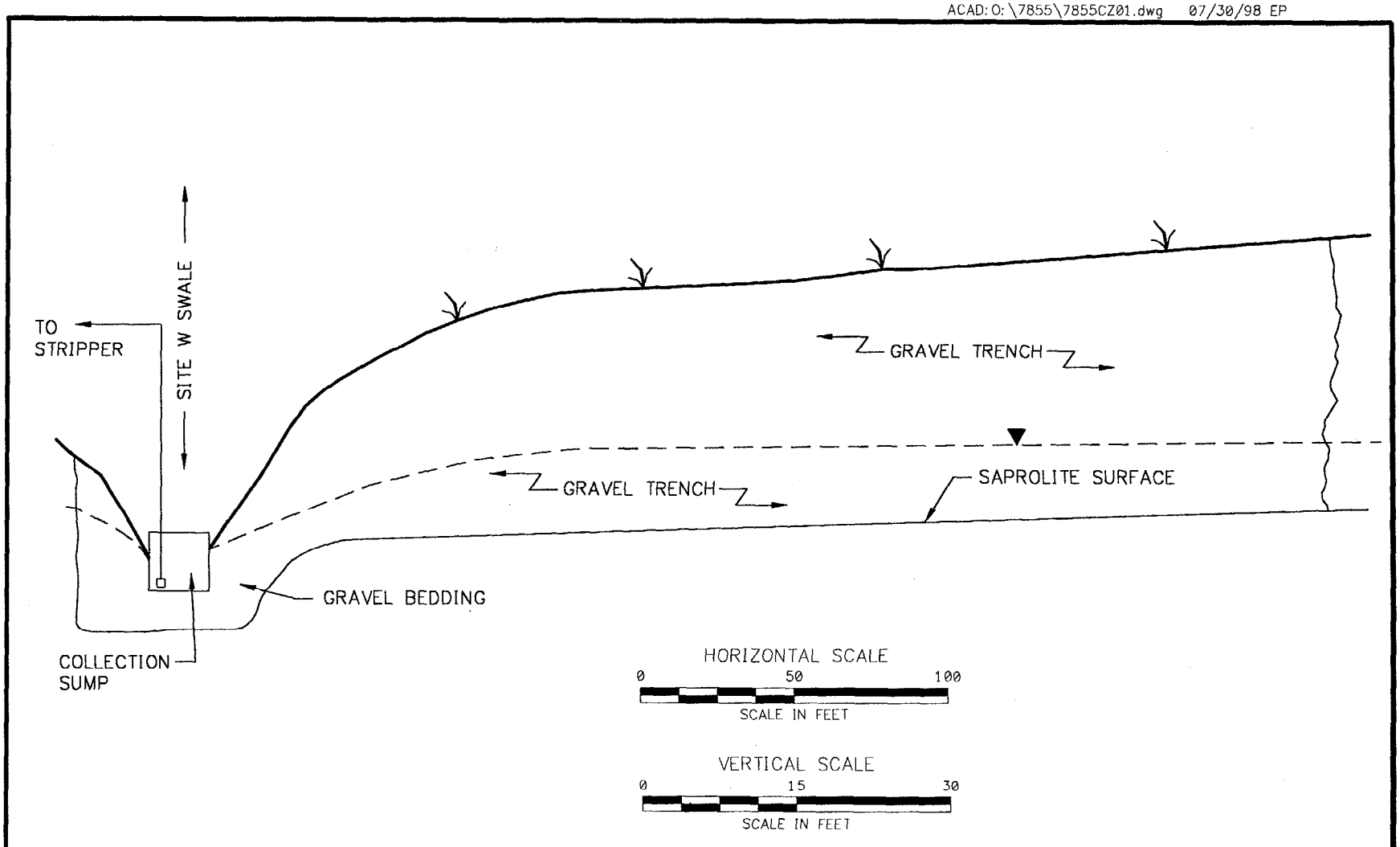

DRAWN BY DLT DATE 7/31/98	Brown & Root Environmental	CONTRACT NO. 7855	OWNER NO. ———
CHECKED BY JO DATE 7/31/98		APPROVED BY JPO	DATE 7/31/98
COST/SCHED-AREA	COLLECTION TRENCH/SUMP SCHEMATIC NSWC ,WHITE OAK, MARYLAND	APPROVED BY	DATE
SCALE AS NOTED		DRAWING NO. FIGURE 4	REV. 0

FORM CADD NO. SOUTH_AV.DWG - REV 0 - 02/07/97

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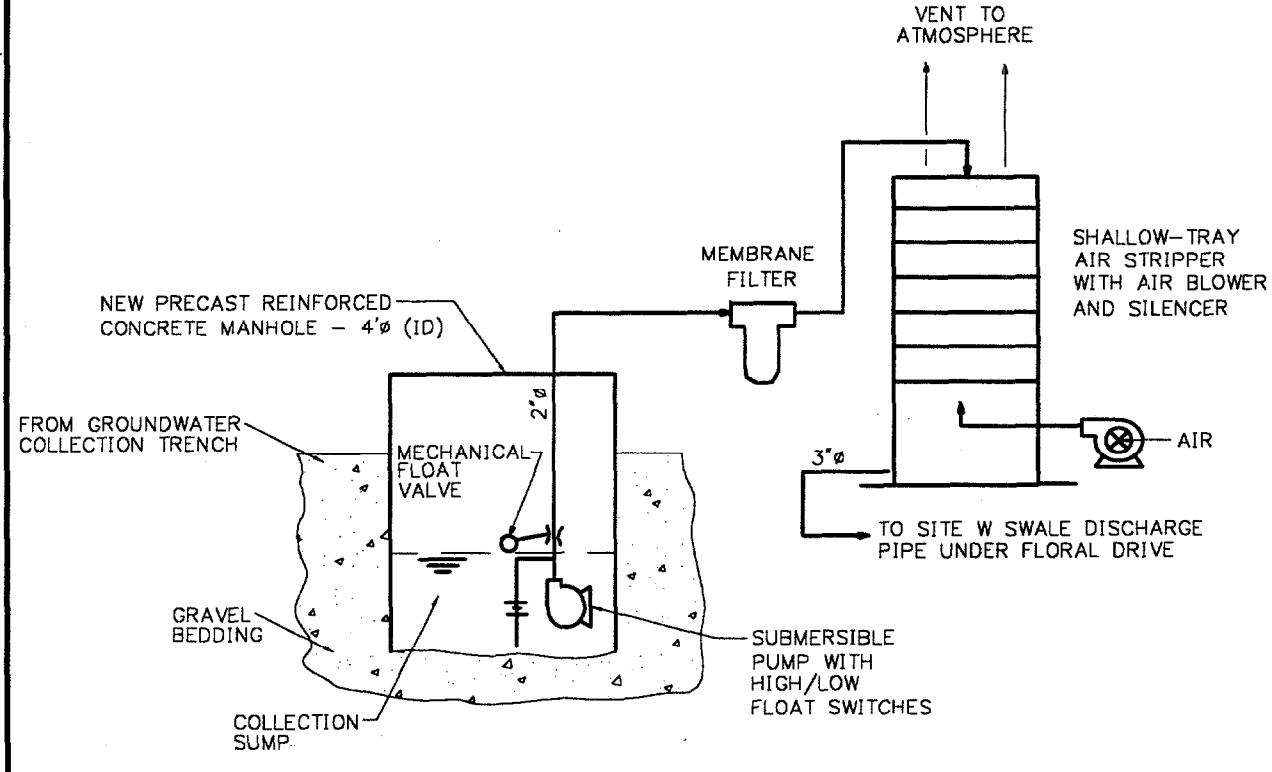

NOTE: THE AIR STRIPPING SYSTEM WITH FILTER IS TO BE INSTALLED IN AN INSULATED PREFABRICATED SHED THAT IS PLACED ON A NEW REINFORCED CONCRETE SLAB

DRAWN BY MF DATE 7/31/98	Brown & Root Environmental	CONTRACT NO. 7612	OWNER NO. 0284
CHECKED BY JO DATE 7/31/98	FLOW SCHEMATIC DIAGRAM SITE W SWALE WATER TREATMENT SYSTEM NSWC WHITE OAK, MARYLAND	APPROVED BY JPO DATE 7/31/98	
REVISED BY DATE		APPROVED BY DATE	
SCALE NONE		DRAWING NO. FIGURE 5	REV. 0

FORM CADD NO. TtNUS_AV.DWG - REV 0 - 1/22/98

Equipment	Description
Air Stripper System	10 gpm water throughput; TCE concentration reduced from 210 to 5 µg/L
• Forced draft blower w/silencer or sound-proof enclosure	300 cfm @ 10 inches water column; 2 HP
• Shallow tray stripping units	
• Collection sump	
• Interconnecting piping	
• Electrical wiring, panel, etc.	
• Membrane filter	Bag type; 15 micron filtration capacity
Submersible Pump	10 gpm @ 20 ft. TDH; 0.25 HP
• Mechanical float control valve	
• Orifice plate	
• High/low flow switches with alarm	
• Electrical wiring, panel, etc.	
• Interconnecting and recycle piping, etc.	
Prefabricated shed	Insulated; design for industrial use

6.0 SCHEDULE

Based on the information provided in the previous sections of this report, it is estimated that this project will have the following schedule:

Detailed Design Package	2-4 weeks
Procurement of Construction Materials	4-6 weeks
Construction, Installation and Relocation	2-4 weeks
Startup	1 week

7.0 COST ESTIMATE

Based on the information developed in the previous sections of this report, the following preliminary cost estimates were developed:

Total Installed Capital Cost (Trench and Relocation of Treatment System)..... $211,279
Total Annual Operation and Maintenance, Monitoring Cost..... $53,620
Present Worth (Based on 20 years of operation and 7 percent annual discount rate)..... $837,743

See Appendix B for further detail regarding these cost estimates.

APPENDIX A

CALCULATIONS

Site W Swale Pump Treat
NSWC, White Oak, MD

ESTIMATION OF
OFF-GAS EMISSIONS
AIR STRIPPER SYSTEM

By: Jpradeep kumar

Checked By: JBG

July 8, 1998

ESTIMATION OF OFF-GAS EMISSIONS:

Vapor-phase Concentrations

Procedure:

1. Obtain mass flow rate of VOC in air assuming 100 % removal from water
2. Ratio of molar flow rate of VOC to molar flow rate of air= vapor-phase conc (ppmv)
3. Based on vapor-phase VOC conc, estimate GAC adsorption capacity
4. Using VOC mass loading and adsorption capacities, estimate GAC usage

Water flow rate=	10.00	gpm
Mass flow rate of VOC = 10 gpm x [C]x0.012 lb/day		
where [C]= VOC concentration in water		
Molar flow rate of VOC= mass flow rate/mol wt.		
Air flow rate=	300.00	cfm (assuming shallow-tray type air stripper)
Air density =	0.08	lb/ft^3
Mass flow rate of air=	23.34	lb/min
Molar flow rate of air=	0.80	lbmol/min

Air Conc of VOC= molar flow rate of VOC/molar flow rate of carrier air

Concentrations in air stream :

Parameter	Water Conc (ug/L)	Mol Wt (lb/lb mol)	Molar flow rat (lbmol/min)	Vapor Conc (ppmv)	Vapor Conc (mg/m^3)	TWA Limi (ppmv)	Maximum Emissions (lb/day)	
TCE	**210**	131.9	1.33E-07	**0.16**	0.95	**50**	**2.52E-02**	
			Total Conc=	**0.16**	**ppmv**	**TotalVOC**	**0.03**	**lb/day**

State of Maryland Exemption for Small Quantities of Toxic Air Pollutants= 0.5 lb/hr for all VOCs whose TLVs exceed 200 micrograms/m^3 (MD Subtitle 11, Chapter 15, Sec 26.11)
Also District of Columbia does not require emissions control if total discharge is less than 15 lb/day for photochemically reactive solvents (Title 20, Chapter 7)

Because regulatory limits are not exceeded, no off-gas treatment would be required.

APPENDIX B

COST ESTIMATES

NAVAL SURFACE WARFARE CENTER - WHITE OAK
Silver Spring, Maryland
Site W Swale
Groundwater/Surface Water Collection and Treatment via Air Stripping

Item	Quantity	Unit	Unit Cost Subcontract	Unit Cost Material	Unit Cost Labor	Unit Cost Equipment	Extended Cost Subcontract	Extended Cost Material	Extended Cost Labor	Extended Cost Equipment	Subtotal Direct Cost	Comments
1 MOBILIZATION/DEMOBILIZATION												
Mobilize/Demobilize Equipment	1	ls				$3,000.00	$0	$0	$0	$3,000	$3,000	Excavator, Loader, Dozer
Mobilize/Demobilize Personnel	10	ea			$500.00		$0	$0	$5,000	$0	$5,000	field crew of 5
Per Diem	50	an-dy			$162.00		$0	$0	$8,100	$0	$8,100	first 10 days of project
Office Trailer	1	mo				$181.00	$0	$0	$0	$181	$181	32' x 8'
Storage Trailer	1	mo				$95.00	$0	$0	$0	$95	$95	
Utilities	1	mo		$500.00			$0	$500	$0	$0	$500	
Clear & Grub	1	ls			$8,000.00	$7,000.00	$0	$0	$8,000	$7,000	$15,000	
Erosion and Sediment Control (silt fence)	100	lf		$0.45	$0.21		$0	$45	$21	$0	$66	
Site Survey	1	ac		$72.00	$720.00		$0	$72	$720	$0	$792	
2 COLLECTION TRENCH/SUMP INSTALLATION												
Grade Trench Path for Excavator	2	day		$1,000.00	$220.40		$0	$2,000	$441	$0	$2,441	Dozer w/ Operator
Import Stone	450	cy		$21.95			$0	$9,878	$0	$0	$9,878	3/4" to 1-1/2" diameter
Excavate Trench, Depths to 20ft	890	cy			$0.42	$2.12	$0	$0	$374	$1,887	$2,261	Excavator w/ Operator
Place Stone/Backfill to Grade	890	cy			$0.76	$0.59	$0	$0	$676	$525	$1,202	No Dewatering
Install Sump - precast concrete manhole	1	ls		$3,000.00	$1,800.00	$2,510.00	$0	$3,000	$1,800	$2,510	$7,310	4-foot ID; 20 feet deep
Dewater Excavation	1	ls		$500.00		$1,365.00	$0	$500	$0	$1,365	$1,865	
Steel Grate for manhole	105	lb		$0.97	$0.42	$0.03	$0	$102	$44	$3	$149	15 lb/sq ft - 3' diameter
Trench Box	1	wk				$1,460.00	$0	$0	$0	$1,460	$1,460	2 boxes - 10'x20'
3 RELOCATE TREATMENT SYSTEM												
Install Concrete Pad - 6" thick, reinforced	96	sf		$2.52	$3.90	$0.15	$0	$242	$374	$14	$631	8' x 12'
Relocate Treatment Bldg & System, Reinstall Piping & Utiliti	1	ls		$5,000.00	$10,000.00	$5,000.00	$0	$5,000	$10,000	$5,000	$20,000	
4 SITE RESTORATION												
Remove Excess Soil, load/haul - from trench/sump	450	cy			$1.62	$3.55	$0	$0	$729	$1,598	$2,327	3 mile RT on site
Hydroseed Disturbed Area	43.56	msf		$28.00	$7.00	$7.35	$0	$1,220	$305	$320	$1,845	utility mix, 7#/msf
Subtotal							$0	$22,558	$36,584	$24,958	$84,100	
Overhead on Labor Cost @ 30%									$10,975		$10,975	
G & A on Labor Cost @ 10%									$3,658		$3,658	
G & A on Material Cost @ 10%								$2,256			$2,256	
G & A on Subcontract Cost @ 10%							$0				$0	
Total Direct Cost							$0	$24,814	$51,218	$24,958	$100,990	
Indirects on Total Direct Labor Cost @ 75%									$38,414		$38,414	
Profit on Total Direct Cost @ 10%											$10,099	
Subtotal											$149,503	
Health & Safety Monitoring											$7,000	
Total Field Cost											$156,503	
Contingency on Total Field Cost @ 20%											$31,301	
Engineering on Total Field Cost @ 15%											$23,475	
TOTAL COST											**$211,279**	

NAVAL SURFACE WARFARE CENTER - WHITE OAK
Silver Spring, Maryland
Site W Swale
Groundwater/Surface Water Collection and Treatment via Air Stripping
Annual Sampling and Evaluation Costs

Item	Item Cost	Notes
Monthly Sampling		
	$320	1 Laborer for one day/month
	$500	Mob/Demob and Per Diem
	$250	Materials - sampleware, decon equipment, etc.
	$575	Analysis of effluent sample for VOCs and NPDES parameters + one trip blank for VOCs
	$525	Analysis of surface water samples for VOCs - 2 locations in swale + one trip blank for VOCs
	$500	Reporting
Total Annual Cost	$32,040	

Periodic reviews of site conditions will be performed every 5 years at a cost of $20,000

NAVAL SURFACE WARFARE CENTER - WHITE OAK
Silver Spring, Maryland
Site W Swale
Groundwater/Surface Water Collection and Treatment via Air Stripping
Annual Operating and Maintenance Costs

	Item	Qty	Unit	Unit Cost	Subtotal Cost	Notes
1	Energy - Electric	19605	Kw-hr	$0.06	$1,176	Blower (2 hp) and submersible pump (1 hp)
2	Maintenance	1	ls	$10,564	$10,564	5% of capital cost
3	Labor	12	mo	$320	$3,840	1 visit per month
4	Mobilization/Demobilization/Per Diem	12	mo	$500.00	$6,000	
	Total Annual Cost				$21,580	

Note: Annual Cost - 24 hr/ day - 365 days/ year

NAVAL SURFACE WARFARE CENTER - WHITE OAK
Silver Spring, Maryland
Site W Swale
Groundwater/Surface Water Collection and Treatment via Air Stripping
Present Worth Analysis

Year	Capital Cost	O & M Cost	Sampling & Evaluation Cost	Total Annual Cost	Annual Discount Rate at 7%	Present Worth
0	$211,279	$21,580	$32,040	$232,859	1.000	$232,859
1		$21,580	$32,040	$53,620	0.935	$50,113
2		$21,580	$32,040	$53,620	0.873	$46,832
3		$21,580	$32,040	$53,620	0.816	$43,770
4		$21,580	$32,040	$53,620	0.763	$40,907
5		$21,580	$52,040	$73,620	0.713	$52,491
6		$21,580	$32,040	$53,620	0.666	$35,727
7		$21,580	$32,040	$53,620	0.623	$33,389
8		$21,580	$32,040	$53,620	0.582	$31,207
9		$21,580	$32,040	$53,620	0.544	$29,164
10		$21,580	$52,040	$73,620	0.508	$37,421
11		$21,580	$32,040	$53,620	0.475	$25,475
12		$21,580	$32,040	$53,620	0.444	$23,807
13		$21,580	$32,040	$53,620	0.415	$22,252
14		$21,580	$32,040	$53,620	0.388	$20,794
15		$21,580	$52,040	$73,620	0.362	$26,680
16		$21,580	$32,040	$53,620	0.339	$18,161
17		$21,580	$32,040	$53,620	0.317	$16,976
18		$21,580	$32,040	$53,620	0.296	$15,866
19		$21,580	$32,040	$53,620	0.277	$14,826
20		$21,580	$52,040	$73,620	0.258	$19,023
					Total Present Worth	**$837,743**