COMPREHENSIVE LONG-TERM ENVIRONMENTAL ACTION NAVY (CLEAN I)
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DEPARTMENT OF THE NAVY
Engineering Field Activity West
Naval Facilities Engineering Command
San Bruno, California

TIME CRITICAL REMOVAL ACTION SCOPING - SITE 18 STORM SEWER SYSTEM SOLIDS AND DEBRIS REMOVAL NAVAL AIR STATION ALAMEDA ALAMEDA, CALIFORNIA

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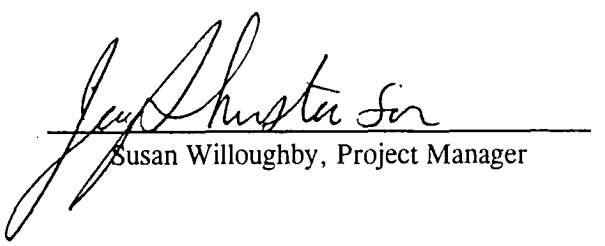


Susan Willoughby, Project Manager

SITE 18

STORM SEWER SYSTEM SOLIDS AND DEBRIS REMOVAL ACTION SCOPING

This scoping document presents the information necessary to begin an implementation work plan for removal of solids and debris from the storm sewer system (Site 18) at Naval Air Station (NAS) Alameda.

Information provided in this scoping document includes a determination of those sections of the storm sewer system (including catch basins, manholes, and pipes) that should be prioritized for cleaning. This determination was made based on a review of available chemical data. Next, the physical condition of pipes in these prioritized areas was evaluated from a previous video inspection of a portion of the system. Reaches of the storm sewer system that are damaged or otherwise unsuitable for cleaning are not recommended for inclusion in this removal action. These unsuitable sections are excluded because they may be damaged or rendered unusable from the cleaning process. Lines that were cleaned or replaced in 1991 were also excluded. However, catch basins and manholes from these sections are included. From this analysis, an estimate was made of the length of pipe that requires cleaning as well as an estimate of solids and debris to be removed. This removal action only covers the removal of the solids and debris from the storm sewer system, their dewatering, on-site storage, and disposal of liquid generated during the removal. The total estimated volume of solids and debris is 1,074 cubic yards.

This scoping document also presents the results of the three-step evaluation process used to choose a removal action alternative. Various process options were screened based on their technical feasibility. The feasible process options were combined into removal action alternatives. The alternatives were then evaluated against the criteria of effectiveness, implementability, and cost. Finally, a recommended alternative was chosen based on a comparative analysis and a ranking system. The recommended alternative includes high pressure jetting for cleaning, filter press for dewatering, holding the dewatered solids in triple-lined and covered storage piles, and sending the wastewater to the NAS Alameda Industrial wastewater treatment plant (IWTP).

In addition, this scoping document presents storm sewer system solids chemical data summaries

(Appendix A), a description of each process option (Appendix B), the assumption made in estimating the quantities of solids and wastewater (Appendix C), and detailed cost opinions for the screened alternatives (Appendix D).

Site History

- Site 18, NAS Alameda's storm sewer system, consists of about 194,000 linear feet of storm sewer lines ranging in size from 2 inches to 42 inches in diameter. These lines empty into the Seaplane Lagoon, Oakland Inner Harbor, and San Francisco Bay. Historically, this system received untreated industrial wastewater from plating shop baths and paint shops, pesticides and herbicides, cleaning solvents, polychlorinated biphenyls (PCB), oil and grease, and fuel hydrocarbons. Currently the system only receives storm water runoff from the base.

- A study conducted in 1991 estimated the presence of approximately 560 cubic yards of solids and debris in selected portions of the storm sewer system lines (no estimate for catch basins or manholes). Solid samples collected at that time showed high levels of petroleum hydrocarbons.

- During recent field investigations, solids from inside storm sewer manholes and catch basins were sampled and analyzed for a variety of organic and inorganic constituents. The results indicate the presence of volatile organic compounds, semivolatile organic compounds, pesticides, PCBs, metals, oil and grease, and fuel hydrocarbons.

Potential Source(s)

- Past industrial activities conducted at NAS Alameda are known sources of contamination. Best management practices for controlling storm water runoff quality are being instituted at the base to minimize current sources.

Documents From Previous Investigations:

- "Television Inspection and Engineering Study of Storm Sewers, Phase II at Alameda Naval Air Station Alameda, California." Prepared by A-N West, Inc. for Navy Public Works Center, San Francisco Bay, January 1991.

- "Draft Data Transmittal Memorandum for Sites 4, 5, 8, 10A, 12, and 14. Naval Air Station Alameda, Alameda, California." PRC Environmental Management, Inc (PRC). January 1995.

- "Draft Data Transmittal Memorandum for Sites 1, 2, Runway Area, 3, 6, 7A, 7B, 7C, 9, 10B, 11, 13, 15, 16, and 19." Naval Air Station Alameda, Alameda, California." PRC Environmental Management, Inc. July 1995.

Chemicals Detected at the Site:

- Table A-1 (Appendix A) presents a summary of the chemical data for the storm sewer solids collected by PRC Environmental Management, Inc. (PRC) during a non-point source study. Appendix A also includes the frequency of detected analytes in the storm sewer solids from the samples collected by IT Corporation

Removal Action Justification:

- The storm sewer system discharges into the Seaplane Lagoon, Oakland Inner Harbor, and San Francisco Bay. This removal action will prevent the existing contaminated solids and debris in the system from entering the nearby receiving waters and the possible negative effects on biota and on human health from ingesting biota.

Removal Action Design Description

During this removal action, solids and debris present in the storm sewer system will be removed, dewatered, and placed in a temporary storage area at the base. Pipes cleaned or replaced in 1991, or in such poor condition that the cleaning would cause further damage will not be included. However, all catch basins and manholes will be cleaned. Figure 1 shows the process that will be used during this removal action. In the near future, a detailed analysis of treatment and disposal options will be performed to complete this removal action. A generalized approach to this removal action consists of the following components:

- Catch basins will be cleaned and a video inspection of the pipes and manholes will follow.
- If the video shows solids and debris that can be cleaned and the condition of the pipes are suitable, solids and debris will be removed from the pipes into the manholes.
- The solids and debris will be removed from the catch basins, pipes, and manholes and dewatered. These solids and debris will be placed in a temporary storage facility at the base.
- A second video inspection of the pipes will be conducted to evaluate the effectiveness of the cleaning. If the first cleaning did not remove all the solids and debris, a second cleaning will be initiated.
- The water generated during the removal and dewatered from the solids will be treated .
- Solids and debris removed from the system will be placed in a triple-lined storage area located in the north west portion of the base, north of the runways.

Potential Applicable or Relevant and Appropriate Requirements (ARAR)

- 40 Code of Federal Regulations (CFR) 50, National Primary and Secondary Ambient Air Quality Standards
- Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA)
- United States Environmental Protection Agency (USEPA) Region IX discretionary authority for clean up of PCBs of unknown spill date and initial concentration (less than 50 parts per million detected at site).
- Toxic Substance Control Act (TSCA), 40 CFR 761
- California Code of Regulations (CCR), Title 26, Division 22, Department of Health Services.
- San Francisco Regional Water Quality Control Board (SF-RWQCB) Waste Discharge Requirements
- Bay Area Air Quality Management District Ambient Air Quality Standards for Fugitive Dust

To Be Considered Guidance

- California Health and Safety Code
- USEPA Region IX Preliminary Remediation Goals (PRG)
- California Environmental Protection Agency (Cal-EPA) PRGs

Prioritizing Storm Sewer Subsystems

The storm drainage system consists of approximately 35 subsystems each with an outfall to a receiving water. The subsystems were prioritized for cleaning as follows:

- The PRC and IT Corporation data from catch basins and manholes were combined into one data set. Only values with no data qualifiers or a "J" qualifier (estimated concentration) were used. The subsystems were then placed into three categories:
  - High Priority for Cleaning: These subsystems had the highest concentration of analytes that have Total Threshold Limit Concentrations as defined by the CCR, Title 26, or contained a maximum concentration of an individual analyte.
  - Medium Priority for Cleaning: Other subsystems not included in high priority but had detectable concentrations of organic and inorganic analytes.

- Unknown Priority: No chemical data is available for these sections of the storm sewer system

- Table 1 presents the sections of the system and their assigned priority; Figure 2 shows the locations of the subsystem outfalls.

Volume of Solids and Debris and Length of Pipe for Cleaning

- Table 2 presents an estimated volume of storm sewer solids in pipes and the pipes' lengths based on available information.

- Table 3 presents the estimated volume for solids in manholes and catch basins.

- Appendix C presents the assumptions used to calculate these volumes.

Storm Sewer Solids Removal Process Options

A process option is a specific equipment item or operation that is used as a component of a removal alternative. The process options evaluated for the four main components of storm sewer solids and debris removal (removal of solids and debris from the sewers, solids separation, solids storage, and liquid waste disposal) are described in Appendix B. These components and process options are:

A. Removal of Solids and Debris from the Sewers

A-1 Winches and cleaning devices
A-2 High pressure jetting
A-3 Flush cleaning

B. Solids Separation

B-1 Dewatering pads
B-2 Baker Tanks
B-3 Lined settling pond
B-4 Filter press
B-5 Centrifuge

C. On-Site Solids Storage

C-1 Roll-off boxes
C-2 55-gallon drums
C-3 Storage piles

D. Liquid Waste Disposal

D-1 Treatment at the NAS Alameda industrial wastewater treatment plant (IWTP)
D-2 Treatment at the East Bay Municipal Utility District treatment plant

Process Option Screening

The process options for storm sewer solids and debris removal were evaluated based on their demonstrated technical feasibility. Table 4 summarizes the results of the process option screening. The evaluation of technical feasibility included:

- Ability to install and operate
- Commercial availability
- Operating efficiency
- Performance
- Reliability

Removal Alternatives

The retained process options were assembled into the following alternatives to accomplish the removal of the solids and debris from the sewers, their dewatering, on-site storage, and liquid waste disposal:

Alternative 1: High pressure jetting, filter press, storage pile, and IWTP

Alternative 2: High pressure jetting, filter press, roll-off boxes, and IWTP

Alternative 3: High pressure jetting, dewatering pad/storage pile (combined), and IWTP

Alternative 4: High pressure jetting, dewatering pad, roll-off boxes, and IWTP

Alternative 5: High pressure jetting, centrifuge, storage piles, and IWTP

Alternative 6: High pressure jetting, centrifuge, roll-off boxes, and IWTP

Processes Common to All Alternatives

- Prior to the initial cleaning of storm sewer lines, pipes will be inspected using video. This survey will provide information on the current condition of the storm sewer system and a record of the pre-cleaning state of the system.

- Plugs will be used downstream of the area being cleaned to minimize the volume of wastewater leaving the storm sewer system.

- Following the initial cleaning, the system will be re-inspected using video equipment. If this second video survey shows additional soil and debris in the system that can be cleaned, a second cleaning will occur followed by a final video survey. This video survey will provide verification of the cleaning of the pipes. For cost opinion

purposes, it was assumed that 25 percent of the pipes will require a second cleaning and video inspection.

- Sections of the storm sewer system that were not cleaned due to the pipes being in poor condition will be repaired, replaced, or isolated from the rest of the system to prevent potentially contaminated solids and debris from entering nearby receiving waters.

Alternative Screening

The assembled alternatives were screened against the effectiveness, implementability, and cost criteria. Table 5 shows the results of the alternative screening. The criteria used in screening were:

- Effectiveness
  - Overall protection of Human Health and Environment
  - Compliance with ARARs
  - Long-term effectiveness and permanence
  - Short-term impact on workers, community, and environment
  - Residuals generated
  - Time to complete
- Implementability
  - Commercial availability
  - Regulatory acceptability/permitting
  - Reliability
- Cost
  - Capital cost
  - Operation and maintenance costs

Retained Removal Action Alternatives

The alternatives retained after the screening are:

Alternative 1: High pressure jetting, filter press, storage pile, and IWTP

Alternative 2: High pressure jetting, filter press, roll-off boxes, and IWTP

Alternative 3: High pressure jetting, dewatering pad/storage pile (combined), and IWTP

Removal Alternative Selection Criteria and Comparative Analysis

A ranking system was developed for the comparative analysis of the retained alternatives.

- Table 6 provides a listing of the criteria and the scoring system for each criteria.

- Table 7 presents the scores given and the ranking results for the effectiveness and implementability criteria.

- Table 8 presents the scores given and the ranking results for the cost criteria. Detailed cost tables are shown in Appendix D.

- Table 9 summarizes the results of the comparative analysis.

Recommendation

Alternative 1 (high pressure jetting, filter press, storage pile, and IWTP) is recommended for storm sewer system solids and debris removal for the following reasons:

- Alternative 1 has the highest overall ranking score.

- Alternative 1 provides for the dewatering the solids with a filter press prior to storage. This will reduce the quantity of wastewater to be managed in the temporary storage area, the cost of this management, and the risk of leakage.

General Concerns

- The advanced age of the storm sewer system (over 50 years) makes the pipes susceptible to damage during high pressure jetting. The proposed approach outlined in Figure 1 will identify those pipes known to be in disrepair. This approach and limiting the the jetting pressure (maximum of 2,000 pounds per suare inch [psi] for pipes in excellent condition and between 800 to 1,000 psi for pipes that are in less than excellent condition) will allow removal of the most mobile solids and debris and minimize damage to existing pipes.

- Seawater in the pipes at the time of cleaning is possible due to the shallow depth of the pipes, proximity to San Francisco Bay, and the degraded condition of the system. If this water mixes with water used during the cleaning process, large volumes of water (residuals) will need to be treated due to possible cross contamination. Pipes will be plugged downstream of cleaning operations to minimize the generation of wastewater.

- Temporary storage of the wastewater in Baker tanks may be necessary if the IWTP is not able to handle the actual volume. The cost of this temporary storage is a function of the actual quantity of wastewater that needing storage and the duration of the storage.

Removal Action Reports

- Implementation Work Plan

TABLE 1
(1 of 2)

PRIORITIZATION OF STORM SEWER SUBSYSTEM BASED ON CHEMICAL DATA AND THEIR LOCATION ON FIGURE 2
SITE 18
NAS ALAMEDA

Category	Storm Drain System Named By Outfall	Outfall Location on Figure 2 [1]
High Priority with Data	G	H-5
	K	H-7
	H	H-5
	J/J2	H-6
	A	Not Shown
	E	H-3
	P	I-8
	FF	F-5
	F	F-5
	W	D-1
	JJ	Not Shown
	R	F-5
	L	H-7
	AA	E-2
	Q	I-8
	V	C-1
	S	D-5
	Z	E-2

TABLE 1
(2 of 2)

PRIORITIZATION OF STORM SEWER SYSTEM SECTIONS BASED ON CHEMICAL DATA AND THEIR LOCATION ON FIGURE 2
SITE 18
NAS ALAMEDA

Category	Storm Drain System Named By Outfall	Outfall Location on Figure 2 [1]
Medium Priority With Data	D	H-2
	O	H-8
	B	G-2
	HH	A-3
	BB	D-2
	DD	B-1
	ZZ	Not Shown
	U	C-5
	T	C-5
	CC	D-1
Unknown Priority (No Data)	GG	A-2
	EE	A-1
	Y	E-2
	KK	Not Shown
	N	H-7
	M	H-7
	I	H-6

1 Figure 2 represents the storm sewer system prior to 1991. Any new or removed lines since 1991 are not included in Figure 2.

TABLE 2

ESTIMATED VOLUME OF STORM SEWER SOLIDS AND DEBRIS IN PIPES AND THEIR LENGTH
SITE 18
NAS ALAMEDA

	High Priority		Medium Priority		No Data		Total Pipes	
	Solids and Debris Cubic Yards	Lineal Feet	Solids and Debris Cubic Yards	Lineal Feet	Solids and Debris cubic Yards	Lineal Feet	Solids and Debris Cubic Yards	Lineal Feet
Cleaned in 1991	86	17,150	0	0	0	0	86	17,150
Replaced in 1991	4	3,943	12	4,025	< 1	1,650	17	9,621
Too Damaged to Clean	186	9,038	0	0	0	0	186	9,038
This Removal	662	129,450	147	27,160	< 1	1,285	809	157,892
Total	938	159,581	159	31,185	1	2,935	1,098	193,701

TABLE 3

SOLIDS AND DEBRIS ESTIMATES FOR MANHOLES AND CATCH BASINS
SITE 18
NAS ALAMEDA

	Quantity	Solids and Debris Cubic Yards
Catch basins	830	246
Manholes	449	19

TABLE 4

PROCESS OPTION TECHNICAL FEASIBILITY SCREENING
SITE 18
NAS ALAMEDA

Process Option	Treatment Process	Screening Comment	Screening Results
A	**Removal of Solids & Debris from Sewers**		
A-1	Winches and cleaning devices	Requires additional devices for solids & debris removal	Eliminated
A-2	High pressure jetting	Effective solids & debris removal, partially dewaters	Retained
A-3	Flush cleaning	Not effective in removing high volumes of solids & debris	Eliminated
B	**Solids Separation**		
B-1	Dewatering pad	Capable of handling large volume of solids & debris	Retained
B-2	Baker tanks	Not designed for solids separation; low volume capacity	Eliminated
B-3	Lined settling pond	Questionable reliability; needs large areal footprint	Eliminated
B-4	Portable Filter press	Effective, proven dewatering process	Retained
B-5	Portable Centrifuge	Effective, proven dewatering process	Retained
C	**On-Site Solids Storage**		
C-1	Roll-off boxes	Effective solids containment	Retained
C-2	55-gallon drums	Limited volume per container	Eliminated
C-3	Storage piles	Feasible with liner, cover, and maintenance	Retained
D	**Liquid Waste Disposal**		
D-1	Treatment at the NAS Alameda industrial wastewater treatment plant (IWTP)	IWTP can treat wastewater stream	Retained
D-2	Treatment at the East Bay Municipal Utility District treatment plant	Likely will not accept this wastewater due to source	Eliminated

TABLE 5

ALTERNATIVE SCREENING
SITE 18
NAS ALAMEDA

Alternative	Combined Process Options (see Table 2)	Description	Meets Effectiveness Criteria	Meets Implementability Criteria	Relative Cost	Pass Screening
1	A-2, B-4, C-3, D-1	High pressure jetting, filter press, storage pile, and IWTP	Medium	High	Low	Yes
2	A-2, B-4, C-1, D-1	High pressure jetting, filter press, roll-off boxes, and IWTP	High	High	High	Yes
3	A-2, B-1, C-3, D-1	High pressure jetting, dewatering pad/storage pile, and IWTP	Medium	High	Low	Yes
4	A-2, B-1, C-1, D-1	High pressure jetting, dewatering pad, roll-off boxes, and IWTP	Medium	High	Medium	No
5	A-2, B-5, C-3, D-1	High pressure jetting, centrifuge, storage piles, and IWTP	Medium	High	High	No
6	A-2, B-5, C-1 D-1	High pressure jetting, centrifuge, roll-off boxes, and IWTP	High	High	Very High	No

EFFECTIVENESS CRITERIA:

- Overall protection of Human health and environment
- Compliance with ARARs
- Long-term effectiveness and permanence
- Short-term impact on workers, community, and environment
- Residuals generated
- Time to complete

IMPLEMENTABILITY CRITERIA:

- Commercial availability
- Regulatory acceptability/permitting
- Reliability

COST:

- Capital cost
- Operation and Maintenance

References for criteria:

EPA 1993. Remediation Technologies Screening Matrix and Reference Guide, Version 1
Dinkelacker, A., 1992. Cleaning of Sewers Water Science Technology. Volume 25, No. 8, pp. 37-46.
EPA 1988. Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA

TABLE 6
(1 of 2)

REMOVAL ACTION SELECTION CRITERIA AND SCORING
SITE 18
NAS ALAMEDA

Evaluation Factors	Score
EFFECTIVENESS	
Overall Protection of Human Health and Environment	
- Highly protective	5
- Moderately protective	3
- Low protectiveness	1
Compliance with ARARs	
- High potential to meet ARARs	5
- Moderate potential to meet ARARs	3
- Low potential to meet ARARs	1
Long-Term Effectiveness and Permanence	
Will maintain protection of human health and the environment over:	
- The long term	5
- An extended period	3
- A moderate period	1
Short-Term Impact on Workers, Community, and Environment	
- Low impacts	5
- Moderate impacts	3
- High impacts	1
Residuals Generated	
- Low	5
- Moderate	3
- High	1
Time to Complete	
- 0-30 days	5
- 30-45 days	3

TABLE 6
(2 of 2)

REMOVAL ACTION SELECTION CRITERIA AND SCORING
SITE 18
NAS ALAMEDA

Evaluation Factors	Score
- > 45 days	1
IMPLEMENTABILITY	
Commercial Availability	
- More than 4 vendors	3
- 2 - 4 vendors	2
- Less than 2 vendors	1
Regulatory Acceptability/Permitting	
- Highly desirable to regulatory/permitting agencies	5
- Desirable to regulatory/permitting agencies	4
- Acceptable to regulatory/permitting agencies	3
- Undesirable to regulatory/permitting agencies	2
- Highly undesirable to regulatory/permitting agencies	1
Reliability	
- Proven reliable	3
- Questionable reliability	2
- Unreliable	1
COST	
Capital Costs	
- 0-$750,000	5
- $750,001-$1,000,000	3
- >$1,000,000	1

TABLE 7

DETAILED ANALYSIS OF ALTERNATIVES
ALTERNATIVE EFFECTIVENESS AND IMPLEMENTABILITY RANKING SUMMARY
SITE 18
NAS ALAMEDA

Alternative	Process Options	Effectiveness						Implementability			Total Score
		Overall Protection of Human Health and Environment	Compliance with ARARs	Long-Term Effectiveness and Permanence	Short-Term Impact on Workers, Community, and Environment	Residuals Generated	Time to Complete	Commercial Availability	Regulatory Acceptability/ Permitting	Reliability	
1	High pressure jetting, filter press, storage pile, and IWTP	5	5	3	3	5	3	2	3	3	32
2	High pressure jetting, filter press, roll-off boxes, and IWTP	5	5	3	5	5	3	2	4	3	35
3	High pressure jetting, dewatering pad/storage pile, and IWTP	5	5	3	3	3	3	3	3	3	31

References:

EPA 1993. Remediation Technologies Screening Matrix and Reference Guide, Version 1
EPA 1988. Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA

TABLE 8

DETAILED ANALYSIS OF ALTERNATIVES
ALTERNATIVE COST RANKING
SITE 18
NAS ALAMEDA

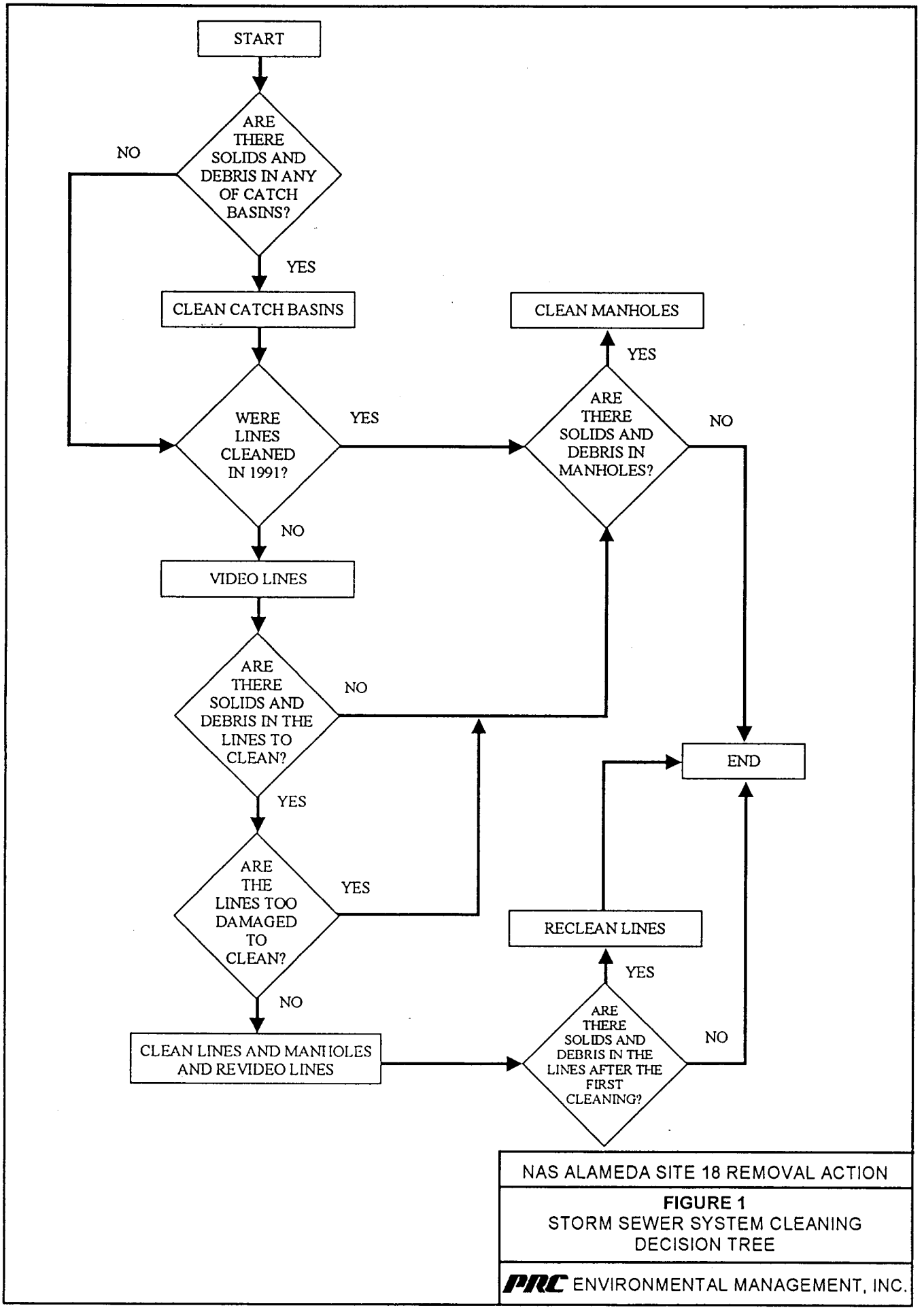
Alternative	Process Options	Cost Opinion Breakdown ($)								Total Cost ($)	Ranking
		Mobilization/Demo-bilization and Prep. Work	Monitoring, Testing, and Analysis	Site Work	Liquids and Solids & Debris Collection and Containment	Site Restoration	Distributive Costs	Contingency (20 % of all previous costs)	Project Administration (10% of all previous costs)		
1	High pressure jetting, filter press, storage pile,, and IWTP	26,000	141,850	24,059	217,149	102,632	8,260	103,989	62,394	686,330	5
2	High pressure jetting, filter press, roll-off boxes, and IWTP	26,000	141,850	53,790	553,149	102,630	8,260	177,136	106,282	1,169,095	1
3	High pressure jetting, dewatering/storage pile, and IWTP	26,000	141,850	39,154	155,849	102,632	8,260	94,748	56,849	625,340	5

TABLE 9

ALTERNATIVE RANKING
SITE 18
NAS ALAMEDA

Alternative	Process Options	Estimated Total Cost ($)	Overall Ranking Score
1	High pressure jetting, filter press, storage pile, and IWTP	686,330	37
2	High pressure jetting, filter press, roll-off boxes, and IWTP	1,169,095	36
3	High pressure jetting, dewatering pad/storage pile and IWTP	625,340	36

Overall ranking score is the sum of effectiveness and implementability ranking score (Table 7) and cost ranking score (Table 8). The alternative with the highest score is the preferred alternative.



NAS ALAMEDA SITE 18 REMOVAL ACTION

FIGURE 1
STORM SEWER SYSTEM CLEANING
DECISION TREE

PRC ENVIRONMENTAL MANAGEMENT, INC.

OAKLAND INNER HARBOR

SAN FRANCISCO BAY

SEAPLANE LAGOON

SAN FRANCISCO BAY

LEGEND

- SEWER SYSTEM CATCH BASIN LOCATION
- SEWER SYSTEM MANHOLE LOCATION
- SEWER SYSTEM LINE
- GREEN OUTFALL INFORMATION, LINE SIZE AND LINE MATERIAL INFORMATION

250 0 250 500

SCALE: IN FEET

FIGURE 2
NAS ALAMEDA
ALAMEDA, CALIFORNIA
SITE 18 REMOVAL ACTION
STORM SEWER SYSTEM

APPENDIX A

Storm Sewer System Solids Chemical Data

7 pages

TABLE A-1

NAS ALAMEDA SITE 18, SAMPLES COLLECTED BY PRC

STATISTICAL SUMMARY OF STORM SEWER SEDIMENT DATA

Analyte	Detected Samples/ Analyzed Samples	Concentration			
		Maximum Detected	Minimum Detected	Maximum SQL	Minimum SQL
Volatiles (mg/kg)					
1,1,1-TRICHLOROETHANE	8/43	1700	0.002	3	0.01
1,1,2,2-TETRACHLOROETHANE	1/42	0.001	0.001	17	0.01
1,1-DICHLOROETHANE	5/43	530	0.01	8	0.01
1,1-DICHLOROETHENE	2/43	5	0.003	17	0.01
1,2-DICHLOROETHANE	2/43	0.75	0.001	17	0.01
1,2-DICHLOROETHENE (TOTAL)	13/43	160	0.002	3	0.01
2-HEXANONE	1/42	0.014	0.014	17	0.01
4-METHYL-2-PENTANONE	2/43	0.058	0.016	17	0.01
CARBON DISULFIDE	3/43	0.05	0.002	17	0.01
CHLOROBENZENE	4/42	3.2	0.001	17	0.01
CHLOROETHANE	1/43	82	82	17	0.01
CHLOROFORM	4/43	8.8	0.002	17	0.01
CHLOROMETHANE	1/43	0.008	0.008	17	0.01
ETHYLBENZENE	6/42	0.66	0.001	17	0.01
STYRENE	1/43	0.002	0.002	17	0.01
TETRACHLOROETHENE	3/42	45	0.014	17	0.01
TOLUENE	14/43	28	0.001	3	0.01
TRICHLOROETHENE	9/43	110	0.002	3	0.01
VINYL CHLORIDE	4/43	20	0.019	17	0.01
XYLENE (TOTAL)	7/43	6.3	0.002	8	0.01
Semivolatiles (mg/kg)					
1,2,4-TRICHLOROBENZENE	1/43	1.4	1.4	190	0.39
1,2-DICHLOROBENZENE	1/43	8	8	190	0.39
1,4-DICHLOROBENZENE	1/43	0.056	0.056	190	0.39
2,4-DIMETHYLPHENOL	2/43	0.027	0.02	190	0.41
2-METHYLNAPHTHALENE	7/43	34	0.05	17	0.39
2-METHYLPHENOL	2/43	0.053	0.038	190	0.39
4-METHYLPHENOL	2/43	0.03	0.016	190	0.39
ACENAPHTHENE	9/43	3.7	0.025	190	0.39

TABLE A-1 (CONTINUED)

NAS ALAMEDA SITE 18, SAMPLES COLLECTED BY PRC

STATISTICAL SUMMARY OF STORM SEWER SEDIMENT DATA

Analyte	Detected Samples/ Analyzed Samples	Concentration			
		Maximum Detected	Minimum Detected	Maximum SQL	Minimum SQL
ACENAPHTHYLENE	2/43	0.29	0.1	190	0.39
ANTHRACENE	12/43	2.3	0.057	190	0.51
BENZO(A)ANTHRACENE	19/43	7	0.16	190	0.51
BENZO(A)PYRENE	22/43	7.9	0.078	190	0.51
BENZO(B)FLUORANTHENE	27/43	6.9	0.066	190	0.51
BENZO(G,H,I)PERYLENE	16/43	4.5	0.13	190	0.51
BENZO(K)FLUORANTHENE	19/43	6	0.12	190	0.51
BIS(2-ETHYLHEXYL)PHTHALATE	4/43	270	8	190	0.79
CARBAZOLE	8/43	0.68	0.027	190	0.51
CHRYSENE	25/43	8.8	0.064	190	0.51
DIBENZ(A,H)ANTHRACENE	5/43	0.23	0.03	190	0.51
DIBENZOFURAN	4/43	13	0.017	17	0.39
FLUORANTHENE	32/43	12	0.062	190	0.89
FLUORENE	8/43	17	0.063	17	0.39
INDENO(1,2,3-CD)PYRENE	17/43	4.3	0.13	190	0.51
N-NITROSO-DIPHENYLAMINE	2/15	77	8.8	17	0.51
NAPHTHALENE	8/43	4.8	0.036	190	0.39
PENTACHLOROPHENOL	1/43	3	3	480	0.95
PHENANTHRENE	23/43	29	0.041	17	0.51
PHENOL	2/43	4.7	0.58	190	0.39
PYRENE	35/43	12	0.067	190	2.2
Inorganics (mg/kg)					
ALUMINUM	43/43	14200.00	2670.00	NL	NL
ANTIMONY	20/43	53.30	0.62	3.90	0.57
ARSENIC	35/43	25.10	1.70	4.10	1.90
BARIUM	43/43	3620.00	23.00	NL	NL
BERYLLIUM	11/43	11.50	0.31	1.20	0.22
CADMIUM	43/43	430.00	0.25	NL	NL
CALCIUM	43/43	33400.00	1460.00	NL	NL
CHROMIUM	43/43	6470.00	25.00	NL	NL

TABLE A-1 (CONTINUED)

NAS ALAMEDA SITE 18, SAMPLES COLLECTED BY PRC

STATISTICAL SUMMARY OF STORM SEWER SEDIMENT DATA

Analyte	Detected Samples/ Analyzed Samples	Concentration			
		Maximum Detected	Minimum Detected	Maximum SQL	Minimum SQL
COBALT	28/43	562.00	4.90	8.80	2.70
COPPER	42/43	4520.00	14.30	11.50	11.50
IRON	43/43	210000.00	7650.00	NL	NL
LEAD	43/43	12200.00	5.90	NL	NL
MAGNESIUM	43/43	9900.00	1410.00	NL	NL
MANGANESE	43/43	2140.00	96.10	NL	NL
MERCURY	21/43	18.50	0.22	0.60	0.16
MOLYBDENUM	22/43	452.00	1.20	5.90	0.81
NICKEL	43/43	7430.00	27.80	NL	NL
POTASSIUM	33/43	2570.00	394.00	1440.00	290.00
SELENIUM	8/43	3.60	0.67	2.50	0.48
SILVER	17/43	245.00	0.88	2.30	0.18
SODIUM	40/43	11500.00	146.00	1250.00	106.00
THALLIUM	1/43	0.49	0.49	2.00	0.40
VANADIUM	43/43	64.00	12.90	NL	NL
ZINC	43/43	3420.00	119.00	NL	NL
Pesticides/PCBs (mg/kg)					
4,4'-DDD	4/5	0.41	0.034	0.043	0.043
4,4'-DDE	4/5	0.11	0.011	0.043	0.043
4,4'-DDT	4/5	0.14	0.019	0.043	0.043
ALPHA-BHC	1/5	0.0062	0.0062	0.022	0.0023
ALPHA-CHLORDANE	2/5	0.041	0.006	0.022	0.011
AROCLOR-1260	4/5	0.57	0.11	0.43	0.43
ENDRIN	2/5	0.031	0.0073	0.043	0.021
ENDRIN ALDEHYDE	1/5	0.0065	0.0065	0.043	0.0044
GAMMA-BHC (LINDANE)	1/5	0.0037	0.0037	0.022	0.0023
GAMMA-CHLORDANE	2/5	0.044	0.0025	0.022	0.011
TPH Extractables (mg/kg)					
OTHER COMPONENTS *	11/16	24000	20	6.6	1.4
TPH - JP-5 (C8-C16)	2/16	610	86	77	1.4

TABLE A-1 (CONTINUED)

NAS ALAMEDA SITE 18, SAMPLES COLLECTED BY PRC

STATISTICAL SUMMARY OF STORM SEWER SEDIMENT DATA

Analyte	Detected Samples/ Analyzed Samples	Concentration			
		Maximum Detected	Minimum Detected	Maximum SQL	Minimum SQL
TPH - KEROSENE (C8-C18)	1/16	2200	2200	77	1.4
TPH - MOTOR OIL (C16-C32)	12/16	5200	300	170	66
TPHC AS DIESEL	2/24	19700.00	8930.00	220.00	12.00
TPHC AS MOTOR OIL	22/24	11400.00	160.00	5000.00	290.00
TPH Purgeables (mg/kg)					
OTHER COMPONENTS *	10/16	670	1.5	1.7	1.2
TPH - ETHYLBENZENE	1/16	0.1	0.1	0.15	0.006
TPH - TOLUENE	3/16	5.5	0.008	0.042	0.006
TPH - TOTAL XYLENES	2/16	0.46	0.36	0.042	0.006
TPHC AS UNLEADED GASOLINE	10/24	3330.00	0.82	1.10	0.52
CLP Cyanide (mg/kg)					
CYANIDE	3/6	1.80	0.75	0.67	0.60
PH					
CLP PH SOIL	27/27	8.40	6.00	NL	NL
Percent Moisture					
MOISTURE	28/28	60.10	2.60	NL	NL

NOTES:

SQL = Sample quantitation limit
NL = Not listed: analyte detected in all samples
Maximum and minimum SQLs refer only to undetected analytes.

07/05/95

APPENDIX A

Storm Sewer System Solids Chemical Data

7 pages

Frequency of Detected Analytes
Storm Sewer Sediments
Alameda NAS

DRAFT

USER_TEST_GROUP	PARAMETER	Analyte Cnt	No. of Smples	% Detects
CLP VOC	1,1,1-TRICHLOROETHANE	2	51	4
CLP VOC	1,1-DICHLOROETHANE	3	51	6
CLP VOC	1,2-DICHLOROETHENE (TOTAL)	3	51	6
CLP SVOC	2,4-DIMETHYLPHENOL	1	51	2
CLP VOC	2-BUTANONE	22	51	43
CLP SVOC	2-CHLORONAPHTHALENE	1	51	2
CLP SVOC	2-METHYLNAPHTHALENE	3	51	6
CLP PEST/PCB	4,4'-DDD	14	51	27
CLP PEST/PCB	4,4'-DDE	9	51	18
CLP PEST/PCB	4,4'-DDT	10	51	20
CLP SVOC	4-CHLORO-3-METHYLPHENOL	1	51	2
CLP SVOC	4-CHLOROANILINE	1	51	2
CLP SVOC	4-METHYLPHENOL	2	51	4
CLP SVOC	ACENAPHTHENE	13	51	25
CLP SVOC	ACENAPHTHYLENE	3	51	6
CLP VOC	ACETONE	9	51	18
CLP PEST/PCB	ALPHA-CHLORDANE	1	51	2
CLP METALS	ALUMINUM	51	51	100
CLP SVOC	ANTHRACENE	13	51	25
CLP METALS	ANTIMONY	30	51	59
CLP PEST/PCB	AROCLOR-1242	1	51	2
CLP PEST/PCB	AROCLOR-1254	8	51	16
CLP PEST/PCB	AROCLOR-1260	22	51	43
CLP METALS	ARSENIC	51	51	100
CLP METALS	BARIUM	51	51	100
CLP SVOC	BENZO(A)ANTHRACENE	23	51	45
CLP SVOC	BENZO(A)PYRENE	17	51	33
CLP SVOC	BENZO(B)FLUORANTHENE	28	51	55
CLP SVOC	BENZO(G,H,I)PERYLENE	16	51	31
CLP SVOC	BENZO(K)FLUORANTHENE	14	51	27
CLP METALS	BERYLLIUM	47	51	92
CLP SVOC	BIS(2-ETHYLHEXYL)PHTHALATE	40	51	78
CLP SVOC	BUTYLBENZYLPHTHALATE	16	51	31
CLP METALS	CADMIUM	49	51	96
CLP SVOC	CARBAZOLE	9	51	18
CLP VOC	CARBON DISULFIDE	10	51	20
CLP VOC	CHLOROBENZENE	1	51	2
CLP METALS	CHROMIUM	51	51	100
CLP SVOC	CHRYSENE	35	51	69
CLP METALS	COBALT	50	51	98
CLP METALS	COPPER	51	51	100
CLP PEST/PCB	DELTA-BHC	2	51	4
CLP SVOC	DI-N-BUTYLPHTHALATE	27	51	53
CLP SVOC	DI-N-OCTYLPHTHALATE	5	51	10
CLP SVOC	DIBENZ(A,H)ANTHRACENE	9	51	18
CLP SVOC	DIBENZOFURAN	7	51	14
BUTYL TIN	DIBUTYLTIN	41	51	80

Frequency of Detected Analytes
Storm Sewer Sediments
Alameda NAS

DRAFT

CLP SVOC	DIETHYLPHTHALATE	11	51	22
CLP SVOC	DIMETHYLPHTHALATE	1	51	2
CLP VOC	ETHYLBENZENE	3	51	6
CLP SVOC	FLUORANTHENE	39	51	76
CLP SVOC	FLUORENE	8	51	16
CLP PEST/PCB	GAMMA-CHLORDANE	1	51	2
CLP SVOC	INDENO(1,2,3-CD)PYRENE	18	51	35
CLP METALS	LEAD	51	51	100
CLP METALS	MANGANESE	51	51	100
CLP METALS	MERCURY	17	51	33
CLP PEST/PCB	METHOXYCHLOR	1	51	2
CLP VOC	METHYLENE CHLORIDE	15	51	29
CLP METALS	MOLYBDENUM	18	51	35
BUTYL TIN	MONOBUTYLTIN	16	51	31
CLP SVOC	N-NITROSODIPHENYLAMINE (1)	1	51	2
CLP SVOC	NAPHTHALENE	4	51	8
CLP METALS	NICKEL	51	51	100
GENERAL CHEM	OIL AND GREASE 9071	43	51	84
ORGANIC LEAD	ORGANIC LEAD	10	51	20
CLP SVOC	PHENANTHRENE	27	51	53
CLP SVOC	PHENOL	1	51	2
CLP SVOC	PYRENE	36	51	71
CLP METALS	SELENIUM	2	51	4
CLP METALS	SILVER	22	51	43
REACTIVITY	SULFIDE	8	51	16
BUTYL TIN	TETRABUTYLTIN	1	51	2
CLP VOC	TETRACHLOROETHENE	2	51	4
CLP METALS	THALLIUM	6	51	12
CLP VOC	TOLUENE	5	51	10
BUTYL TIN	TRIBUTYL TIN (TBT)	44	51	86
CLP VOC	TRICHLOROETHENE	2	51	4
CLP METALS	VANADIUM	51	51	100
CLP VOC	VINYL CHLORIDE	1	51	2
CLP VOC	XYLENE (TOTAL)	10	51	20
CLP METALS	ZINC	51	51	100

APPENDIX B

Process Option Descriptions

4 Pages

APPENDIX B
SITE 18
NAS ALAMEDA

PROCESS OPTION DESCRIPTIONS FOR SOLIDS AND DEBRIS REMOVAL, SOLIDS SEPARATION, SOLIDS STORAGE, AND LIQUID WASTE DISPOSAL

A. Removal of Solids from Storm Sewers

A-1 Winches and Cleaning Devices

This technology uses winches and cleaning devices for storm sewer cleaning and solids and debris removal. With the help of two winches and a cable, a cleaning device is moved through the sewer. Several different cleaning devices are on the market including buckets, brushes, and root cutters. The method can be applied in the whole range of sewer pipes from small diameters up to sewers of several meters in diameter. Usually winch cleaning is combined with some technique for solids and debris removal (for example, sludge suction).

A-2 High Pressure Jetting

High pressure jetting is a widely applied method for storm drain cleaning and solids and debris removal. A high pressure jetting vehicle equipped with a water storage tank (typically 3,000 gallons) and with a high pressure pump (typically 2,000 pounds per square inch pressure and 100 gallons per minute discharge) supplies high pressure water to a cleaning nozzle in the sewer. Connection between pump and nozzle is done with a pressure hose of a length of about 300 feet. The jet emerging from the nozzle opening generates thrust which moves the cleaning nozzle together with the supply water hose along the sewer. Simultaneously, the jets wash the pipe walls and remove deposit. In a second part of the cleaning process the high pressure hose is wound back into the cleaning vehicle with the help of a motor winch. The cleaning nozzle in this part of the process still jetting now moves the solids and debris towards the manhole, where they can be removed with the help of a suction vehicle.

The method of high pressure jetting can be applied in sewers of all sizes and shapes up tp approximately 51 inches (1.30 meters) in diameter. Large volumes of clean water are normally required for this process option. Recent developments have equipped high pressure cleaning vehicles with water cleaning devices so that waste water can be reused for the jetting process. Very little is known about how the high speed water jets (possibly in combination with solid particles) affect the surface of the sewer pipes.

Some vendors that perform storm sewer solids and debris removal with high pressure jetting employ proprietary water separation devices. One device consists of a settling chamber and filtration unit built into one unit as part of a high pressure jetting system. Solids removal is claimed to be between 85 to 99 percent (volume). This initial solids separation can assist in reducing the volume of wastewater

generated during the cleaning process. These vendors also recycle the water so the production of wastewater is minimized.

A-3 Flush Cleaning

Cleaning with flushing devices is probably the oldest method of sewer/storm drain cleaning, but it still can be used efficiently and economically.

The flush cleaning device is put inside the manhole or the sewer. Wastewater is collected upstream of the cleaning device to a certain water level. The flow is led through a pipe and with a nozzle to the front of the apparatus where it forms a water jet which removes deposits and washes them downstream. As soon as enough deposits are removed, the apparatus moves a few centimeters downstream. The major disadvantage to this method is that a comparatively large amount of work inside the sewer under sometimes dangerous working conditions is necessary. Other problems with this method are that in the pipe section upstream of the cleaning apparatus, where the flow velocity is small, new solids may be formed; and in cases of sudden rainfall, the apparatus cannot be removed from the sewer quickly enough so the storm water capacity of the sewer is reduced.

B. Solids Separation

B-1 Dewatering Pads

Dewatering pads are widely used to reduce the moisture content and subsequently the volume of solids associated with wastewater treatment. Solids capture is typically between 85 and 99 percent for properly designed systems. Pads are typically made from gravel, approximately 3 feet thick.

B-2 Baker Tanks

These large mobile tanks would be used as gravity settling basins. After a period of time the water on top would bo syphoned off and solids would remain.

B-3 Lined Settling Ponds

A lined settling pond is a temporary structure dug below grade and lined with an impervious material. Any solids associated with the water entering the pond would settle to the bottom of the pond by gravity. Solids capture is typically between 75 and 90 percent (by volume) for a properly designed pond.

B-4 Filter Press

There are two major types of filter presses: belt and plate and frame.

Belt filter presses use single or double moving belts to dewater solids by (1) conditioning through either the addition of a flocculant or by a thickening drum, (2) gravity drainage of water, (3) compression against a roller.

Plate and frame filter presses consist of parallel vertical plates placed in series, covered on both sides with a filter fabric. The slurry flows into the filter press and is squeezed between the plates. The water flows through the filter fabric and is collected for treatment. When the press is opened, the filter cake is collected off the plates

B-5 Centrifuge

Centrifugation uses rapid rotation of the fluid/solids mixture inside a rigid vessel to separate the components based on their mass. The forces in a centrifuge are similar to the gravitation forces of sedimentation but much stronger. These forces are generated from the energy cost of operating the centrifuge.

C. On-Site Solids Storage

C-1 Roll-Off Boxes

These containers are sealed metal boxes that hold between 1 and 40 standard cubic yards of material and are easily loaded on trucks for transport. The boxes would need to be stored in an area that contains a secondary containment system.

C-2 55-Gallon Drums

These metal drums hold approximately one-quarter of a standard cubic yard each. Like the roll-off boxes they would require a secondary containment area for on-site storage.

C-3 Storage Piles

Solids are stockpiled on an impervious liner and covered to prevent loss by wind and rain erosion. Runoff or water from dewatering under its own weight would be collected in a sump and pumped to a storage pond for temporary storage.

D. Liquid Waste Disposal

D-1 Treatment at NAS Alameda Industrial Wastewater Treatment Plant (IWTP)

The liquid waste would be discharged to a nearby industrial sewer at the base. Treatment would occur in the IWTP at NAS Alameda. This plant is permitted to treat hazardous waste streams.

D-2 Treatment at the East Bay Municipal Utility District treatment plant

The wastewater would be sent to the local wastewater treatment system via the existing sanitary sewer system.

APPENDIX C

Assumptions Used in Estimating Solids and Wastewater Quantities

2 Pages

APPENDIX C
SITE 18
NAS ALAMEDA

ASSUMPTIONS USED IN ESTIMATING SOLIDS AND DEBRIS AND WASTEWATER QUANTITIES

1. Solids and Debris

Total solids and debris volume (this removal):	1,074 cubic yards

A. Catch Basins

Total number at base:	830
Average area of each:	16 square feet (4 feet by 4 feet)
Average solids and debris depth in each :	6 inches
Total solids and debris volume in all catch basins:	246 cubic yards

B. Manholes

Total number at base:	449
Average diameter:	5 feet
Average diameter circular channel:	2 feet
Average solids and debris depth in each :	3 inches
Total solids and debris volume in all manholes:	19 cubic yards

C. Pipes

Total length of pipe (this removal):	157,892 linear feet

A depth of solids and debris (ranging from 0.5 inches to 3 inches in damaged areas and 4 inches to 26 inches problem areas) was assumed over the entire length of the pipe segment. This assumption should be considered conservative, likely causing an overestimate of the actual solids and debris volume. The depth was based on field observations by IT Corporation at adjacent catch basins and manholes and information in the A-N West (1991) report.

Total solids and debris volume (this removal):	809 cubic yards

2. Wastewater

Total wastwater volume:	477,566 gallons

Does not include any water in the system at the time of cleaning or water any entering the system during the cleaning (except for the water used for cleaning)

A. Generated During Cleaning

Water application rate:	35 gallons per minute at maximum pressure of 2,000 pounds per square inch
Wastewater generation rate:	2 gallons/linear foot (17 minutes per 300 linear feet of pipe including manholes and catch basins)
Total wastewater generated During cleaning:	368,713 gallons

B. Generated During Dewatering

Percent Solids:	50 percent
Total solids and debris volume:	1,074 cubic yards
Total wastewater generated During dewatering:	108,853 gallons

APPENDIX D

Detailed Cost Opinions for Alternatives

3 Pages

ALTERNATIVE 1
COST OPINION AND ASSUMPTIONS
SITE 18
NAS ALAMEDA

Alternative 1 - High pressure jetting, filter press, storage piles, and IWTP

WBS Code	Item/Description	Unit	Unit Cost ($)	Quantity	Total ($)
33	**HTRW Removal Action**				
33.01	**Mobilization and Preparatory Work**				
33.01.03	Removal Action Work Plan	lump sum	10,000	1	10,000
33.01.90	Bid Preparation and Evaluation	lump sum	5,000	1	5,000
33.01.91	Permitting	lump sum	1,000	1	1,000
	Subtotal				**16,000**
33.02	**Monitoring, Sampling, Testing, and Analysis**				
33.02.05	Sampling Liquid Waste-labor	hour	60	25	1,500
33.02.06	Sampling Solids-labor	hour	60	12	720
33.02.90	Liquid Waste Analysis (one sample/tank truck)	sample	1,000	25	25,000
33.02.91	Solids Analysis (one sample/ 100 cubic yards)	sample	1,000	12	12,000
33.02.92	Pre-removal video inspection	linear foot	0.65	157,892	102,630
	Subtotal				**141,850**
33.03	**Site Work**				
33.03.05	Fencing - Rented 6 ft high chain link	lump sum	7.05	440	3,102
33.03.90	Construct Storage Area				
	Site prep & mobilization	lump sum	1,000	1	1,000
	Gravel	cubic yard	6.32	91	575
	65 mil HDPE liner w/installation	square foot	1	9,649	7,237
	Geotextile (8 mil)	square foot	0.50	9,800	4,900
	Sand bags (708@3 cubic feet)	cubic yard	5	79	395
	Hay bales	ton	350	1	350
	Cover (20 mil HDPE)	sqare feet	0.50	10,000	5,000
	Labor for construction/operation & maintenance	lump sum	1,500	1	1,500
	Subtotal				**24,059**
33.09	**Liquids, Sediments, and Sludge Collection and Containment**				
33.09.90	Storm Drain Cleaning (initial)	linear foot	0.55	157,892	86,841
33.09.90	Storm Drain Cleaning (second pass-25% of total)	linear foot	0.55	39,473	21,710
33.09.91	Catch basin cleaning	each	30	830	24,900
33.09.92	Modular wastewater tank (24,000 gallons) -2 tanks	month	689	2	1,378
	Tank shipping	each way	1,200	4	4,800
	Tank liner (36 mil polypropylene, double)	each	1,790	4	7,160
	Tank installation/decomissioning	lump sum	800	2	1,600
33.09.93	Oil/water separators (2)	month	150	2	300
	Separator shipping	lump sum	280	2	560
	Separator installation/decomissioning	lump sum	100	2	200
33.09.94	Filter press dewatering				
	Rental (15 cy capacity)	day	1,200	25	30,000
	Shipping	each way	1,200	2	2,400
	Installation & setup	lump sum	1,000	1	1,000
	Modular feed tank rental (1@10,000 gallons)	month	500	1	500
	Tank shipping	each way	1,000	2	2,000
	Tank installation/decomissioning	lump sum	800	1	800
	Labor for operation (1 person, 2 shifts/day, 8 hours/shift for 35 days)	day	1,200	25	30,000
	Handling filter cake	lump sum	500	1	500
	Decontamination/decommissioning	lump sum	500	1	500
33.09.96	Wastewater disposal at IWTP	gallon	0	477,566	0
	Subtotal				**217,149**
33.20	**Site Restoration**				
33.20.90	Post-removal video inspection of pipes	linear foot	1	157,892	102,630
	Subtotal				**102,630**
33.21	**Demobilization**				
33.21.04	Demobilization of Equipment	lump sum	2,000	1	2,000
33.21.06	Preparation of Removal Action Report	lump sum	8,000	1	8,000
	Subtotal				**10,000**
33.99	**Distributive Costs**				
33.99.01	Supervision/Management	hour	60	96	5,760
33.99.02	Administration	hour	50	20	1,000
33.99.12	Computer and Data	lump sum	500	1	500
33.99.15	Health and Safety	lump sum	1,000	1	1,000
	Subtotal				**8,260**
	Contingency (20% of previous costs)	(20%)			**103,989**
	Project Administration (10% of all costs)	(10%)			**62,394**
	Grand Total				**$686,330**

ALTERNATIVE 2
COST OPINION AND ASSUMPTIONS
SITE 18
NAS ALAMEDA

Alternative 2 - High pressure jetting, filter press, roll-off boxes and IWTP

WBS Code	Item/Description	Unit	Unit Cost ($)	Quantity	Total ($)
33	**HTRW Removal Action**				
33.01	**Mobilization and Preparatory Work**				
33.01.03	Removal Action Work Plan	lump sum	10,000	1	10,000
33.01.90	Bid Preparation and Evaluation	lump sum	5,000	1	5,000
33.01.91	Permitting	lump sum	1,000	1	1,000
	Subtotal				**16,000**
33.02	**Monitoring, Sampling, Testing, and Analysis**				
33.02.05	Sampling Liquid Waste-labor	hour	60	25	1,500
33.02.06	Sampling Solids-labor	hour	60	12	720
33.02.90	Liquid Waste Analysis (one sample/tank truck)	sample	1,000	25	25,000
33.02.91	Solids Analysis (one sample/ 100 cubic yards)	sample	1,000	12	12,000
33.02.92	Pre-removal video inspection	linear foot	0.65	157,892	102,630
	Subtotal				**141,850**
33.03	**Site Work**				
33.03.05	Fencing - Rented 6 ft high chain link	lump sum	7.05	656	4,625
33.03.90	Construct containment area for roll-off boxes				
	Site prep & mobilization	lump sum	1,000	1	1,000
	65 mil HDPE liner w/installation	square foot	1.00	30,440	30,440
	Hay bales	ton	350	3.0	1,050
	Sand	cubic yard	5	1,043.0	5,215
	Geotextile (8mil)	square foot	0.50	18,920.0	9,460
	Labor for construction/operation & maintenance	lump sum	2,000	1	2,000
	Subtotal				**53,790**
33.09	**Liquids, Sediments, and Sludge Collection and Containment**				
33.09.90	Storm Drain Cleaning (initial)	linear foot	0.55	157,892	86,841
33.09.90	Storm Drain Cleaning (second pass-25% of total)	linear foot	0.55	39,473	21,710
33.09.91	Catch basin cleaning	each	30	830	24,900
33.09.92	Modular wastewater tank (24,000 gallons) -2 tanks	month	689	2	1,378
	Tank shipping	each way	1,200	4	4,800
	Tank liner (36 mil polypropylene, double)	each	1,790	4	7,160
	Tank installation/decomissioning	lump sum	800	2	1,600
33.09.93	Oil/water separators (2)	month	150	2	300
	Separator shipping	lump sum	280	2	560
	Separator installation/decomissioning	lump sum	100	2	200
33.09.94	Filter press dewatering				
	Rental (15 cy capacity)	day	1,200	40	48,000
	Shipping	each way	1,200	2	2,400
	Installation & setup	lump sum	1,000	1	1,000
	Modular feed tank rental (1@10,000 gallons)	month	500	1	500
	Tank shipping	each way	1,000	2	2,000
	Tank installation/decomissioning	lump sum	800	1	800
	Labor for operation (1 person, 2 shifts/day, 8 hours/shift for 35 days)	hour	50	560	28,000
	Handling filter cake	lump sum	500	1	500
	Decontamination/decommissioning	lump sum	500	1	500
33.03.95	Storage in roll-off boxes				
	Box rental (10 cy @$220/box X 55 boxes)	week	12,100	24	290,400
	Box liners (36mil poly prop,300 sqft/box X 55 boxes)	square foot	1	16,500	23,100
	Transportation to storage area	lump sum	1,000	1	1,000
	Pump for waterwater handling	lump sum	500	1	500
33.09.96	Wastewater disposal at IWTP	gallon	0	477,566	0
	Truck rental including labor	month	5,000	1	5,000
	Subtotal				**553,149**
33.20	**Site Restoration**				
33.20.90	Post-removal video inspection of pipes	linear foot	1	157,892	102,630
	Subtotal				**102,630**
33.21	**Demobilization**				
33.21.04	Demobilization of Equipment	lump sum	2,000	1	2,000
33.21.06	Preparation of Removal Action Report	lump sum	8,000	1	8,000
	Subtotal				**10,000**
33.99	**Distributive Costs**				
33.99.01	Supervision/Management	hour	60	96	5,760
33.99.02	Administration	hour	50	20	1,000
33.99.12	Computer and Data	lump sum	500	1	500
33.99.15	Health and Safety	lump sum	1,000	1	1,000
	Subtotal				**8,260**
	Contingency (20% of previous costs)	(20%)			**177,136**
	Project Administration (10% of all costs)	(10%)			**106,281**
	Grand Total				**$1,169,095**

ALTERNATIVE 3
COST OPINION AND ASSUMPTIONS
SITE 18
NAS ALAMEDA

Alternative 3 - High pressure jetting, dewatering pad/storage pile, and IWTP

WBS Code	Item/Description	Unit	Unit Cost ($)	Quantity	Total ($)
33	**HTRW Removal Action**				
33.01	**Mobilization and Preparatory Work**				
33.01.03	Removal Action Work Plan	lump sum	10,000	1	10,000
33.01.90	Bid Preparation and Evaluation	lump sum	5,000	1	5,000
33.01.91	Permitting	lump sum	1,000	1	1,000
	Subtotal				**16,000**
33.02	**Monitoring, Sampling, Testing, and Analysis**				
33.02.05	Sampling Liquid Waste-labor	hour	60	25	1,500
33.02.06	Sampling Solids-labor	hour	60	12	720
33.02.90	Liquid Waste Analysis (one sample/tank truck)	sample	1,000	25	25,000
33.02.91	Solids Analysis (one sample/ 100 cubic yards)	sample	1,000	12	12,000
33.02.92	Pre-removal video inspection	linear foot	0.65	157,892	102,630
	Subtotal				**141,850**
33.03	**Site Work**				
33.03.05	Fencing - Rented 6 ft high chain link	lump sum	7.05	520	3,666
33.03.90	Construct Dewatering pad/storage pile				
	Site prep & mobilization	hour	500	1	500
	Gravel	cubic yard	6.32	185	1,169
	65 mil HDPE liner w/installation	square foot	1	15,125	11,344
	Geotextile (8 mil)	square foot	0.50	20,000	10,000
	Sand bags (1,056@3 cubic feet)	cubic yard	5	120	600
	Hay bales	ton	350	3	875
	Cover (20 mil HDPE)	sqare feet	0.50	12,000	6,000
	Labor for construction/operation & maintenance	hour	50	100	5,000
	Subtotal				**39,154**
33.09	**Liquids, Sediments, and Sludge Collection and Containment**				
33.09.90	Storm Drain Cleaning (initial)	linear foot	0.55	157,892	86,841
33.09.90	Storm Drain Cleaning (second pass-25% of total)	linear foot	0.55	39,473	21,710
33.09.91	Catch basin cleaning	each	30	830	24,900
33.09.92	Modular wastewater tank (24,000 gallons) -2 tanks	month	689	2	1,378
	Tank shipping	each way	1,200	4	4,800
	Tank liner (36 mil polypropylene, double)	each	1,790	4	7,160
	Tank installation/decomissioning	lump sum	800	2	1,600
33.09.93	Oil/water separators (2)	month	150	2	300
	Separator shipping	lump sum	280	2	560
	Separator installation/decomissioning	lump sum	100	2	200
33.09.94	Dewatering/storage piles wastewater				
	Wastewater sump & pump	lump sum	1,000	1	1,000
	Pump for storage pond	lump sum	400	1	400
33.09.95	Wastewater disposal at IWTP	gallon	0	477,566	0
	Truck rental including labor	month	5,000	1	5,000
	Subtotal				**155,849**
33.20	**Site Restoration**				
33.20.90	Post-removal video inspection of pipes	linear foot	1	157,892	102,630
	Subtotal				**102,630**
33.21	**Demobilization**				
33.21.04	Demobilization of Equipment	lump sum	2,000	1	2,000
33.21.06	Preparation of Removal Action Report	lump sum	8,000	1	8,000
	Subtotal				**10,000**
33.99	**Distributive Costs**				
33.99.01	Supervision/Management	hour	60	96	5,760
33.99.02	Administration	hour	50	20	1,000
33.99.12	Computer and Data	lump sum	500	1	500
33.99.15	Health and Safety	lump sum	1,000	1	1,000
	Subtotal				**8,260**
	Contingency (20% of previous costs)	(20%)			**94,748**
	Project Administration (10% of all costs)	(10%)			**56,849**
	Grand Total				**$625,340**