

**PROPOSED SAMPLING PROGRAM
TO ESTABLISH THE EXTENT OF
CONTAMINATION
MALTA ROCKET FUEL AREA SITE**

13 January 1994

ERM-Northeast, Inc.
501 New Karner Road
Suite 7
Albany, New York 12205



ERM



Kristen F. Begor
Remedial Project Manager

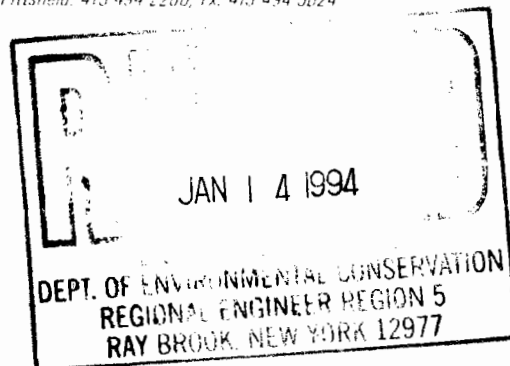
Corporate Environmental Programs
General Electric Company
One Computer Drive South, Albany, NY 12205
Albany: 518 458 6620, Ex: 518 458 9247
Pittsfield: 413 494 2266, Ex: 413 494 5024

January 13, 1994

Alison Hess, Project Manager
c/o Mel Hauptman
U.S. Environmental Protection Agency
26 Federal Plaza - Room 737
New York, New York 10278
(3 copies)

Virginia Capon, Esquire
U.S. Environmental Protection Agency
26 Federal Plaza - Room 437
New York, New York 10278
(1 copy)

Victor Cardona, Project Manager
Bureau of Eastern Remedial Action
Division of Hazardous Waste Remediation
NYS Department of Environmental Conservation
50 Wolf Road - Room 222
Albany, New York 12233
(3 copies)



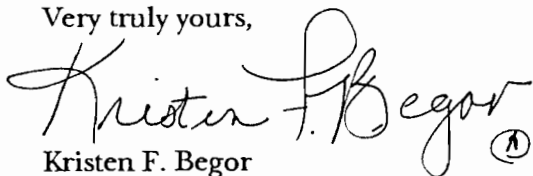
Re: Malta Rocket Fuel Area Site-'Proposed Sampling Program to Establish the Extent of Contamination' and 'Technical Memorandum Dry Well/Septic Tank Inventory and Test Pit/Dry Well Soil Sampling Results - Fall 1993'

Dear Ms. Hess, et al:

Enclosed, pursuant to the USEPA's letter of December 23, 1993, is the revised "Proposed Sampling Program to Establish the Extent of Contamination" and "Technical Memorandum - Dry Well/Septic Tank Inventory and Test Pit/Dry Well Soil Sampling Results - Fall 1993" for the Malta Rocket Fuel Area Site. Field work is anticipated to commence the week of January 24, 1994.

Please call if you have any questions.

Very truly yours,


Kristen F. Begor

attc:

cc: Hal Brodie, Esq., NYS Energy Research & Development Authority
Phil Gitlin, Esq., Whiteman, Osterman & Hanna
Don Hooker, U.S. Army Corps of Engineers
Angus Macbeth, Esq., Sidley & Austin
Kirk Macfarlane, Esq., General Electric
William Miller, ERM-Northeast
Cathy Sanders, Esq., U.S. Army Corps of Engineers
Dan Steenberg, NYS Department of Environmental Conservation

**PROPOSED SAMPLING PROGRAM
TO ESTABLISH THE EXTENT OF
CONTAMINATION
MALTA ROCKET FUEL AREA SITE**

13 January 1994

**ERM-Northeast, Inc.
501 New Karner Road
Suite 7
Albany, New York 12205**

TABLE OF CONTENTS

1.0	INTRODUCTION	1-1
2.0	OBJECTIVES	2-1
3.0	DETERMINATION OF MRFA COMPARATIVE CRITERIA	3-1
3.1	MAXIMUM BACKGROUND CONCENTRATIONS	3-1
3.1.1	Surface and Subsurface Soil	3-1
3.1.2	Surface Water	3-3
3.1.3	Sediment	3-4
3.1.4	Ground Water	3-4
3.2	AVAILABLE REGULATORY STANDARDS/GUIDANCE VALUES/CRITERIA	3-5
3.2.1	Surface and Subsurface Soil	3-5
3.2.2	Surface Water	3-6
3.2.3	Sediment	3-7
3.2.4	Ground Water	3-8
3.3	HEALTH-BASED COMPARATIVE CRITERIA	3-8
3.3.1	Surface and Subsurface Soil	3-8
3.3.2	Surface Water	3-10
3.3.3	Sediment	3-11
3.3.4	Ground Water	3-11
3.4	SUMMARY OF MRFA COMPARATIVE CRITERIA	3-11
3.4.1	Surface and Subsurface Soil	3-11
3.4.2	Surface Water	3-12
3.4.3	Sediment	3-13
3.4.4	Ground Water	3-13
4.0	COMPARISON OF ANALYTICAL RESULTS TO MRFA COMPARATIVE CRITERIA	4-1
4.1	SURFACE SOIL	4-1
4.2	SUBSURFACE SOIL	4-2
4.3	SURFACE WATER	4-4
4.3.1	Ravines	4-5
4.3.2	Quench Pits	4-6
4.3.3	Muggett's Pond	4-7
4.4	SEDIMENT	4-8
4.4.1	Ravines	4-9
4.4.2	Quench Pits	4-10
4.4.3	Muggett's Pond	4-11

4.4.4	<i>Catch Basins</i>	4-11
4.4.5	<i>Open Sump</i>	4-12
4.4.6	<i>Retention Ponds and Muggett's Pond Drainage Ditch</i>	4-13
4.5	<i>GROUND WATER</i>	4-13
4.6	<i>SEPTIC TANKS</i>	4-15
4.7	<i>DRY WELLS</i>	4-17
5.0	<i>PROPOSED SAMPLING PROGRAMS</i>	5-1
5.1	<i>SURFACE SOIL</i>	5-1
5.2	<i>SUBSURFACE SOIL</i>	5-3
5.3	<i>SURFACE WATER</i>	5-6
5.3.1	<i>Ravines</i>	5-6
5.3.2	<i>Quench Pits</i>	5-7
5.3.3	<i>Muggett's Pond</i>	5-8
5.4	<i>SEDIMENT</i>	5-8
5.4.1	<i>Ravines</i>	5-8
5.4.2	<i>Quench Pits</i>	5-9
5.4.3	<i>Muggett's Pond</i>	5-10
5.4.4	<i>Catch Basins</i>	5-10
5.4.5	<i>Open Sump</i>	5-12
5.5	<i>GROUND WATER</i>	5-12
5.6	<i>SUMMARY OF PROPOSED SAMPLING PROGRAMS</i>	5-13
6.0	<i>SCHEDULE</i>	6-1
7.0	<i>CONCLUSIONS</i>	7-1
8.0	<i>REFERENCES</i>	8-1

APPENDICES

A	<i>Development of Toxicity Criteria and Health-Based Comparative Criteria</i>
B	<i>Proposed Sampling Locations</i>

LIST OF FIGURES

- 1** *Flow Chart for Assessment of MRFA Site Locations Requiring Further Characterization*
- 2** *Surface Soil Sampling Locations*
- 3** *Subsurface Soil Sampling Locations*
- 4** *Ravine Surface Water and Sediment Sample Location Map*
- 5** *Site Surface Water and Sediment Sampling Locations*
- 6** *Single Well and Well Pair Location Map*
- 7** *Dry Well and Septic Tank Sampling Location Map*
- 8** *Dry Well and Septic Tank Sampling Location Map - GE/Exxon Building*

LIST OF TABLES

- 1** *Measured Background Inorganic Ranges for Each Media*
- 2** *Surface Soil Statistical Background Concentrations-Inorganic Analytes*
- 3** *Subsurface Soil Statistical Background Concentrations-Inorganic Analytes*
- 4** *Ravine 6a Surface Water Concentrations-Inorganic Analytes*
- 5** *Ravine 6a Sediment Concentrations-Inorganic Analytes*
- 6** *Upgradient Ground Water Concentration Ranges-Inorganic Analytes*
- 7** *NYSTAGM Values for Soil-Inorganic Analytes*
- 8** *NYSTAGM Values for Soil-Organic Compounds Detected in Site Soil*
- 9** *NYSSWS and Federal Surface Water Criteria-Inorganic Analytes*
- 10** *NYSSC, ER-L and ER-M Sediment Criteria-Inorganic Analytes*
- 11** *NYSSC, ER-L and ER-M Sediment Criteria - Organic Compounds Detected in Site Sediment*
- 12** *Federal and State Ground Water Criteria - Inorganic Analytes*
- 13** *Federal and State Ground Water Criteria - Organic Compounds Detected in Site Ground Water*
- 14** *Health-Based Soil Comparative Criteria - Inorganic Analytes*
- 15** *MRFA Comparative Criteria - Surface Soil - Inorganic Analytes*
- 16** *MRFA Comparative Criteria - Subsurface Soil - Inorganic Analytes*
- 17** *MRFA Comparative Criteria - Surface Water - Inorganic Analytes*
- 18** *MRFA Comparative Criteria - Sediment - Inorganic Analytes*
- 19** *MRFA Comparative Criteria - Sediment - Organic Compounds*
- 20** *MRFA Comparative Criteria - Ground Water - Inorganic Analytes*
- 21** *MRFA Comparative Criteria - Ground Water - Organic Compounds Detected in Site Ground Water*
- 22** *Surface Soil Sampling Program*
- 23** *Comparison of Site Surface Soil to Comparative Criteria*
- 24** *Surface Soil Sample Locations with Analytes Above MRFA Comparative Criteria*
- 25** *Comparison of Site Subsurface Soil to Comparative Criteria - Inorganic Analytes*
- 26** *Subsurface Soil Sample Locations With Analytes Above MRFA Comparative Criteria*
- 27** *Surface Water Sample Locations With Analytes Above MRFA Comparative Criteria*

28	<i>Sediment Sample Locations With Inorganic Analytes Above MRFA Comparative Criteria</i>
29	<i>Sediment Sample Locations With Organic Compounds Above Applicable Criteria</i>
30	<i>Ground Water Sample Locations With Analytes Above MRFA Comparative Criteria - June 1992 Unfiltered</i>
31	<i>Ground Water Sample Locations With Analytes Above MRFA Comparative Criteria - November 1992 Unfiltered</i>
32	<i>Ground Water Sample Locations With Analytes Above MRFA Comparative Criteria - June 1992 Filtered</i>
33	<i>Ground Water Sample Locations With Analytes Above MRFA Comparative Criteria - November 1992 Filtered</i>
34	<i>Proposed Sampling Programs</i>
35	<i>Proposed Sampling Summary</i>

LIST OF ABBREVIATIONS

CaCO₃	calcium carbonate
CRDL	contract required detection limit
DW	dry well
ER-L	effects range - low from NOAA Technical Memorandum
ER-M	effects range - medium from NOAA Technical Memorandum
ERM	Environmental Resources Management
GE	General Electric
IDL	instrument detection limit
LSR	Literature Search Report
M	monitoring well
mg/kg	milligrams per kilogram (equivalent to ppm)
mg/l	milligrams per liter (equivalent to ppm)
MRFA	Malta Rocket Fuel Area
MW	monitoring well
NOAA	National Oceanic and Atmospheric Administration
NPDWS	National Primary Drinking Water Standards
NSDWS	National Secondary Drinking Water Standards
NYSDEC	New York State Department of Environmental Conservation
NYSGWS	New York State Ground Water Standards
NYSSC	New York State Sediment Criteria
NYSSWS	New York State Surface Water Standards
NYSTAGM	New York State Technical and Administrative Guidance Memorandum
OSWER	Office of Solid Waste and Emergency Response
P	test pit
PCB	polychlorinated biphenyl
POP	Project Operations Plan
ppb	parts per billion
ppm	parts per million
PRG	preliminary remediation goal
QA/QC	quality assurance/quality control
RA	risk assessment
RAG	risk assessment goal
RDA	recommended dietary allowance
RfD	reference dosage
RI	remedial investigation
S	soil boring
SB	site background
SD	sediment
SF	slope factor
SS	surface soil
SVOC	semi-volatile organic compound
SW	surface water
TAL	target analyte list
TCL	target compound list
TIC	tentatively identified compound

ug/kg *micrograms per kilogram (equivalent to ppb)*
ug/l *micrograms per liter (equivalent to ppb)*
USEPA *United States Environmental Protection Agency*
VOC *volatile organic compound*

The purpose of this document is to evaluate the MRFA Site data obtained to date in order to determine which areas of the site require further investigation. The site data will be compared to a set of criteria that have been established as part of this document. Where concentrations observed on site exceed these values, the need for further investigation will be carefully assessed. Where regulatory and guidance values do not exist or they refer to background, the background concentrations for the site will be used.

The background surface water, sediment, and soil sampling programs for the Malta Rocket Fuel Area (MRFA) Site were completed pursuant to USEPA-approved scopes of work dated 20 August 1993 and 18 October 1993. The objectives, methodologies, and findings for these background sampling programs are discussed in the Technical Memorandum Background Investigation Report submitted to the USEPA on 30 November 1993.

The Background Technical Memorandum established measured background concentration ranges of naturally occurring constituents (e.g., inorganics and organics) for the surface water, sediment, surface soil, subsurface soil, and ground water at the MRFA Site. The measured background concentration ranges in each of these media, as identified in the Background Technical Memorandum, are summarized in Table 1.

Within this document, background concentration ranges; available regulatory standards, guidance values, and criteria; and health-based criteria are collectively used for comparison to MRFA RI analytical results. Because inorganic constituents are so prevalent in the naturally occurring soil and because of the nature of available guidance values for these

constituents, specific procedures were utilized to evaluate the need for further investigation of such constituents in the soil medium. As part of this, maximum statistical background concentrations for the inorganic analytes and some specific health-based criteria had to be calculated for soil. From this, maximum concentrations (hereinafter referred to as the MRFA Comparative Criteria) for each organic compound and inorganic analyte in each medium have been developed. The MRFA Comparative Criteria were then compared to the MRFA RI analytical results in order to identify locations on the MRFA Site that may require further characterization. For those areas and constituents which were determined to require further investigation, sampling programs were developed and are set forth in Section 5.0 of this document. A flow chart illustrating the assessment process utilized in this document is presented in Figure 1.

The MRFA Comparative Criteria are not intended as cleanup goals or preliminary remediation goals (PRGs). They are simply concentrations which represent a level of environmental quality above which further characterization may be warranted and that any potential risks associated with the observed environmental quality should also be evaluated.

OBJECTIVES

The objectives of this document are as follows:

- (a) determine maximum background concentrations for each constituent;
- (b) compare maximum background concentrations to available regulatory standards, guidance values, and criteria, and health-based criteria to determine MRFA Comparative Criteria;
- (c) compare the MRFA RI analytical results to the MRFA Comparative Criteria to identify locations at the MRFA Site that may require further characterization; and
- (d) make necessary recommendations for additional investigations.

Based on these evaluations, a sampling program has been prepared to adequately define the vertical and horizontal extent of constituents in areas of the MRFA Site that have been identified as warranting further characterization. The proposed sampling program is designed to provide the information necessary to perform a risk assessment (RA) and to evaluate potential remedial actions.

3.0

DETERMINATION OF MRFA COMPARATIVE CRITERIA

There are numerous environmental quality criteria that could be used for comparison to MRFA Site analytical data. In determining the MRFA Comparative Criteria, the 1) maximum background concentrations (statistically derived for soil); 2) available standards, guidance values, and criteria; and 3) health-based criteria were evaluated for each medium (surface and subsurface soil, surface water, sediment, and ground water). The following sections discuss each of the above listed criteria and the rationale used in determining the MRFA Comparative Criteria for each analytical parameter in each medium.

3.1

MAXIMUM BACKGROUND CONCENTRATIONS

Maximum background concentrations were determined for soil, sediment, and surface water using the measured background analytical results as presented in the 30 November 1993 Technical Memorandum and for ground water using the MRFA RI analytical results. The following subsections discuss the method by which the maximum background concentrations were determined and present a summary of the maximum background concentrations for each medium.

3.1.1

SURFACE AND SUBSURFACE SOIL

The background soil sampling program involved the collection and laboratory analysis of twenty surface soil samples and thirty-two subsurface soil samples on or adjacent to the MRFA Site. Both the surface and subsurface soil samples were analyzed for the Target Analyte List (TAL) Inorganics plus boron. The surface soil samples were also analyzed for the Target Compound List (TCL) semi-volatile organic compounds (SVOCs). The inorganic analytical results for these samples provided a sufficient

database for a statistical evaluation of the background sample analytical results for inorganics. No statistical analysis was performed for the SVOCs in surface soil since the analytical results for SVOCs in all of the background surface soil samples were below the available regulatory standards, guidance values, and criteria.

The measured background surface and subsurface soil inorganic analytical results were evaluated to determine their statistical distribution (i.e., normal, log normal, or non-parametric). This was done by calculating the mean, variance, standard deviation, the coefficient of variation, and the skewness. For those inorganic analytes that were not detected, one-half the Instrument Detection Limit (IDL) was used in the statistical calculations. Though statistical evaluations of environmental data frequently assume normal distributions, the background soil inorganic analytical results were checked for normality. All inorganic analytes were normally distributed for the background surface and subsurface soil samples with the exception of calcium and cyanide for the subsurface soil samples which were log normally distributed (see Attachment C in the Background Technical Memorandum).

After reviewing the analytical data and the derived statistics, a statistical range for each inorganic analyte (with a sufficient number of detections) was established. The statistical range is a more accurate representation of the actual background conditions than the measured range because the 20 to 30 background samples collected may not accurately represent the environmental quality of the entire soil mass.

There are numerous methods for determining statistical or actual ranges from data collected randomly and normally distributed (as was the case for this data). A statistical range of the background inorganic soil quality was developed as the arithmetic mean plus or minus two standard deviations for

each inorganic analyte at the request of the USEPA (verbal communication, November 1993). Theoretically, this procedure establishes a concentration range which would include 95.44 percent of the entire soil mass (Gilbert, 1987). Using this, the maximum statistical background concentrations for each inorganic analyte in surface and subsurface soil has been established as the maximum concentration of the calculated statistical range (arithmetic mean plus two standard deviations). The maximum statistical background concentrations are presented on Table 2 for surface soil and Table 3 for subsurface soil.

Only a portion of the subsurface soil inorganic analytical results (21 samples) were evaluated using statistics. The ten deepest background samples (greater than ten feet) that were collected from just above the water table were not used in the statistical analysis. Nearly all of the soil samples collected at the MRFA Site have been collected from significantly shallower depths (zero to ten feet below grade). Additionally, the concentrations of some inorganic analytes (calcium and sodium) in the deepest soil samples were different enough from the shallower subsurface soil samples to consider them a different population. These ten deeper samples may be used for comparison to future deep site soil samples.

3.1.2 *Surface Water*

The background surface water sampling program involved the collection of surface water samples from three locations in Ravine 6a north of the MRFA Site. The analytical results for these three background samples do not provide a sufficient database for statistical analysis; therefore, no statistical analysis was performed. The maximum background concentrations for inorganic analytes in surface water were determined to be the maximum measured concentrations for each inorganic analyte in the three background samples. These maximum background concentrations are summarized on

Table 4. No background data is available for organic compounds in surface water.

3.1.3 *Sediment*

The background sediment sampling program involved the collection of sediment samples from three locations in Ravine 6a north of the MRFA Site. The analytical results for these three background samples do not provide a sufficient data base for statistical analysis; therefore, no statistical analysis was performed. The maximum background concentrations for inorganic analytes in sediment were determined to be the maximum measured concentrations for each inorganic analyte in the three background samples. These maximum background concentrations are summarized on Table 5. No background data is available for organic compounds in sediment.

3.1.4 *Ground Water*

Ground water sampling was not performed as part of the background sampling program; however, two rounds of ground water sampling were performed as part of the MRFA RI. Analytical results for the ground water samples collected during the MRFA RI are summarized in Tables D-6-1 through D-6-4 of Appendix D-6 in the Draft RI Report. Based on the existing ground water elevations and analytical data, five monitoring wells adjacent to the Triangular Parcel (MW-1 through MW-4 and 14D) have been identified as being upgradient (i.e., representative of background) of the MRFA Site.

The analytical results for these five monitoring wells do not provide a sufficient database for statistical analysis; therefore, no statistical analysis was performed. The maximum background concentrations for inorganic

analytes in the ground water were determined to be the maximum measured concentrations for each inorganic analyte in the filtered and unfiltered ground water samples from these wells during the two ground water sampling events (June 1-5, 1992 and November 9-13, 1992). The maximum background concentrations for inorganic analytes are summarized on Table 6. Organic compounds are not expected in upgradient ground water; therefore, no maximum background concentrations were developed for organic compounds in ground water.

3.2 ***AVAILABLE REGULATORY STANDARDS/GUIDANCE VALUES/CRITERIA***

Available regulatory standards, guidance values, and criteria were reviewed for each medium. The following sections discuss and summarize those available regulatory standards, guidance values, and criteria for each organic compound and inorganic analyte in each medium, where appropriate.

3.2.1 ***Surface and Subsurface Soil***

The New York State Department of Environmental Conservation (NYSDEC) developed soil cleanup objectives for organic compounds and inorganic analytes in a NYS Technical and Administrative Guidance Memorandum (NYSTAGM) in 1992. The NYSTAGM does not differentiate between surface soil and subsurface soil cleanup objectives with the exception of PCBs.

NYSTAGM values for inorganic analytes are shown on Table 7. Nine of the inorganic analytes list site background as the NYSTAGM value and thirteen analytes list a concentration or site background as the NYSTAGM

value. Only mercury lists a concentration with no reference to site background. NYSTAGM values do not exist for cyanide and boron.

NYSTAGM values for organic compounds that were detected in site soil samples are shown on Table 8. NYSTAGM values do not exist for several of the detected organic compounds. A NYSTAGM value of 10 ppm is used for total volatile organic compounds (VOCs) and total pesticides to account for individual organic compounds without NYSTAGM values. A NYSTAGM value of 1 ppm is used for total PCBs in surface soil, while 10 ppm is used for total PCBs in subsurface soil. For SVOCs, a NYSTAGM value of 50 ppm and 500 ppm for individual SVOCs and total SVOCs, respectively, are used.

3.2.2 *Surface Water*

The USEPA and the NYSDEC have both developed surface water quality criteria which can be used for comparison purposes to the MRFA RI analytical results. The USEPA developed both acute and chronic water quality criteria for a number of organic compounds and inorganic analytes. These federal water quality criteria are for comparison purposes only and are not enforceable. The NYSDEC also developed ambient water quality standards and/or guidance values for a number of organic compounds and inorganic analytes. The New York State Surface Water Standards (NYSSWS) consist of both standards which are enforceable and guidance values which are not enforceable (though calculated by the same methods) depending on the compound/analyte. The federal water quality criteria and the NYSSWS for inorganic analytes are summarized on Table 9. The federal water quality criteria and the NYSSWS for organic compounds have not been summarized since no target organic compounds were detected in the MRFA Site surface water samples.

The NYSDEC developed sediment quality criteria which can be used for comparison purposes to the MRFA RI analytical results. The New York State Sediment Criteria (NYSSC) apply to both organic compounds and inorganic analytes. Table 10 presents a summary of the NYSSC values for inorganic analytes. The NYSSC were also developed for organic compounds for both fresh water and marine environments on both an aquatic toxicity and human health residue basis. Since there are no marine environments present at the MRFA Site, the NYSSC values for organic compounds in a fresh water environment on both an aquatic toxicity and human health residue basis have been summarized in Table 11.

Other potential sediment criteria were identified by the USEPA (Comment #16 in USEPA's letter dated 3 September 1993) and evaluated for use in comparison to site sediment data. These other potential criteria are published in a NOAA Technical Memorandum (Long and Morgan, 1990) and in the U.S. Fish and Wildlife's Eisler Contaminant Hazard Reviews Report (Eisler, 1985 to 1993). Although they provide criteria for a few additional parameters relative to the NYSSC, the criteria identified in these two documents are generally not representative of the MRFA Site ecosystems. The database on which these federal criteria were established is primarily representative of salt-water estuarine environments. The authors of the NOAA Technical Memorandum also caution against the use of their "effect-range" concentrations in regulatory decisions or any other similar applications (Long and Morgan, 1990). Despite their limited use, the applicable NOAA criteria for both inorganic analytes and organic compounds are provided in Table 10 and Table 11, respectively, for relative comparison.

3.2.4 *Ground Water*

The USEPA and the NYSDEC have developed ground water quality criteria which can be used for comparison purposes to the MRFA RI analytical results. The USEPA developed the National Primary Drinking Water Standards (NPDWS) and National Secondary Drinking Water Standards (NSDWS) for both organic compounds and inorganic analytes. Similarly, the NYSDEC developed the New York State Ground Water Standards (NYSGWS) for both organic compounds and inorganic analytes. Table 12 and Table 13 present a summary of the NPDWS, NSDWS, and NYSGWS for inorganic analytes and organic compounds, respectively. Only the organic compounds that were detected in one or more of the ground water samples collected at the MRFA Site are listed in Table 13.

3.3 *HEALTH-BASED COMPARATIVE CRITERIA*

The use of health-based comparative criteria for comparison to the MRFA RI analytical results was reviewed and criteria were calculated for soil. The following sections discuss the methods by which health-based comparative criteria were determined, where applicable, and present a summary of the health-based comparative criteria, where appropriate.

3.3.1 *Surface and Subsurface Soil*

According to the NYSTAGM, the cleanup objectives for organic compounds were developed on a health basis, whereas, the cleanup objectives for inorganic analytes were not developed on a health basis. In order to be consistent with the comparison method that was to be used for organic compounds, health-based comparative criteria for inorganic analytes in soil were developed following USEPA guidelines where USEPA

approved toxicity criteria were available or by using typical mineral supplemental intake where toxicity criteria were not available.

The method for deriving health-based comparative criteria for the MRFA Site is the same as that presented for the development of PRGs in USEPA's Human Health Evaluation Manual Part B, "Development of Risk-Based Preliminary Remediation Goals", (USEPA, 1991). As a conservative measure, the residential exposure scenario was used, although this is not the current or likely future use of the property. At the USEPA's request, a hazard index of 0.1 was used rather than the hazard index of 1.0 as specified in the guidance documents. This was done as a conservative measure to account for possible additive effects of exposure to multiple noncarcinogenic substances. The development of the health-based comparative criteria is further discussed in Appendix A.

Health-based comparative criteria were developed for each of the inorganic analytes of interest at the MRFA Site (i.e., those that exceeded the site background or NYSTAGM value). The USEPA-approved toxicity criteria for carcinogens and noncarcinogens (i.e., slope factor (SF) and reference dose (RfD), respectively) were used along with exposure assumptions to derive the health-based comparative criteria. With the exception of boron, copper, manganese, and zinc, no USEPA toxicity criteria exist for the remainder of the "nontoxic" inorganics (sodium, calcium, iron, magnesium, potassium).

For other inorganics where USEPA toxicity criteria were not available, health-based comparative criteria were developed based on an evaluation of recommended dietary allowances (RDAs) (National Research Council, 1989) and pediatric electrolyte and mineral supplemental doses (in the case of iron, magnesium, and calcium), or typical food portions for toddlers (in the case of potassium and sodium).

USEPA toxicity criteria exist for all other inorganics with the exception of lead. The health-based comparative criteria used for this evaluation is that set forth in an Office of Solid Waste and Emergency Response (OSWER) directive for residential lead soil levels (500 ppm), which is based on the uptake biokinetics model and blood lead levels. The development of the health-based comparative criteria for these substances is documented in Appendix A.

As stated above, for those substances with USEPA toxicity criteria the health-based comparative criteria used for soil are based on a residential soil exposure scenario and a target hazard quotient of 0.1 versus 1.0. A person (child-adult) is assumed to be exposed to the constituents in the surface soil via ingestion. As an added conservative measure, the subsurface soil was evaluated as if it were surficial (i.e., applied to the same health-based comparative criteria). The health-based comparative criteria for essential minerals and electrolytes were doses typically consumed by children in food or supplements. The health-based comparative criteria used for surface soil and subsurface soil are presented on Table 14. The health-based comparative criteria will be collectively used with the statistically derived maximum background concentrations and available regulatory standards, guidance values, and criteria to determine the MRFA Comparative Criteria for surface and subsurface soils.

3.3.2 *Surface Water*

Health-based comparative criteria were not calculated for comparison to the MRFA RI surface water sample analytical results. MRFA Comparative Criteria will be established using the maximum background concentrations and the available regulatory standards, guidance values, and criteria.

3.3.3 *Sediment*

Health-based comparative criteria were not calculated for comparison to the MRFA RI sediment sample analytical results. MRFA Comparative Criteria will be established using the maximum background concentrations and the available regulatory standards, guidance values, and criteria.

3.3.4 *Ground Water*

Health-based comparative criteria were not calculated for comparison to the MRFA RI ground water sample analytical results. MRFA Comparative Criteria will be established using the maximum background concentrations and the available regulatory standards, guidance values, and criteria.

3.4 *SUMMARY OF MRFA COMPARATIVE CRITERIA*

The previous sections discussed the various criteria used for comparison to the MRFA analytical results. The following sections compare these criteria for each organic compound and inorganic analyte, where appropriate, in each medium. The purpose of this comparison is to determine the MRFA Comparative Criteria for each organic compound and inorganic analyte in each medium. These MRFA Comparative Criteria will be used for comparison to the MRFA RI analytical results to identify locations on the site that may potentially require further characterization.

3.4.1 *Surface and Subsurface Soil*

MRFA Comparative Criteria for surface and subsurface soil were a combination of (1) the maximum statistical background concentrations, (2) available regulatory standards, guidance values, and criteria, and (3) health-based comparative criteria. The NYSTAGM values for inorganic analytes

and organic compounds in the soil, previously shown on Tables 7 and 8, were considered under this second category (i.e., regulatory criteria). If a specific inorganic analyte did not have a NYSTAGM value, then the maximum statistical background concentration was used. No statistical analysis was performed for organic compounds in soil as a result of either no background organic compound data was available or the analytical results (SVOCs in surface soil only) were below the NYSTAGM values. The NYSTAGM values and maximum statistical background concentrations were then compared to the calculated health-based comparative criteria.

Health-based comparative criteria were developed for twenty-one of the twenty-five inorganic analytes. Health-based comparative criteria were not calculated for the remaining four inorganic analytes (barium, beryllium, cobalt, and selenium). The MRFA RI analytical results showed that these inorganic analytes were either not detected, were detected at concentrations below the NYSTAGM value, or were below the maximum statistical background concentration in all of the soil samples collected at the MRFA Site. If the calculated health-based comparative criteria for an inorganic analyte exceeded both the NYSTAGM value and the maximum statistical background concentration, then the health-based comparative criteria was used for the MRFA Comparative Criteria. Tables 15 and 16 present a summary of the MRFA Comparative Criteria for inorganic analytes in surface soil and subsurface soil, respectively.

3.4.2 *Surface Water*

MRFA Comparative Criteria for surface water were a combination of the maximum measured background concentrations and available regulatory standards, guidance values, and criteria. No target organic compounds were detected in any of the surface water samples collected at the MRFA Site; therefore, a determination of MRFA Comparative Criteria for organic

compounds was not necessary. MRFA Comparative Criteria for inorganic analytes in surface water consist of the NYSSWS value for each inorganic analyte. If a specific inorganic analyte did not have a NYSSWS value, then the maximum measured background concentration was used as the MRFA Comparative Criteria. Table 17 presents a summary of the MRFA Comparative Criteria for inorganic analytes in surface water. The federal water quality criteria for inorganic analytes were used as general guides but were not selected as MRFA Comparative Criteria since these criteria are not enforceable.

3.4.3 *Sediment*

MRFA Comparative Criteria for sediment were a combination of the maximum measured background concentrations and available regulatory standards, guidance values, and criteria. MRFA Comparative Criteria for inorganic analytes and organic compounds in sediment were determined to be the NYSSC values previously shown on Tables 10 and 11, respectively. If a specific inorganic analyte did not have an NYSSC value, then the maximum measured background concentration was used as the MRFA Comparative Criteria. Tables 18 and 19 present a summary of the MRFA Comparative Criteria for inorganic analytes and organic compounds, respectively in sediment. The federal sediment quality criteria (ER-L and ER-M values) were used as general guides but were not selected as MRFA Comparative Criteria since these criteria are not enforceable and they are not representative of the MRFA environment.

3.4.4 *Ground Water*

MRFA Comparative Criteria for ground water were a combination of the maximum measured background concentrations and available regulatory standards, guidance values, and criteria. MRFA Comparative Criteria for

inorganic analytes and organic compounds in ground water were selected from the available regulatory standards, guidance values, and criteria (NPDWS, NSDWS, or NYSGWS) previously shown on Tables 12 and 13, respectively. If a specific inorganic analyte did not have an NPDWS, NSDWS, or NYSGWS value, then the maximum measured background concentration was used as the MRFA Comparative Criteria.

Eighteen of the twenty-five inorganic analytes had available regulatory standards, guidance values, and criteria which were selected as the MRFA Comparative Criteria. MRFA Comparative Criteria for six (aluminum, calcium, cobalt, nickel, potassium, and vanadium) of the seven remaining inorganic analytes were determined to be the maximum measured background concentrations of the unfiltered samples from both rounds of ground water sampling. A MRFA Comparative Criterion for boron was not selected since boron was not detected in any of the background samples, and does not have an available NPDWS, NSDWS, or NYSGWS value. Table 20 presents a summary of the MRFA Comparative Criteria for inorganic analytes in ground water. The MRFA Comparative Criteria for organic compounds were a combination of the available regulatory criteria and are summarized on Table 21.

4.0 *COMPARISON OF ANALYTICAL RESULTS TO MRFA COMPARATIVE CRITERIA*

The following sections provide a comparison of the MRFA RI analytical results with the MRFA Comparative Criteria determined in Section 3.0. The samples that exceeded the MRFA Comparative Criteria have been identified and an evaluation of the need for further site characterization at those sampling locations is presented. Those locations recommended for further characterization are included in the proposed sampling program provided in Section 5.0.

4.1 *SURFACE SOIL*

Surficial soil sampling was previously conducted at 53 locations as part of the RI and specified in the USEPA-approved POP (See Table 22). The surface soil sampling locations are shown on Figure 2. The analytical results for these samples are summarized on Tables D-3-1 through D-3-6 included in Appendix D-3 of the Draft RI Report.

The MRFA Comparative Criteria developed for surface soil consist of a combination of (1) the maximum statistical background concentrations, (2) NYSTAGM values, and (3) health-based comparative criteria for inorganic analytes. Site surface soil quality was compared to the MRFA Comparative Criteria to determine whether further characterization of the surface soil is warranted. Table 23 lists the MRFA Comparative Criteria for surface soil and the number of MRFA Site samples that exceeded these criteria for each inorganic analyte. The MRFA Comparative Criteria for organic compounds in soil were determined to be the NYSTAGM values (Table 8) only, since no maximum statistical background concentrations or health-based comparative criteria were calculated as previously discussed.

Table 24 summarizes the surface soil locations with one or more organic compounds or inorganic analytes above the MRFA Comparative Criteria.

Thirteen of the 53 site surface soil samples collected during the RI had one or more organic compounds or inorganic analytes detected at concentrations above the MRFA Comparative Criteria. Included in these 53 samples are the samples collected from the Muggett's Pond Drainage Ditch and the ditch in front of Building 27/Magazine Area as well as the samples collected from open "dry wells" at the end of concrete drainage troughs at Building 3 and the open swale at Building 4. The thirteen samples with one or more analytes above the MRFA Comparative Criteria were collected from the following twelve areas:

- Area S-1
- Building 3
- Building 6
- Building 20
- Building 21
- Building 23P
- Building 24
- Building 25
- Building 25S
- Building 27B
- Building 27C
- Muggett's Pond Drainage Ditch

The need for further site characterization in these twelve areas is evaluated in Section 5.0.

4.2 *SUBSURFACE SOIL*

Subsurface soil sampling was previously conducted at 122 locations (102 borings, 13 test pits, 7 dry wells) during the RI as specified in the USEPA-approved POP. Subsurface soil sampling locations are shown on Figure 3. The analytical results for these samples are summarized on Table D-4-1

through D-4-8 and D-5-1 through D-5-5 included in Appendices D-4 and D-5 of the Draft RI Report.

Eight additional subsurface soil samples were collected during the test pit investigation conducted in the fall of 1993 in Areas S-1, D-1, D-2, D-4, and D-5. In addition, six more subsurface soil samples were collected from the six dry wells located at the GE/Exxon Building during the fall 1993 investigation. The validated analytical results for these subsurface soil samples are provided in a separate technical memorandum which accompanies this document.

The MRFA Comparative Criteria developed for subsurface soil consist of a combination of (1) maximum statistical background concentrations, (2) NYSTAGM values, and (3) health-based comparative criteria for inorganic analytes. The subsurface soil results were compared to the MRFA Comparative Criteria to determine whether further site characterization is warranted. Table 25 lists the MRFA Comparative Criteria for inorganic analytes in subsurface soil and the number of site samples that exceeded the criteria for each inorganic analyte. The MRFA Comparative Criteria for organic compounds in soil were determined to be the NYSTAGM values (Table 8) only, since no maximum statistical background concentrations or health-based comparative criteria were calculated, as previously discussed. Table 26 summarizes the subsurface soil locations with one or more organic compounds and inorganic analytes above the MRFA Comparative Criteria.

Fourteen of the 136 site subsurface soil samples had one or more organic compounds or inorganic analytes detected at concentrations above the MRFA Comparative Criteria. Included in these 136 samples are four building floor drain samples (DW-1A, DW-2-3, DW-15, DW-EXNUC) and dry well samples from Buildings 2, 4, and GE/Exxon. The floor drain and dry well samples were included because the drains and dry wells open to

subsurface soil. The fourteen samples with one or more organic compounds or inorganic analytes above the MRFA Comparative Criteria were collected in the following thirteen areas:

Area S-2	Building 4
Area D-1	Building 14
Area D-2	Building 15
Area D-5	Building 25
Area D-6	Building 28 (Area A)
Building 1	GE/Exxon Building
Building 2	

The need for further site characterization in these thirteen areas is evaluated in Section 5.0.

4.3 *SURFACE WATER*

Surface water samples were collected from two ravines (Ravines 1b and 6a), three quench pits (Buildings 3, 4, and 25), and Muggett's Pond. The analytical results for these samples are summarized on Table D-1-1 and D-1-2 included in Appendix D-1 of the Draft RI report. The analytical results for these surface water samples are compared to the MRFA Comparative Criteria (Table 17) in the following sections. The MRFA Comparative Criteria for each organic compound and inorganic analyte are based on a comparison of the maximum measured background concentrations (Ravine 6a samples) and the NYSSWS. Site surface water quality was compared to the MRFA Comparative Criteria to determine whether further site characterization is warranted.

The surface water features sampled at the MRFA Site (i.e., ravines, quench pits, pond) represent very different environments. The ravines are running water ecosystems whereas the quench pits and Muggett's Pond are standing water ecosystems. Because of the differing environmental ecosystems, a

direct comparison of the Ravine 6a water quality to the pond and quench pit water quality is not appropriate. The MRFA Comparative Criteria are primarily used for comparison to the Ravine 1b analytical results. The quench pit and pond analytical results are compared to the NYSSWS values only, although this may not be appropriate for the quench pit surface water environments.

4.3.1 Ravines

Surface water samples were collected from Ravines 1b and 6a during two sampling events. During the first event in February 1992, a single sample was collected from the headwaters of Ravine 1b. During the second sampling event in September 1993, surface water samples were collected from three locations in each ravine (headwater, midstream, and downstream). All of the surface water sampling locations are shown on Figure 4. The analytical results for the surface water samples collected in Ravine 6a were evaluated and compared to the NYSSWS to determine the MRFA Comparative Criteria for each inorganic analyte (Table 17). These MRFA Comparative Criteria were used for comparison to the MRFA RI analytical results for Ravine 1b surface water samples.

All Ravine 1b surface water samples had inorganic analyte concentrations that exceeded the MRFA Comparative Criteria. Aluminum, iron, potassium, sodium, manganese, and calcium all exceeded the MRFA Comparative Criteria in at least one Ravine 1b surface water sample. Generally, the headwaters had more inorganic analytes exceeding the MRFA Comparative Criteria than the downstream samples. Table 27 presents a summary of the inorganic analytes that exceeded the MRFA Comparative Criteria for each surface water sample. Two of the inorganic analyte concentrations for ravine surface water were rejected due to data validation requirements. The surface water samples and the inorganic

analyte concentrations that were rejected are further discussed in Section 5.3.

In addition to the inorganic analysis, one of the surface water samples from Ravine 1b (SW-D3-01) was also analyzed for organic compounds. Validated analytical results for this sample indicated that no organic compounds were detected.

4.3.2 *Quench Pits*

Surface water samples were collected from three quench pits (Buildings 3, 4, and 25) at the MRFA Site in February 1992. The analytical results for the surface water samples from these quench pits were compared to the NYSSWS values only. The validated MRFA RI analytical results showed that only two SVOC tentatively identified compounds (TICs) were detected in Building 4 and Building 25 quench pit waters, with the total concentration of SVOC TICs in each quench pit being 10 ppb and 5 ppb, respectively. There are no NYSSWS values for SVOC TICs in surface water. No other organic compounds were reported in any of these three samples.

The validated analytical results also showed detectable concentrations of inorganic analytes in all three quench pit surface water samples. Only iron in the Building 25 quench pit water exceeded the NYSSWS value. All of the other detected concentrations of inorganic analytes in these three samples were below NYSSWS values. The surface water samples with detectable concentrations of inorganic analytes that exceed the NYSSWS values are summarized on Table 27. Two of the inorganic analyte concentrations for the quench pit surface water samples were rejected due to data validation requirements. The surface water samples and the

inorganic concentrations that were rejected are further discussed in Section 5.3.

For additional comparison, the analytical results for quench pit water were compared to the maximum background concentrations (Ravine 6a samples) for these inorganic analytes with no NYSSWS values. This comparison showed that only potassium in the Building 4 quench pit water and sodium in the Building 25 quench pit water exceeded the maximum background concentrations based on the analytical results of the background (Ravine 6a) surface water samples (Table 4). No other inorganic concentrations for the quench pit surface water samples exceeded the maximum background concentrations.

4.3.3 *Muggett's Pond*

Muggett's Pond surface water was sampled in February 1992. The MRFA analytical results for Muggett's Pond surface water were compared to the NYSSWS values (Table 9) only. The validated MRFA organic analytical results showed that only SVOC TICs were detected in Muggett's Pond. The highest total concentration of SVOC TICs in the Muggett's Pond water was 236 ppb. There are no NYSSWS values for SVOC TICs in surface water. No other organic compounds were reported in the surface water in Muggett's Pond.

Validated analytical results also showed detectable concentrations of inorganic analytes in the surface water in Muggett's Pond. The reported concentrations of iron and manganese in the surface water samples exceeded the NYSSWS values. The detectable concentrations of inorganic analytes that exceed the NYSSWS values are summarized on Table 27.

For additional comparison, the Muggett's Pond water analytical results were compared to the maximum background concentrations (Ravine 6a samples) for the inorganic analytes with no NYSSWS values. This comparison showed that only aluminum exceeded the maximum background concentration based on the analytical results of the background, Ravine 6a surface water samples (Table 4). No other inorganic concentrations for the Muggett's Pond surface water samples exceeded the maximum background concentrations.

4.4 *SEDIMENT*

Sediment samples were collected from two ravines (Ravines 1b and 6a), three quench pits (Buildings 3, 4, and 25), Muggett's Pond, several catch basins (Buildings 5, 20, and 24), and the open sump at Building 1. The analytical results for these samples are summarized on Tables D-2-1 through D-2-5 and D-7-1 through D-7-5 included in Appendix D-2 and D-7 of the Draft RI Report. The analytical results for these sediment samples are compared to the MRFA Comparative Criteria (Table 18) in the following sections. These MRFA Comparative Criteria for each organic compound and inorganic analyte are a combination of the maximum background concentrations (Ravine 6a samples) and the NYSSC values. Site sediment quality was compared to the MRFA Comparative Criteria to determine whether further site characterization is warranted.

As stated in the previous section on surface water, the environmental ecosystems for the various surface water features are not similar. The ravines are running water ecosystems whereas the quench pits and the pond are standing water ecosystems. Because of the differing environmental ecosystems, a direct comparison of the Ravine 6a sediment quality to the quench pit and pond sediment quality is not appropriate. A direct comparison of the Ravine 6a sediment quality to the quality of the sediment

that has accumulated in the catch basin and open sump (engineered structures designed to collect storm water and trap sediment) is also not appropriate. Therefore, the MRFA Comparative Criteria for sediment are only used for comparison to the Ravine 1b sediment sample analytical results. The quench pit, Muggett's Pond, catch basin, and open sump sediment sample analytical results are compared to the NYSSC values only.

4.4.1 Ravines

Ravine sediment samples were collected at the same locations and during the same sampling events as the ravine surface water samples, which are described in Section 4.3. All of the sediment sampling locations are shown on Figure 4.

As discussed above and in the Background Technical Memorandum, the analytical results for the sediment samples collected in Ravine 6a were evaluated and compared to the NYSSC values to determine the MRFA Comparative Criteria for each inorganic analyte (Table 18). These MRFA Comparative Criteria were used to compare validated MRFA RI analytical results for Ravine 1b sediment samples. Three of the four Ravine 1b sediment samples had inorganic analyte concentrations that exceeded the MRFA Comparative Criteria. Validated analytical results showed one or more inorganic analyte concentrations that exceeded the MRFA Comparative Criteria in at least one of these three sediment samples. The midstream sample collected from Ravine 1b had no detectable concentrations of inorganic analytes above the MRFA Comparative Criteria. Generally, the headwaters had more inorganic analytes exceeding the MRFA Comparative Criteria than the downstream sediment samples. Table 28 presents a summary of the inorganic analytes that exceeded the MRFA Comparative Criteria for each sediment sample.

In addition to the inorganic analysis, one of the ravine sediment samples (SD-D3) was also analyzed for organic compounds. Validated analytical results for this sample showed detectable concentrations of SVOC TICs only. The total concentration of SVOC TICs in this sample is 4.5 ppm. There are no NYSSC values for SVOC TICs in sediment.

4.4.2 *Quench Pits*

Sediment samples were collected from three quench pits (Buildings 3, 4, and 25) at the MRFA Site in May 1992. The analytical results for the quench pit sediment samples were compared to the NYSSC values (Table 9) only. As previously stated, the NYSSC values may not be appropriate for sediments in the quench pits as opposed to sediment elsewhere at the MRFA Site. The validated MRFA RI analytical results showed detectable concentrations of target organic compounds in all three quench pit sediment samples. In comparison to the NYSSC values, only the concentrations of PCBs reported in the sediment from the Building 3 and Building 25 quench pits, exceeded the NYSSC values. Table 29 presents a summary of the organic compounds that exceeded the NYSSC values for the sediment samples collected at the MRFA Site.

The validated MRFA RI analytical results also showed detectable concentrations of inorganic analytes in the sediment samples from the Building 3 and Building 25 quench pits. The analytical results for inorganic analytes that exceeded the NYSSC are summarized on Table 26.

Some of the quench pit sediment analytical results were rejected due to data validation requirements. The MRFA RI analytical results for VOCs and the acid extractable fraction of the SVOCs for the sediment in the Building 3 quench pit and the analytical results for pesticide/PCBs for the sediment in Building 4 quench pit were all rejected due to data validation requirements.

The analytical results for the inorganics in the sediment sample from the Building 4 quench pit were also rejected due to data validation requirements. Additional sampling of the quench pits to address the rejected analytical results is discussed in Section 5.4.

4.4.3 *Muggett's Pond*

Sediment samples were collected from Muggett's Pond in May 1992. The analytical results for the Muggett's Pond sediment samples were compared to the NYSSC values (Table 10) only. The validated MRFA RI analytical results showed detectable concentrations of target organic compounds in the Muggett's Pond sediment samples from both the north and south ends of the pond. In comparison to the NYSSC values, only the concentrations of PCBs and concentrations of several SVOCs exceeded the NYSSC values. Table 29 presents a summary of the organic compounds that exceeded the NYSSC values for the sediment samples collected at the MRFA Site.

The validated MRFA RI analytical results also showed detectable concentrations of inorganic analytes in the sediment samples collected in Muggett's Pond. The analytical results for the inorganic analytes that exceeded the NYSSC values are summarized on Table 28.

4.4.4 *Catch Basins*

Sediment samples were collected from five catch basins at the MRFA Site; two catch basins at Building 5, one catch basin at Building 20, and two catch basins at Building 24. The analytical results for the catch basin sediment samples were compared to the NYSSC values (Table 10) only, although this may not be appropriate, as previously stated. The validated MRFA RI analytical results showed detectable concentrations of target organic compounds in all of the catch basin sediment samples. In

comparison to the NYSSC values, analytical results exceeded the NYSSC values for VOCs, SVOCs, and pesticides/PCBs at some of the five catch basin sediment sampling locations. Table 29 presents a summary of the organic compounds that exceeded the NYSSC values for the catch basin sediment samples collected at the MRFA Site.

The validated MRFA RI analytical results also showed detectable concentrations of inorganic analytes in all of the catch basin sediment samples. The analytical results for the inorganic analytes that exceeded the NYSSC values are summarized on Table 28.

4.4.5 *Open Sump*

One sediment sample (DW-1A-2) was collected from the open sump adjacent to Building 1. The analytical results for this sediment sample were compared to the NYSSC values (Table 10) only, although this may not be appropriate, as previously stated. The validated MRFA RI analytical results showed detectable concentrations of target organic compounds in this sediment sample. In comparison to the NYSSC values, only the concentration of PCBs reported in this sediment sample exceeded the NYSSC values. Validated analytical results for this sediment sample also showed 1.6 percent Freon 113; however, there is no NYSSC value for Freon 113 in sediment. Table 29 presents a summary of the organic compounds that exceeded the NYSSC values for the open sump sediment sample.

The validated MRFA RI analytical results also showed detectable concentrations of several inorganic analytes that exceed the NYSSC values in this sediment sample. The analytical results for the inorganic analytes that exceeded the NYSSC values are summarized on Table 28.

As a result of the Freon 113 in the sump, the contents of the open sump were removed and properly disposed in October 1992. During the cleanup of the open sump, one subsurface soil sample was collected for laboratory analysis from below the base of the open sump approximately four feet below ground surface. The analytical results for this soil sample were compared to the MRFA Comparative Criteria for subsurface soils (Section 3.4.1) to assess the potential impact of the open sump on the subsurface soil quality. Detectable concentrations of inorganic analytes and trace concentrations of target organic compounds were reported in this soil sample; however, the reported concentrations were well below the MRFA Comparative Criteria for organic compounds and inorganic analytes. The cleaning procedures and the analytical results for the cleanup of the open sump were summarized in the "Report for the Cleanup of the Building 1A Sump at the Malta Rocket Fuel Area Site," dated 4 January 1993, which was submitted to the USEPA.

4.4.6 *Retention Ponds and Muggett's Pond Drainage Ditch*

Additional samples were collected at the retention ponds and along Muggett's Pond Drainage Ditch to assess the environmental quality in these areas. These locations do not contain standing water and samples collected from these locations are considered surface soil samples rather than sediment samples. This is justified by the lack of water and the grassy vegetation within these features and is reflected by sample collection procedures as described in the USEPA-approved POP. The analytical results for these samples were previously discussed in Section 4.1.

4.5 *GROUND WATER*

Ground water sampling was conducted at 43 on-site ground water monitoring wells from June 1 through 5, 1992 and from November 9

through 13, 1992. The ground water monitoring well locations at the MRFA Site are shown on Figure 5. The analytical results for both rounds of ground water sampling are summarized on Tables D-6-1 and D-6-2 in Appendix D-6 of the Draft RI Report. MRFA Comparative Criteria were developed for both organic compounds and inorganic analytes in ground water. The MRFA Comparative Criteria consists of a combination of (1) the maximum background concentrations, and (2) a combination of the available regulatory standards, guidance values, and criteria. Site ground water quality was compared to the MRFA Comparative Criteria to determine whether further site characterization is warranted.

The organic compounds that exceeded the MRFA Comparative Criteria in one or more of the samples from June 1992 included carbon tetrachloride, bis(2-ethylhexyl)phthalate, chloromethane, tetrachloroethene, 1,1,1-trichloroethane, and trichloroethene. The organic compounds that exceeded the MRFA Comparative Criteria in one or more of the samples from November 1992 included carbon tetrachloride, chloroform, bis(2-ethylhexyl)phthalate, tetrachloroethene, and trichloroethene.

In addition to the organic compounds, inorganic constituents (unfiltered and filtered) were also analyzed and compared to a MRFA Comparative Criteria for ground water. The validated MRFA RI analytical results showed detectable concentrations of inorganic analytes above the MRFA Comparative Criteria in 37 of the 43 wells (unfiltered) and in 21 of the 43 wells (filtered) in the June 1992 sampling event. The validated MRFA RI analytical results also showed detectable concentrations of inorganic analytes above the MRFA Comparative Criteria in 38 of the 43 wells (unfiltered) and in 19 of the 42 wells (filtered) in the November 1992 sampling event. Tables 30 through 33 present a summary of the organic compounds and inorganic analytes that exceed the MRFA Comparative

Criteria for the unfiltered and filtered analytical results for the ground water samples collected in both June 1992 and November 1992.

The turbidity of the ground water varies from well to well in this geographic region. As a result, both unfiltered and filtered ground water samples were collected during the MRFA RI. The inorganics adsorbed onto the fine grained soil particles in suspension (i.e. turbidity) increase concentrations in the unfiltered samples. For this reason, the analytical results for the filtered groundwater samples better represent the actual ground water quality beneath the MRFA Site.

Some of the analytical results for both organic compounds and inorganic analytes for the ground water samples were rejected due to data validation requirements. The analytical results and the ground water samples with rejected results are further discussed in Section 5.5.

4.6 *SEPTIC TANKS*

There are a total of nine septic tank systems at the MRFA Site. These nine septic tank systems are located at Buildings 13, 14, 16, 17, 20, 24, 25, and the GE/Exxon Building. There are two septic tank systems at Building 20, an old system and a new system. Seven of these septic tank systems (Buildings 13, 14, 17, 20 (old and new), 25, and GE/Exxon) were sampled during the MRFA RI as shown on Figure 7. The analytical results for these samples are summarized on Tables D-8-1 through D-8-5 of Appendix D-8 of the Draft RI Report. The remaining two septic tank systems (Buildings 16 and 24) could not be located and, therefore, were not sampled.

The validated analytical results for these samples showed detectable concentrations of organic compounds and inorganic analytes in each septic

tank sample, which was anticipated since septic tanks are receptacles for human wastes and household/office cleaning products and kitchen wastes.

Soil test borings were installed in the vicinity of each of the sampled septic tank systems to assess whether the septic tanks have had an impact on subsurface soil quality. A total of six subsurface soil samples were collected from six soil borings as follows:

S-11 (2-4')	Building 13
S-6 (4-6')	Building 17
S-56 (2-4')	Building 20 (old)
S-58 (6-8')	Building 20 (new)
S-80 (0-2')	Building 25
S-99 (2-4')	GE/Exxon Building

The validated analytical results for these six samples are included on Table D-4-1 through D-4-4 in Appendix D-4 of the Draft RI Report. No subsurface soil sample was collected from the vicinity of the Building 14 septic tank system.

The validated analytical results for these six soil samples were compared to the MRFA Comparative Criteria for subsurface soils (Table 16). The analytical results showed detectable concentrations of inorganic analytes in each soil sample, however, none of these detectable concentrations exceed the MRFA Comparative Criteria for inorganic analytes in subsurface soil. The analytical results also showed that the organic compounds were not detected in any of these six soil samples with the exception of one SVOC and several SVOC TICs in the soil sample near the Building 25 septic tank system. Phenol was reported in this sample at an estimated concentration of 46 ug/kg which only marginally exceeds the MRFA Comparative Criteria of 30 ug/kg (Table 26). Several SVOC TICs were also reported at

a total concentration of 1605 ug/kg. The total SVOC concentration (1651 ug/kg) is well below the MRFA Comparative Criteria for total SVOCs in soil (500,000 ug/kg).

The analytical results for the six soil samples were also compared to the analytical results for the respective septic tank samples. In general, the reported inorganic analyte concentrations for the septic tank samples were equivalent to or were two orders of magnitude higher than the reported inorganic analyte concentrations for the respective soil samples at each location. Detectable concentrations of organic compounds were reported in each of the septic tank samples, however, the analytical results for organic compounds in the respective soil samples were not detected (with the exception of the soil sample at Building 25, as previously discussed). These analytical results indicate that the septic tank systems have not had an impact on the subsurface soil quality in these areas.

4.7 *DRY WELLS*

A total of sixteen locations categorized as dry wells were sampled during the MRFA RI as shown on Figure 7. The analytical results for these samples are summarized on Tables D-7-1 through D-7-5 in Appendix D-7 of the Draft RI Report. The analytical results for six of these sixteen samples including five catch basin samples at Buildings 5, 20, and 24, and the open sump at Building 1A were previously discussed in Sections 4.4.4 and 4.4.5, respectively. The remaining ten samples plus an additional six samples collected during the Fall 1993 investigation are summarized below:

DW-1A-1	floor drain	Building 1A
DW-2-1	dry well	Building 2
DW-2-2	dry well	Building 2
DW-2-3	floor drain	Building 2

DW-3-1	open dry well	Building 3
DW-3-2	open dry well	Building 3
DW-4-1	dry well	Building 4
DW-4-2	open swale	Building 4
DW-15	floor drain	Building 15
DW-EXNUC	floor drain	GE/Exxon Building
DW-GE/EX-1	dry well	GE/Exxon Building
DW-GE/EX-2	dry well	GE/Exxon Building
DW-GE/EX-3	dry well	GE/Exxon Building
DW-GE/EX-4	dry well	GE/Exxon Building
DW-GE/EX-5	dry well	GE/Exxon Building
DW-GE/EX-6	dry well	GE/Exxon Building

These six additional samples were collected from the six dry wells outside the GE/Exxon Building as shown on Figure 8. The analytical results for these samples were compared to the MRFA Comparative Criteria for subsurface soils to determine whether further site characterization is warranted.

The validated analytical results for the above listed samples showed detectable concentrations of inorganic analytes in all sixteen samples, however, only four of these sixteen samples had inorganic analyte concentrations that exceeded the MRFA Comparative Criteria. The analytical results for the inorganic analytes that exceeded the MRFA Comparative Criteria for subsurface soils are summarized on Table 26.

The validated analytical results also showed detectable concentrations of organic compounds in fourteen of these sixteen samples, however, only five of these sixteen samples had organic compound concentrations that exceeded the MRFA Comparative Criteria. The analytical results for the

organic compounds that exceeded the MRFA Comparative Criteria for organic compounds in soil are summarized on Table 26.

The following sections present proposed additional surface water, sediment, surface soil, subsurface soil, and ground water sampling programs at the MRFA Site. These additional sampling programs are based on the evaluation of the MRFA RI analytical results in comparison to established MRFA Comparative Criteria for the various media as presented in Section 4.0.

SURFACE SOIL

As discussed in Section 4.1, thirteen surface soil samples collected at the MRFA Site had at least one organic compound or inorganic analyte detected above the MRFA Comparative Criteria (Table 24). Table 34 includes a summary of the proposed surface soil sampling program. Appendix B contains figures illustrating the approximate sampling locations. Additional sampling may be necessary if the analytical results of the proposed samples exceeds the appropriate MRFA Comparative Criteria.

Sampling is proposed at six of the thirteen locations (DW-3-1, SS-20/1, SS-21, SS-24, SS-25S, and SD-DD1) as shown on Table 34. At the Building 3 open dry well (DW-3-1), the Aroclor 1260 concentration is estimated but is more than an order of magnitude higher than the MRFA Comparative Criteria. Therefore, one surface soil sample will be collected within the dry well to confirm the level of Aroclor 1260 detected in DW-3-1. At sampling locations SS-20/1, SS-21, SS-25S, and SD-DD1, a boring will be drilled as close as possible to the original surface soil sample location to a depth of ten feet. Samples will be collected from two to four feet, four to six feet, and eight to ten feet below grade to determine the quality of the soil below the ground surface. The samples will be analyzed, archived, or extracted and archived depending on the location (Table 34). Analysis at

each location will include only those organic compounds or inorganic analytes that exceeded the MRFA Comparative Criteria in the original surface soil sample. The archived samples will be analyzed only if the shallow samples had organic compounds or inorganic analytes above MRFA Comparative Criteria. In addition to the boring, three surface soil samples (0-6") will be collected twenty feet radially from the original surface soil sample and analyzed for the organic compounds and inorganic analytes that exceeded the MRFA Comparative Criteria. These three samples allow for determination of lateral surface soil quality. The additional samples may be less than twenty feet from the original location if visual staining is present or if necessary due to man-made features. The exact sampling locations will be determined in the field.

At sampling location SS-24, a boring will be drilled at the original sampling location to a depth of twelve feet and three borings will be drilled twenty feet radially from the original sampling location to a depth of eight feet. Table 34 lists the sampling intervals for each boring.

Sampling is not proposed at the remaining seven of the thirteen locations (SS-DTINT, SS-S1, SS-6, SS-23P, SS-25, SS-27B, SS-27C). No sampling is necessary at SS-DTINT because this location is adjacent to SD-DD1 and is considered essentially the same location. No sampling is proposed at the other six locations because the compounds/analytes in these samples were only slightly above the MRFA Comparative Criteria and/or the concentrations were qualified as estimated with a "J" flag. It is believed that the existing data at these locations is sufficient for characterization purposes.

The shallow samples collected from each boring and the surface soil samples will be analyzed with an accelerated laboratory turnaround. If the analytical results from these samples have compounds/analytes above

MRFA Comparative Criteria, additional sampling will be conducted at these locations. The accelerated laboratory turnaround is intended to allow the additional sampling to be conducted during the initial field effort without multiple mobilization (i.e., if necessary, return to a location during this field event). All surface soil sampling will be performed as outlined in Section 5.8 of the USEPA-approved POP.

5.2 *SUBSURFACE SOIL*

As discussed in Section 4.2, fourteen site subsurface soil samples had at least one organic compound or inorganic analyte detected above the MRFA Comparative Criteria (Table 26). Table 34 includes a summary of the proposed sampling in each area. Appendix B contains figures illustrating the approximate sampling locations.

The following general sampling program is proposed at seven of these fourteen locations (DW-4-2, S-39 (0-2'), S-75 (2-4'), S-85 (4-6'), P-19 (2-4'), P-70 (2-4'), and DW-GE/EX-2). A new boring will be drilled at each original subsurface soil sample location to the water table.

Split spoons will be collected continuously from each boring for visual inspection and head space analysis. Samples for laboratory analysis will be collected from the two foot interval two feet below the interval previously sampled and from the deepest two foot interval of the boring and from the two foot interval immediately above the water table to determine the quality of the soil beneath the previous sampling interval (see Table 34 for specific sampling in each area). The shallower of these three proposed soil samples will be analyzed for only those organic compounds or inorganic analytes that exceeded the MRFA Comparative Criteria in the original sample. The deeper of these three proposed soil samples will be archived, or extracted and archived (depending on the analytical parameters) for possible analysis

depending on the analytical results of the shallower soil sample. The deeper proposed soil samples will only be analyzed if the analytical results for the shallower proposed soil sample exceed the appropriate MRFA Comparative Criteria. If analysis of the deeper soil sample is required, only the inorganic analytes and organic compounds that exceeded the MRFA Comparative Criteria in the previously sampled interval will be analyzed.

In addition to the deeper boring at the previous location, three borings will be drilled to the water table. These three borings will be drilled twenty feet radially from the original subsurface soil location. Split spoon samples will be collected from the same two foot interval as the original sample and from the deepest two foot interval and from the two foot interval immediately above the water table and analyzed for the same organic compounds and inorganic analytes as the other boring. The archiving and analysis of the soil samples from each of these borings will follow the same procedures discussed in Section 5.1.

At sampling location DW-15, one boring will be drilled to a depth of eight feet at the outfall location of the building floor drain. Samples will be collected from the zero to two foot and six to eight foot interval. The zero to two foot sample will be analyzed for arsenic, iron, lead, and mercury, and the six to eight foot sample will be archived for possible analysis of the same inorganic analytes depending upon the analytical results of the shallow sample. Two borings will also be drilled to a depth of six feet around the outfall location and sampled from four to six feet and analyzed for arsenic, iron, lead, and mercury.

Re-sampling is proposed at locations DW-1A-1 (Bldg. 1) and DW-2-3 (Bldg. 2). These two samples were collected from floor drains at the base of the covered stairwell to each building. Borings in the floor drain and

within twenty feet of the floor drain are not possible due to physical access limitations. Therefore, resampling of the floor drain beneath the original sample interval will be attempted to confirm the presence of the detected analytes. The subsurface soil samples will be collected using a power auger to drill into the soil beneath the floor drain. A standard split spoon sampler will then be manually driven into the soil to extract a soil sample from beneath the original sample interval.

Sampling is not proposed at S-84 (0-2'), S-80 (0-2') and P-11 (2'-4') (see Table 26) since only one compound/analyte was detected in each sample and the concentrations were only slightly above the MRFA Comparative Criteria. The concentrations were also qualified as estimated with a "J" flag. The existing data at these locations is believed to be adequate for characterization purposes.

In addition to the locations described above, four additional locations are proposed for subsurface soil sampling to address USEPA comments (July 8, 1993). These locations are in the following four areas: Area S-2, Area S-7, Area D-1, and Building 14. The proposed sampling program and rationale for each area is shown on Table 34.

Borings are not proposed for the three areas of buried crushed drums (two in Area S-1 and one in Area D-1) encountered during the Fall 1993 test pit investigation. These areas of crushed drums will most likely be addressed during site remediation. Boring through the drums is not recommended since the possibility of encountering compressed gas cylinders cannot be eliminated.

During the supplemental dry well and septic tank inventory, two previously unmentioned dry wells were discovered at Building 20. The construction of these two dry wells is consistent with the other dry wells at Building 20 as

discussed in the accompanying Technical Memorandum. Subsurface soil sampling at these dry wells is not proposed since these dry wells appear to receive storm water runoff only.

As with the surface soil program, the shallow samples from each boring will be analyzed with an accelerated laboratory turnaround to allow additional sampling during the initial field effort, if necessary.

All subsurface soil sampling will be performed as outlined in Section 5.9 of the USEPA-approved POP. All soil borings will be drilled as close as possible to the original surface soil sampling location, taking into consideration all overhead or underground utilities. A tripod drill rig will be used at locations where there is no access for a truck-mounted drill rig. It is anticipated that some locations will be inaccessible even to the tripod drill rig. At these locations, the boring will be drilled as near to the original surface soil sample location as physically possible.

5.3 *SURFACE WATER*

5.3.1 *Ravines*

The analytical results for the surface water samples collected from Ravine 6a were used to establish the MRFA Comparative Criteria for ravine surface water. For this reason, and since Ravine 6a is not believed to have been impacted by the MRFA Site, no additional surface water sampling is proposed for Ravine 6a.

The surface water samples collected from Ravine 1b all had concentrations of one or more of the following inorganic analytes that exceeded the MRFA Comparative Criteria: aluminum, iron, potassium, sodium, manganese, and calcium. No organic compounds were detected in the surface water in

Ravine 1b. Although the MRFA Comparative Criteria were exceeded for the above listed metals, no additional surface water sampling in Ravine 1b is proposed. The surface water in Ravine 1b is not used for drinking water, fishing, or fish propagation purposes, and the analytes exceeding the MRFA Comparative Criteria are considered to be relatively non-toxic. Therefore, no further characterization of the ravine surface water quality is warranted. The analytical results reported for lead and sodium in the Ravine 1b surface water sample collected in February 1992 were both rejected due to data validation requirements. This same location was sampled again in September 1993.

5.3.2 *Quench Pits*

The validated MRFA RI analytical results showed that none of the detectable concentrations of organic compounds or inorganic analytes exceeded the NYSSWS values for the three quench pit surface water samples with the exception of iron in the Building 25 quench pit. The MRFA RI analytical results reported for potassium in both the Building 3 and Building 25 quench pits were rejected due to data validation requirements.

Although the single iron concentration that exceeds the NYSSWS value in the Building 25 quench pit does not warrant additional surface water sampling in the quench pits, additional surface water sampling of the three quench pits is proposed due to the USEPA's interest in the quench pits. The proposed surface water sampling involves the collection and analysis of one discrete deep water sample from the bottom of each quench pit to further assess the high liquid content sediment material in the quench pits. The collection of these three samples is discussed in Section 5.4. No other additional surface water sampling is proposed for the quench pits.

5.3.3 *Muggett's Pond*

Muggett's Pond is a small (50 feet across) isolated water body. The validated MRFA RI analytical results showed that none of the detectable concentrations of organic compounds or inorganic analytes exceeded the NYSSWS values for the Muggett's Pond surface water samples with the exception of iron and manganese. Although the concentrations reported for iron and manganese exceeded the NYSSWS values, no additional surface water sampling is proposed in Muggett's Pond. Muggett's Pond is not used for drinking water, fishing, or fish propagation purposes; therefore, no further characterization of the Muggett's Pond surface water quality is warranted. The existing data at this location is believed adequate for characterization purposes.

5.4 *SEDIMENT*

5.4.1 *Ravines*

The validated MRFA RI analytical results for the sediment samples collected from Ravine 6a were used to establish the MRFA Comparative Criteria for ravine sediment. For this reason, and since Ravine 6a is not believed to have been impacted by the MRFA Site, no additional investigation is proposed for Ravine 6a.

All but one of the sediment samples collected from Ravine 1b has one or more inorganic analyte concentrations exceeding MRFA Comparative Criteria. No organic compounds were detected above the NYSSC values in sediment samples collected from Ravine 1b. Although the reported concentrations of some of the inorganics exceeded the MRFA Comparative Criteria, no additional investigation is proposed for Ravine 1b. The surface water in Ravine 1b is not used for drinking water, fishing or fish

propagation purposes; therefore, no further characterization of the ravine sediment quality is warranted. The existing data for Ravine 1b is believed adequate for characterization purposes.

5.4.2 *Quench Pits*

The validated MRFA RI inorganic analytical results showed that Building 3 and Building 25 quench pit sediment samples exceeded inorganic analyte NYSSC values. The analytical results also showed detectable concentrations of one or more organic compounds that exceeded the NYSSC values in all three of the quench pit sediment samples. In addition to the detectable concentrations of analytical parameters exceeding the NYSSC values, the analytical results for inorganics in the Building 4 quench pit sediment sample were rejected due to data validation requirements. The analytical results for VOCs and the acid extractable fraction of the SVOCs in the Building 3 quench pit sediment sample and the pesticide/PCBs in the Building 4 quench pit sediment sample were also rejected due to data validation requirements. Based on analytical results that exceed the NYSSC values and due to the percentage of rejected analytical results, additional sampling of the quench pits is proposed. This data will provide adequate characterization of the surface water for possible remediation.

As discussed in the Draft RI Report, what little material that could be sampled from the bottom of the quench pits consisted of high liquid content organic detritus with very little silt content. Rather than sampling this material again and risking poor sample recovery and further data rejections, one deep water sample from the bottom of each of the quench pits will be collected using a discrete interval water sampling device. These deep water samples will be analyzed for TCL Organics and TAL Inorganics plus boron.

In addition to the deep water samples, three subsurface soil borings will be drilled immediately adjacent to each quench pit. The purpose of installing these borings is to evaluate the subsurface soil quality adjacent to the quench pits and assess whether the quench pits have had an impact on the subsurface soil quality in those areas. The soil borings will be continuously sampled to ten feet below water table for logging purposes and head space analysis following the methodology described in the USEPA-approved POP. One soil sample below the perforated section of the quench pit in each of the soil borings will be submitted for TCL Organics and TAL Inorganics plus boron analyses. The locations of these proposed soil borings are shown on the figures presented in Appendix B.

5.4.3 *Muggett's Pond*

The validated MRFA RI analytical results for the Muggett's Pond sediment samples showed that both organic and inorganic analyte concentrations that exceeded the NYSSC values in both of the sample locations. Although the reported concentrations of some organic compounds and inorganic analytes exceeded the NYSSC values, no additional investigation of Muggett's Pond is proposed for two reasons. One, Muggett's Pond is extremely limited in size and two, the ground water monitoring wells that were previously installed downgradient of Muggett's Pond (M-31S and M-31D) are adequate for assessing the potential impact of Muggett's Pond on the ground water quality.

5.4.4 *Catch Basins*

The validated MRFA RI analytical results for the catch basin sediment samples indicated both organic compound and inorganic analyte concentrations exceeded NYSSC values in all five of the catch basins

sampled. Based on these results, additional investigation of all the catch basins is being proposed.

Two shallow soil test borings will be drilled at each of the catch basins at Building 5 and 24. The test borings will be installed on opposite sides of each catch basin away from any utilities and within five feet of catch basins where physical access conditions permit. Each test boring will be continuously sampled to ten feet below ground surface for visual inspection and head space analysis using the hollow stem auger method as discussed in the USEPA-approved POP. The locations of these proposed soil borings are shown on the figures presented in Appendix B.

Subsurface soil samples will be collected from the four to six and eight to ten foot intervals in each test boring. These soil samples will be submitted to the laboratory for TCL Organics and TAL Inorganics plus boron analysis. All of the samples from the four to six foot intervals will be extracted and analyzed to evaluate whether the sediment in the catch basins has impacted the local subsurface soil quality. The eight to ten foot sample extracts will be archived and only analyzed if the analytical results from the four to six foot interval are above the appropriate MRFA Comparative Criteria. No other investigations related to the catch basins are proposed at this time.

One boring will be drilled to the water table adjacent to the catch basin at Building 20H (DW-20H). The boring will be continuously split spoon sampled to the bottom for visual inspection and head space analysis. Analytical samples will be collected from six to eight feet, ten to twelve feet, and the two foot interval immediately above the water table. The two shallow samples will be analyzed for lead, mercury, and SVOCs which were the analytes detected above MRFA Comparative Criteria in sample

DW-20H. The deep sample will be extracted and archived for the same analytes for possible analysis.

5.4.5 *Open Sump*

The validated MRFA RI analytical results showed detectable concentrations of one organic compound (PCB Aroclor-1260) and several inorganic analytes above the NYSSC values for the sediment sample collected from the open sump adjacent to Building 1. Freon 113 was also detected in this sample as previously discussed. The contents of the open sump were subsequently removed and properly disposed. One soil sample from beneath the open sump was collected and analyzed following the procedures. As previously discussed in Section 4.4.5, the analytical results for organic compounds and inorganic analytes in this subsequent sample were below the MRFA Comparative Criteria for subsurface soils. Therefore, based on the analytical results of the post-cleanup soil sample that was collected from beneath the open sump, no further investigation related to the open sump is proposed.

5.5 *GROUND WATER*

As discussed in Section 4.5, several of the monitoring wells have organic compounds and inorganic analytes in both the unfiltered and filtered ground water samples that exceed the MRFA Comparative Criteria for at least one round of ground water sampling. The existing ground water monitoring well network at the MRFA Site is believed to be sufficient for evaluating the nature and extent of organic compounds and inorganic analytes in the ground water and for defining ground water flow direction.

Appendix K of the Draft RI Report contains a series of seven ground water elevation contour maps for both shallow and deep ground water flow

direction. These maps show that the ground water flow direction for both shallow and deep ground water is very well defined and fairly consistent over time. Iso-concentration contour maps for specific organic compounds (carbon tetrachloride and trichloroethene) and inorganic analytes (iron, copper, and lead) are presented in Appendix L and Section 5.0 of the Draft RI Report. These iso-concentration contour maps show that the presence of these organic compounds and inorganic analytes in the ground water and the MRFA Site have been adequately defined.

No additional characterization of the nature and extent of organic compounds and inorganic analytes in the ground water is necessary; therefore, no additional ground water wells are proposed. Sampling of the five newly installed wells (M-33S, M-33I, M-34, M-35S, and M-35D) and previously installed well MW-4 is proposed. The five new wells have not yet been sampled, and MW-4 was redeveloped in the fall of 1993. Ground water from these wells will be analyzed for TCL Organics and TAL Inorganics plus boron using low level methodologies.

5.6 SUMMARY OF PROPOSED SAMPLING PROGRAMS

Table 32 presents a summary of the proposed sampling programs to establish the extent of constituents above the MRFA Comparative Criteria the MRFA Site. The proposed sampling programs were established based on MRFA Comparative Criteria for each sampling media and on comments on the Draft RI Report from the USEPA in a letter dated 8 July 1993. A total of 66 borings are proposed with approximately 1500 feet of total footage. Thirteen surface soil samples, three surface water samples, and six ground water samples (six monitoring wells) are proposed. No new monitoring well installations are proposed based on the discussion in Section 5.5. Table 35 provides a summary of the number of samples per media and the analyses proposed.

Pursuant to the USEPA's 23 December 1993 letter, the proposed sampling programs described herein should be accomplished within 60 days of USEPA approval of this sampling program, which includes the receipt and validation of the analytical data.

The drilling program as outlined in this document is expected to take at least 22 days (assuming 3 borings per day). The final laboratory results for TCL/TAL protocols cannot be produced in less than 30 days. Data validation is expected to require another 20 days or so. These time schedules do not account for any additional borings that may be deemed necessary due to expedited verbal laboratory results used for field decisions regarding additional sampling.

Considering the proposed level of effort (see Table 35), the winter conditions, and the TCL/TAL laboratory reporting requirements, this schedule the 60 day schedule may be problematic. An attempt will be made to complete this scope of work, with the exception of surface soil sampling (due to current frost conditions in the soil), within 60 days as requested by USEPA; however, delays due to the weather may be unavoidable. The USEPA will be notified as soon as possible if completion of the scope of work is expected to exceed 60 days. The surface soil sampling program will be delayed until spring. The analytical results of this additional sampling will be communicated to the USEPA when validation is completed. The complete discussion of the findings will be incorporated into the RI Report.

The actual start date of field activities is anticipated for the end of January 1994, depending on any necessary field modifications, subcontractor

availability and physical access. The selected sampling locations will be chosen to minimize physical access constraints.

CONCLUSIONS

MRFA Comparative Criteria have been developed for surface soil, subsurface soil, surface water, sediment, and ground water. The MRFA RI analytical results were compared to the MRFA Comparative Criteria to determine locations where further investigation may be required. This comparison showed that additional site characterization was warranted for specific areas of the MRFA Site for each media. Proposed sampling programs have been presented based on the MRFA Comparative Criteria in relation to MRFA RI analytical data and comments from the USEPA (dated 8 July 1993) on the Draft RI Report.

- Ciba-Geigy, Scientific Tables, 7th Edition, Ciba-Geigy Limited, Basla, Switzerland 1970. Family Physician's Compendium of Drug Therapy, Biomedical Information Corporation, New York, NY 1982-1983.
- Eisler, Ronald, United States Fish and Wildlife Service, Contaminant Hazard Reviews Report Number 1 through 26; 1985 to 1993.
- ERM-Northeast, Inc., Report for the Cleanup of the Building 1A Sump at the Malta Rocket Fuel Area Site; 4 January 1993.
- ERM-Northeast, Inc., Scope of Work for Additional Background Soil Sampling Malta Rocket Fuel Area Site; 20 August 1993.
- ERM-Northeast, Inc., Scope of Work for Additional RI Sampling, Malta Rocket Fuel Area Site; 18 October 1993.
- ERM-Northeast, Inc., Technical Memorandum, Background Investigation Report, Malta Rocket Fuel Area Site; 30 November 1993.
- Geraghty & Miller, Inc., Project Operations Plan, Malta Rocket Fuel Area Superfund Site; August 1991.
- Gilbert, Richard O., Statistical Methods for Environmental Pollution Monitoring, Van Nostrand Reinhold, New York; 1987.
- Long, Edward R. and Morgan, Lee G., NOAA Technical Memorandum NOS OMA 52, United States Department of Commerce, National Ocean Service, Rockville, MD., Potential for Biological Effects of Sediment-Sorbed Contaminants Tested in the National Status and Trends Program; March 1990.
- National Research Council, Recommended Dietary Allowances, National Academy Press, Washington, D.C., 1989.
- New York State Department of Environmental Conservation, Draft Cleanup Criteria for Aquatic Sediments; December 1989.
- New York State Department of Environmental Conservation, Draft Cleanup Policy and Guidelines, Water Cleanup Criteria; 22 May 1991.

New York State Department of Environmental Conservation, Division of
Technical and Administrative Guidance Memorandums:
Determination of Soil Cleanup Objectives and Cleanup Levels,
HWR-92-4046; 16 November 1992.

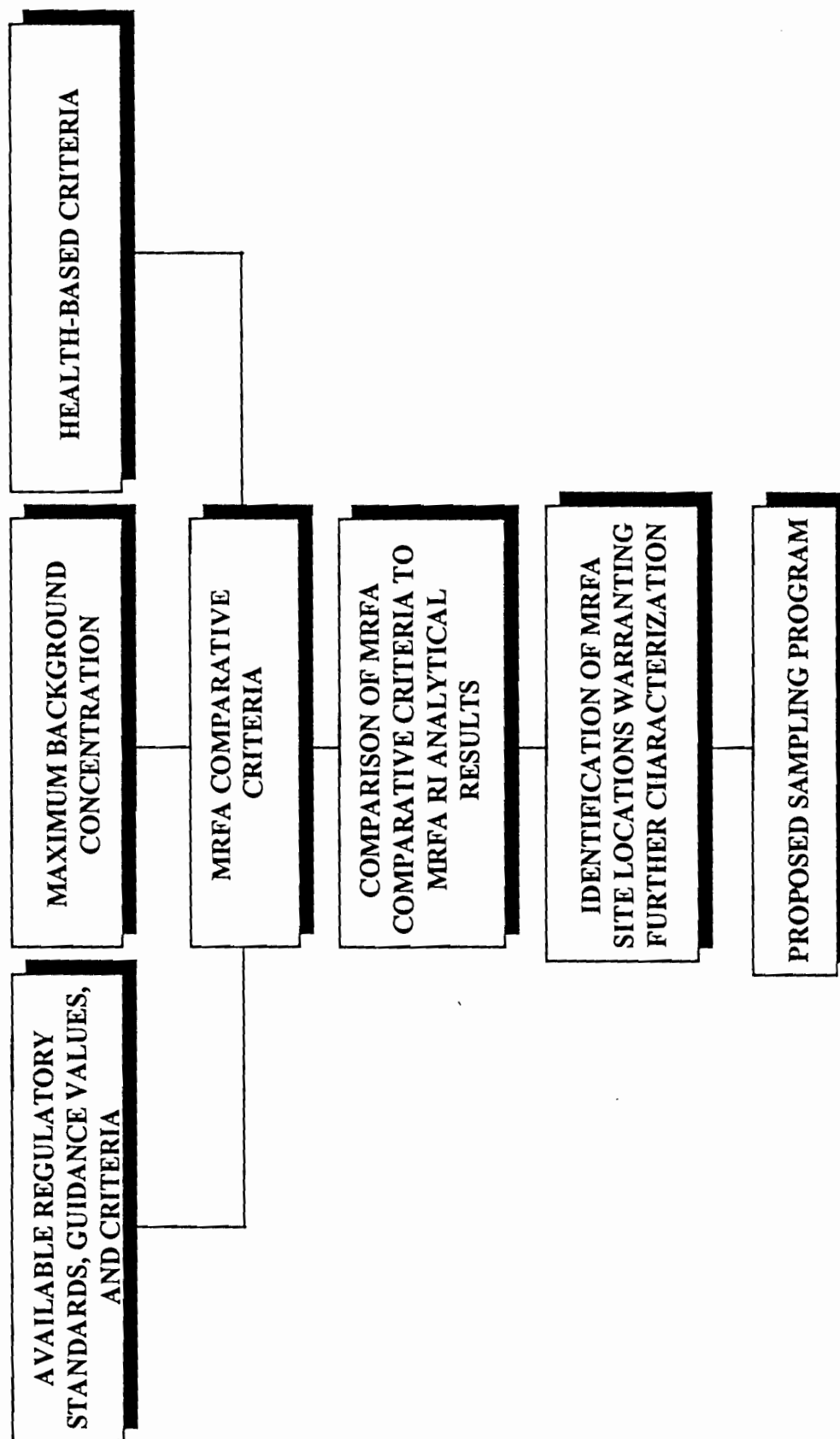
USEPA Exposure Factors Handbook, 1991.

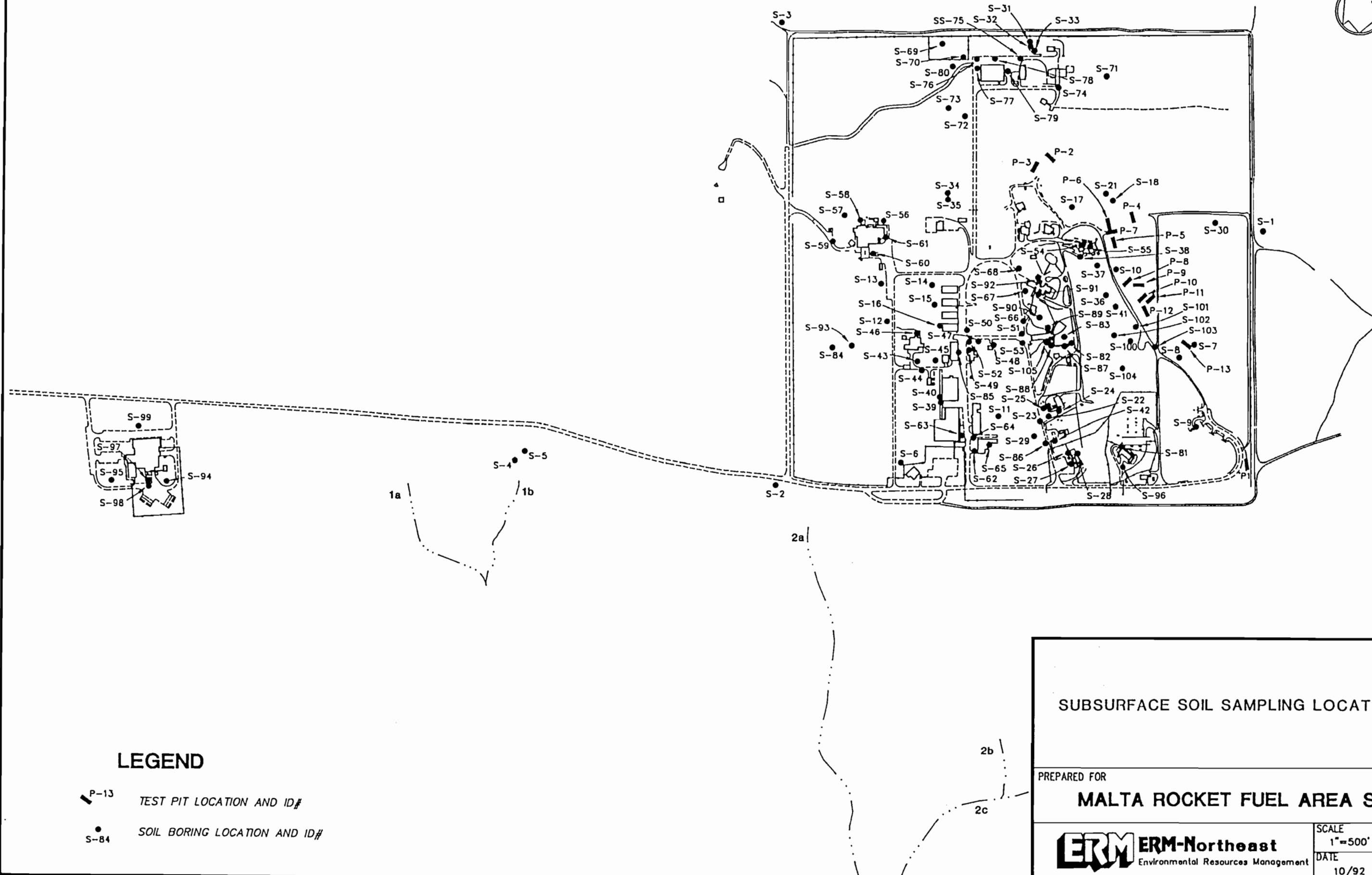
United States Environmental Protection Agency, Risk Assessment Guidance
for Superfund Volume I Human Health Evaluation Manual (Part B),
Development of Risk Based Preliminary Remediation Goals Interim,
EPA 9285.7-01B, December 1991.

United States Environmental Protection Agency, Statistical Analysis of
Ground Water Monitoring Data at RCRA Facilities. Interim Final
Guidance, EPA/530-SW-89-026, PB89-153047, February 1989.

FIGURES

FIGURE 1
FLOW CHART FOR ASSESSMENT OF MRFA SITE
LOCATIONS REQUIRING FURTHER CHARACTERIZATION





LEGEND

- P-13 TEST PIT LOCATION AND ID#
- S-84 SOIL BORING LOCATION AND ID#

SUBSURFACE SOIL SAMPLING LOCATIONS

PREPARED FOR

MALTA ROCKET FUEL AREA SITE

ERM ERM-Northeast
Environmental Resources Management

SCALE
1"=500'
DATE
10/92

FIGURE
3

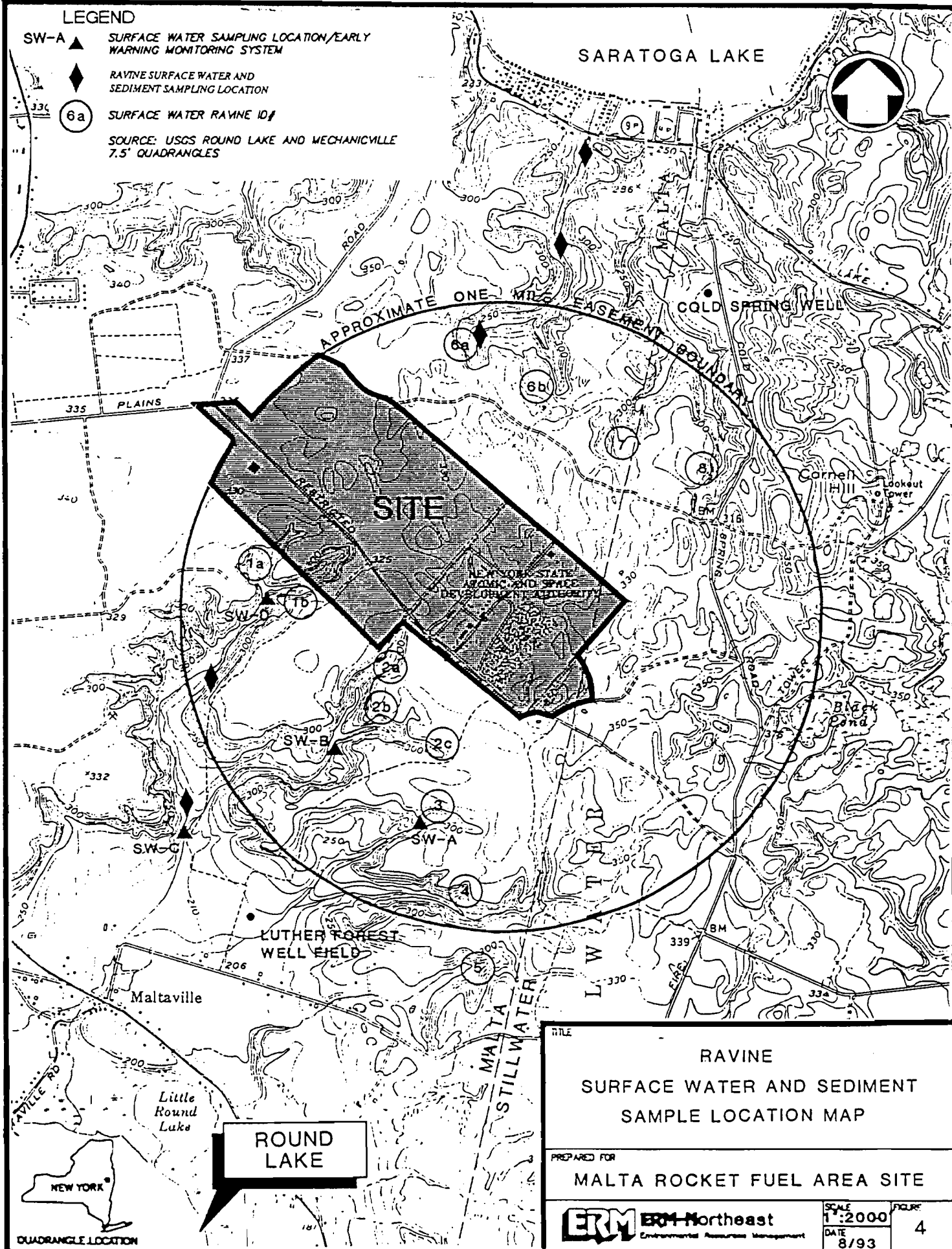
LEGEND

SW-A ▲ SURFACE WATER SAMPLING LOCATION/EARLY WARNING MONITORING SYSTEM

◆ RAVINE SURFACE WATER AND SEDIMENT SAMPLING LOCATION

6a ○ SURFACE WATER RAVINE ID#

SOURCE: USGS ROUND LAKE AND MECHANICVILLE 7.5' QUADRANGLES



TITLE

RAVINE
SURFACE WATER AND SEDIMENT
SAMPLE LOCATION MAP

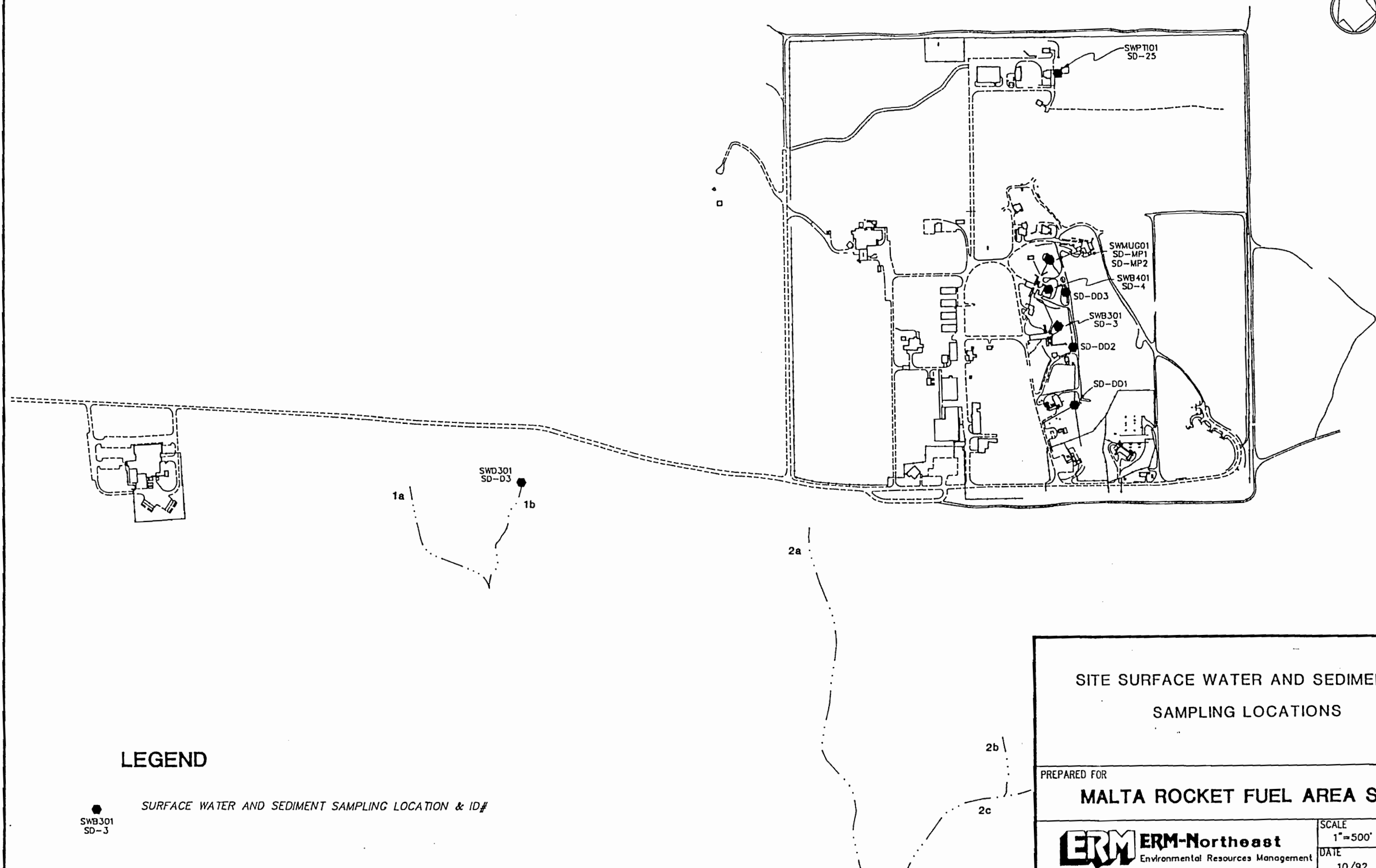
PREPARED FOR

MALTA ROCKET FUEL AREA SITE

ERM Environmental Resources Management
ERM Northeast

SCALE
1"=2000'
DATE
8/93

PAGE
4



LEGEND

● SURFACE WATER AND SEDIMENT SAMPLING LOCATION & ID#
SWB301
SD-3

SITE SURFACE WATER AND SEDIMENT SAMPLING LOCATIONS

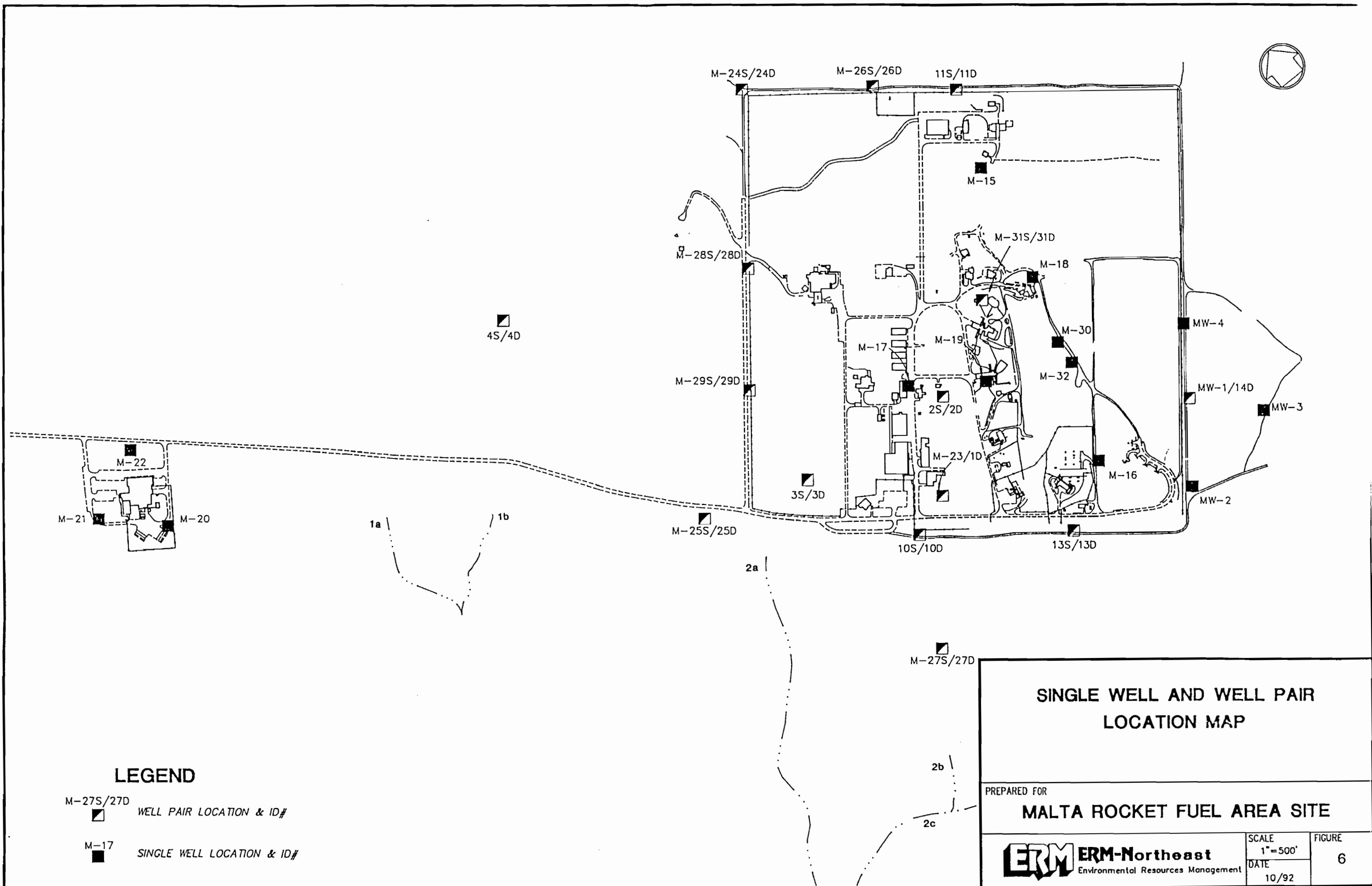
PREPARED FOR

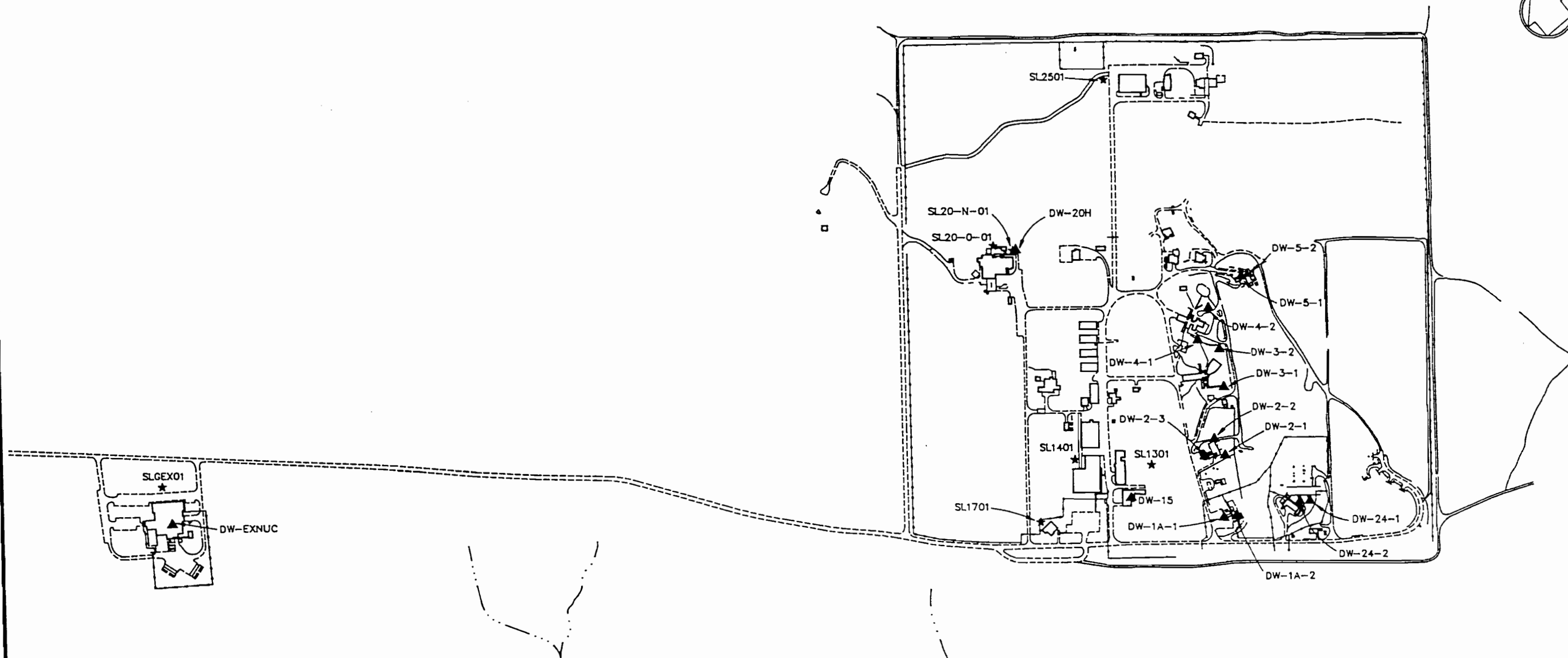
MALTA ROCKET FUEL AREA SITE

ERM **ERM-Northeast**
Environmental Resources Management

SCALE
1"=500'
DATE
10/92

FIGURE
5





LEGEND

- ▲ DW-EXNUC DRY WELL SAMPLING LOCATION & SAMPLE ID
- ★ SLGEX01 SEPTIC TANK SAMPLING LOCATION & SAMPLE ID

DRY WELL AND SEPTIC TANK SAMPLING LOCATION MAP

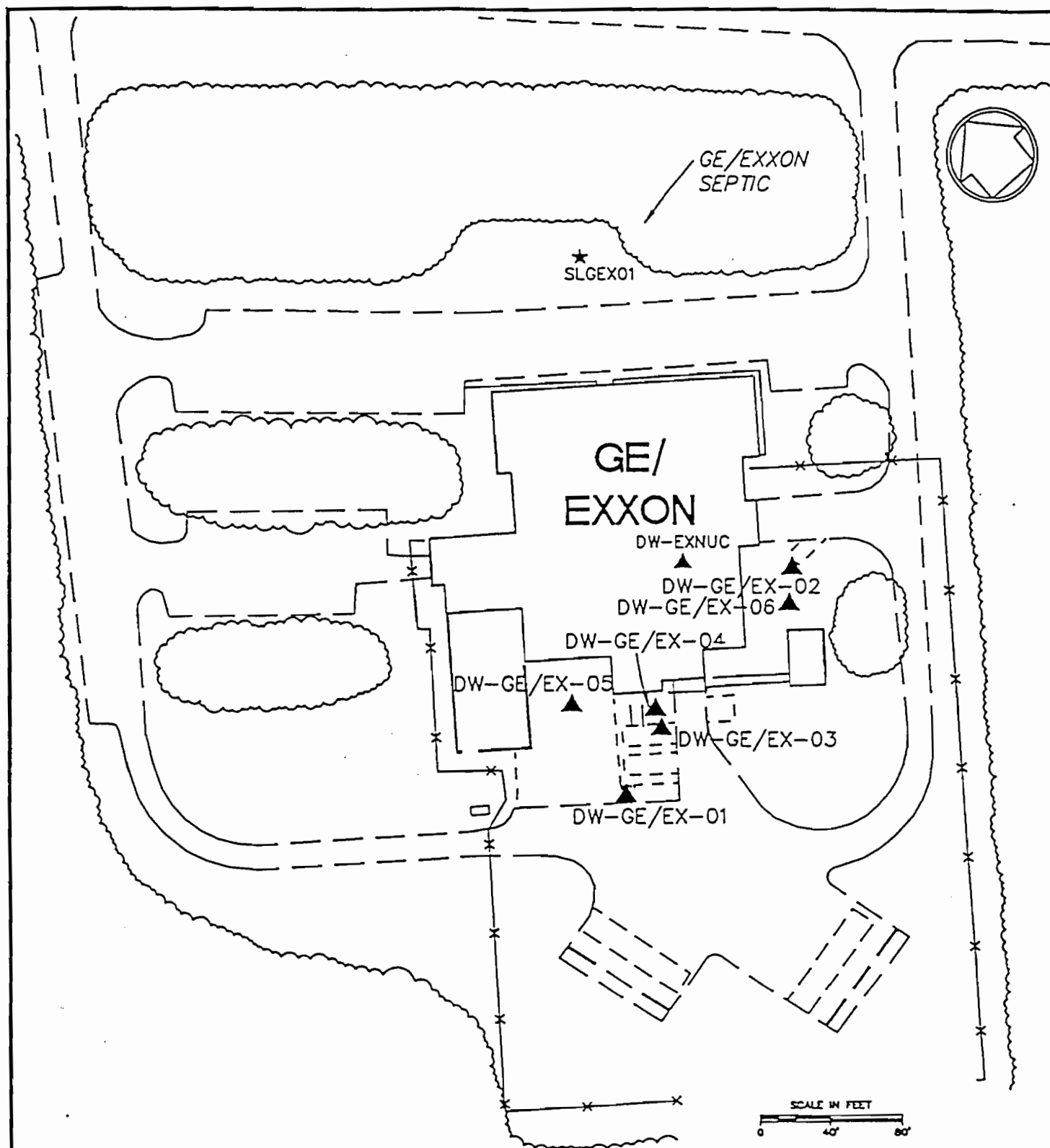
PREPARED FOR

MALTA ROCKET FUEL AREA SITE

ERM **ERM-Northeast**
Environmental Resources Management

SCALE
1"=500'
DATE
10/92

FIGURE
7



LEGEND

DW-EXNUC



DRY WELL SAMPLING LOCATION & SAMPLE ID

★ SLGEX01



SEPTIC TANK SAMPLING LOCATION & SAMPLE ID

DRY WELL AND SEPTIC TANK SAMPLING LOCATION MAP

GE/EXXON BUILDING

PREPARED FOR

MALTA ROCKET FUEL AREA SITE



ERM-Northeast
Environmental Resource Management

SCALE
1"=80'
DATE
12/93

FIGURE
8

-

-

-

-

-

TABLES

-

-

-

-

-

-

-

-

-

-

-

-

-

-

TABLE 1
MALTA ROCKET FUEL AREA SITE
MEASURED BACKGROUND INORGANIC RANGES FOR EACH MEDIA

Analyte	Surface Soil Range	Subsurface Soil Range	Ravine 6a Surface Water Range	Ravine 6a Sediment Range	Ground Water Range* (unfiltered)	Ground Water Range* (filtered)
Aluminum	4850-9000	3270-7670	<44.50-47.00	2400-2890	745-42900	<37.9-83.1
Antimony	<7.2-13.2	<4.9-13.8	<52.30-<52.70	<9.10-<12.10	<16.5-45.6	<16.5-<37.8
Arsenic	<0.24-3.1	1.1-3.1	1.60-1.90	1.40-5.50	<1.1-14.3	<1.1-<1.5
Barium	9.3-49	9.4-19.4	15.80-21.30	15.70-35.60	25.8-282	52.0-94.2
Beryllium	0.20-0.38	0.19-0.34	<0.30	0.09-0.14	<0.50-3.2	<0.50
Cadmium	<0.45-<0.74	<0.24-<0.69	<3.30	<0.57-<0.76	<1.9-2.9	<1.9-<2.6
Calcium	197-622	215-12200	54700-57900	834-5510	47500-465000	15900-52200
Chromium	4.2-8.0	3.9-8.0	<2.50	3.90-8.30	2.5-53.7	<1.9-<2.2
Cobalt	1.2-3.3	2.4-4.3	<4.90	1.80-2.80	<3.7-50.2	<3.7-<4.6
Copper	4.2-8.7	6.4-12.2	<3.70-4.40	2.90-5.20	5.5-167	<2.1-<2.6
Iron	6830-10500	7570-11800	84.3-231	7310-9520	2370-86900	25.7-143
Lead	10.5-23.9	2.0-6.0	<0.59-0.66B	1.30-1.80	2.0-56.5	<0.60-<1.00
Magnesium	652-1330	1170-1850	11000-12100	826-1550	8710-33800	4870-8340
Manganese	62-1180	180-321	27.4-260	162-249	54.4-6220	<1.1-8.1
Mercury	<0.03-0.16	<0.02-<0.04	<0.07	<0.03-<0.05	<0.05-<0.06	<0.05-<0.06
Nickel	4.0-8.1	5.5-10.6	<4.10	3.60-5.40	<6.0-86.8	<3.4-3.6
Potassium	170-582	372-2080	724-845	247-297	1180-12800	<592-988
Selenium	<0.17-0.38	<0.15-0.23	<1.10-1.30	<0.20-0.55	<1.00	<0.99-<1.00
Silver	<0.91-<1.50	<0.69-<1.40	<6.60-<6.70	<1.20-<1.50	<3.8	<3.8
Sodium	92-149	16.1-75.7	1900B-4840B	<11.40-<15.10	1440-2850	1530-2560
Thallium	<0.19-<0.27	<0.16-<0.37	<1.20	<0.21-<0.27	<1.6	<1.6
Vanadium	11.0-16.9	6.4-15.2	<3.30	10.30-13.20	4.7-97.5	<3.5-<4.0
Zinc	16.1-32.8	13.9-24.3	4.50-150	10.50-19.00	27.0-224	21.6-97.2
Cyanide	<0.08-0.14	<0.08-<0.62	<1.20	<0.09-<0.11	<10.0	NA
Boron	<13.6-<22.4	<12.3-<20.8	<99.10-<99.60	<17.30-<19.80	<99.1-<100	<99.0-<100

Notes:

1. All soil and sediment concentrations are in milligrams per kilogram (mg/kg = parts per million (ppm)).
2. All surface and ground water concentrations are in micrograms per liter (ug/l = parts per billion (ppb)).
3. * = Range is based on two sampling events.

ALLRANG.XLS 12/14/93

TABLE 2
MALTA ROCKET FUEL AREA SITE
SURFACE SOIL STATISTICAL BACKGROUND CONCENTRATIONS
INORGANIC ANALYTES

BACKGROUND SURFACE SOIL (20 SAMPLES)

Analyte	No. of Detections	% Detections	Range	Mean	Standard Deviation	Maximum Background Concentration*
Aluminum	20	100%	4850-9000	6926	1335	9596
Antimony	2	10%	<7.2-13.2	5.7	2.4	10.5
Arsenic	19	95%	<0.24-3.1	2.2	0.6	3.4
Barium	20	100%	9.3-49	26	12.7	51.4
Beryllium	20	100%	0.20-0.38	0.28	0.06	0.40
Cadmium	0	0%	<0.45-<0.74	0.31	0.04	0.39
Calcium	20	100%	197-622	377	98.2	573
Chromium	20	100%	4.2-8.0	5.7	1	7.7
Cobalt	20	100%	1.2-3.3	2.3	0.53	3.4
Copper	20	100%	4.2-8.7	6.4	1.1	8.6
Iron	20	100%	6830-10500	8974	1122	11218
Lead	20	100%	10.5-23.9	17	3.4	23.8
Magnesium	20	100%	652-1330	1002	204	1410
Manganese	20	100%	62-1180	407	314	1035
Mercury	17	85%	<0.03-0.16	0.06	0.03	0.12
Nickel	20	100%	4.0-8.1	5.8	1	7.8
Potassium	20	100%	170-582	341	111	563
Selenium	9	45%	<0.17-0.38	0.20	0.11	0.42
Silver	0	0%	<0.91-<1.50	0.64	0.07	0.78
Sodium	20	100%	92-149	116	12.5	141
Thallium	0	0%	<0.19-<0.27	0.12	0.01	0.14
Vanadium	20	100%	11.0-16.9	14	1.8	17.6
Zinc	20	100%	16.1-32.8	21	4.1	29.2
Cyanide	2	10%	<0.08-0.14	0.05	0.03	0.11
Boron	0	0%	<13.6-<22.4	9.4	1.1	11.6

Notes:

1. All concentrations are in milligrams per kilogram (mg/kg = parts per million (ppm)).
2. One-half the Instrument Detection Limit (IDL) was used in all calculations where an analyte was not detected.
3. * = Maximum background concentration = background mean + 2 standard deviations.

TABLE 3
MALTA ROCKET FUEL AREA SITE
SUBSURFACE SOIL STATISTICAL BACKGROUND CONCENTRATIONS
INORGANIC ANALYTES

BACKGROUND SUBSURFACE SOIL (21 SAMPLES*)

Analyte	No. of Detections	% Detections	Range	Mean	Standard Deviation	Maximum Background Concentration**
Aluminum	21	100%	3270-7670	4955	1144	7243
Antimony	5	24%	<4.9-13.8	6.0	3.6	13.2
Arsenic	21	100%	1.1-3.1	2.1	0.51	3.1
Barium	21	100%	9.4-19.4	14.4	2.9	20.2
Beryllium	21	100%	0.19-0.34	0.25	0.04	0.33
Cadmium	0	0%	<0.24-<0.69	0.27	0.05	0.37
Calcium	21	100%	215-12200	1447	2809	7065
Chromium	21	100%	3.9-8.0	5.2	1.1	7.4
Cobalt	21	100%	2.4-4.3	3.3	0.55	4.4
Copper	21	100%	6.4-12.2	8.8	1.9	12.6
Iron	21	100%	7570-11800	9684	1370	12424
Lead	21	100%	2.0-6.0	2.8	0.87	4.5
Magnesium	21	100%	1170-1850	1541	195	1931
Manganese	21	100%	180-321	231	43.6	318
Mercury	0	0%	<0.02-<0.04	0.02	0.003	0.03
Nickel	21	100%	5.5-10.6	7.5	1.2	9.9
Potassium	21	100%	372-2080	621	350	1321
Selenium	3	14%	<0.15-0.23	0.12	0.05	0.22
Silver	0	0%	<0.69-<1.40	0.55	0.09	0.73
Sodium	20	95%	16.1-75.7	29.7	14.0	57.7
Thallium	0	0%	<0.16-<0.37	0.10	0.02	0.14
Vanadium	21	100%	6.4-15.2	9.5	2.3	14.1
Zinc	21	100%	13.9-24.3	18.1	2.6	23.3
Cyanide	0	0%	<0.08-<0.62	0.05	0.06	0.17
Boron	0	0%	<12.3-<20.8	8.4	1.1	10.6

Notes:

1. All concentrations are in milligrams per kilogram (mg/kg = parts per million (ppm)).
2. One-half the Instrument Detection Limit (IDL) was used in all calculations where an analyte was not detected.
3. * = Includes eleven samples from 4'-6' below grade and ten samples from 8'-10' below grade.
4. ** = Maximum background concentration = background mean + 2 standard deviations.

TABLE 4
MALTA ROCKET FUEL AREA SITE
RAVINE 6A SURFACE WATER CONCENTRATIONS
INORGANIC ANALYTES

Analyte	SW-6A-01		SW-6A-02		SW-6A-03		Maximum Background Concentration
Aluminum	47.00	B	44.80	U	44.50	U	47.00 B
Antimony	52.60	U J	52.70	U J	52.30	U J	52.70 U J
Arsenic	1.90	B	1.60	B	1.90	B	1.90 B
Barium	15.80	B	20.80	B	21.30	B	21.30 B
Beryllium	0.30	U	0.30	U	0.30	U	0.30 U
Cadmium	3.30	U	3.30	U	3.30	U	3.30 U
Calcium	54700		57900		57300		57900
Chromium	2.50	U	2.50	U	2.50	U	2.50 U
Cobalt	4.90	U	4.90	U	4.90	U	4.90 U
Copper	3.70	U	3.70	U	4.40	B	4.40 B
Iron	231	J	84.3	B	99.7	J	231 J
Lead	0.59	U	0.66	B	0.64	B	0.66 B
Magnesium	11000		12100		12000		12100
Manganese	260		29.8		27.4		260
Mercury	0.07	U	0.07	U	0.07	U	0.07 U
Nickel	4.10	U	4.10	U	4.10	U	4.10 U
Potassium	845	B	727	U	724	B	845 B
Selenium	1.30	B J	1.10	B	1.10	U	1.30 B J
Silver	6.70	U	6.70	U	6.60	U	6.70 U
Sodium	1900.00	B	4840.00	B	4830.00	B	4840.00 B
Thallium	1.20	U	1.20	U	1.20	U	1.20 U
Vanadium	3.30	U	3.30	U	3.30	U	3.30 U
Zinc	150.00		4.50	B	42.30		150.00
Cyanide	1.20	U	1.20	U	1.20	U	1.20 U
Boron	99.60	U J	99.90	U J	99.10	U J	99.90 U J

Notes:

1. All concentrations are in micrograms per liter (ug/l = parts per billion (ppb)).
2. U = Analyte was not detected.
3. J = Semi-quantitative value due to QA/QC data validation requirements.
4. B = Value is above the Instrument Detection Limit (IDL) but below the Contract Required Detection Limit (CRDL).

TABLE 5
MALTA ROCKET FUEL AREA SITE
RAVINE 6A SEDIMENT CONCENTRATIONS
INORGANIC ANALYTES

Analyte				Maximum Background Concentration
	SD-6A-01	SD-6A-02	SD-6A-03	
Aluminum	2890.00	2400.00	2410.00	2890.00
Antimony	9.10 U J	10.40 U J	12.10 U J	12.10 U J
Arsenic	5.50	1.40 B	1.70 B	5.50
Barium	35.60	21.60 B	15.70 B	35.60
Beryllium	0.14 B	0.10 B	0.09 B	0.14 B
Cadmium	0.57 U	0.65 U	0.76 U	0.76 U
Calcium	5510	1150	834 B	5510
Chromium	8.30	4.50	3.90	8.30
Cobalt	2.80 B	2.00 B	1.80 B	2.80 B
Copper	5.20	2.90 B	2.90 B	5.20
Iron	9520	9110	7310	9520
Lead	1.30 J	1.80 J	1.50 J	1.80 J
Magnesium	1550	941 B	826 B	1550
Manganese	225	249	162	249
Mercury	0.05 U	0.03 U	0.03 U	0.05 U
Nickel	5.40 B	3.60 B	3.80 B	5.40 B
Potassium	297 B	247 B	291 B	297 B
Selenium	0.55 B	0.20 U	0.38 B	0.55 B
Silver	1.20 U	1.30 U	1.50 U	1.50 U
Sodium	11.40 U	13.10 U	15.10 U	15.10 U
Thallium	0.22 U	0.21 U J	0.27 U	0.27 U
Vanadium	13.20 J	13.10 J	10.30 B J	13.20 J
Zinc	19.00	10.90	10.50	19.00
Cyanide	0.11 U	0.09 U	0.09 U	0.11 U
Boron	17.30 U	19.80 U	22.90 U	22.90 U

- Notes:
- 1. All concentrations are in milligrams per kilogram (mg/kg = parts per million (ppm)).
 - 2. U = Analyte was not detected.
 - 3. J = Semi-quantitative value due to QA/QC data validation requirements.
 - 4. B = Value is above the Instrument Detection Limit (IDL) but below the Contract Required Detection Limit (CRDL).

TABLE 6
MALTA ROCKET FUEL AREA SITE
UPGRADIENT GROUND WATER CONCENTRATION RANGES
INORGANIC ANALYTES

Analyte	MW-1,2,3,4,14D Unfiltered Range*	MW-1,2,3,4,14D Filtered Range*
Aluminum	745-42900	<37.9-83.1
Antimony	<16.5-45.6	<16.5-<37.8
Arsenic	<1.1-14.3	<1.1-<1.5
Barium	25.8-282	52.0-94.2
Beryllium	<0.50-3.2	<0.50
Cadmium	<1.9-2.9	<1.9-<2.6
Calcium	47500-465000	15900-52200
Chromium	2.5-53.7	<1.9-<2.2
Cobalt	<3.7-50.2	<3.7-<4.6
Copper	5.5-167	<2.1-<2.6
Iron	2370-86900	25.7-143
Lead	2.0-56.5	<0.60-<1.00
Magnesium	8710-33800	4870-8340
Manganese	54.4-6220	<1.1-8.1
Mercury	<0.05-<0.06	<0.05-<0.06
Nickel	<6.0-86.8	<3.4-3.6
Potassium	1180-12800	<592-988
Selenium	<1.00	<0.99-<1.00
Silver	<3.8	<3.8
Sodium	1440-2850	1530-2560
Thallium	<1.6	<1.6
Vanadium	4.7-97.5	<3.5-<4.0
Zinc	27.0-224	21.6-97.2
Cyanide	<10.0	NA
Boron	<99.1-<100	<99.0-<100

Notes:

1. All concentrations are in micrograms per liter (ug/l = parts per billion (ppb)).
2. * = Range is based on two sampling events.

TABLE 7
MALTA ROCKET FUEL AREA SITE
NYSTAGM VALUES FOR SOIL
INORGANIC ANALYTES

Analyte	NYSTAGM
Aluminum	SB
Antimony	SB
Arsenic	7.5 or SB
Barium	300 or SB
Beryllium	1.0 or SB
Cadmium	1 or SB
Calcium	SB
Chromium	10 or SB
Cobalt	30 or SB
Copper	25 or SB
Iron	2000 or SB
Lead	30 or SB
Magnesium	SB
Manganese	SB
Mercury	0.1
Nickel	13 or SB
Potassium	SB
Selenium	2 or SB
Silver	SB
Sodium	SB
Thallium	SB
Vanadium	150 or SB
Zinc	20 or SB
Cyanide	none
Boron	none

Notes:

1. All concentrations are in milligrams per kilogram (mg/kg = parts per million (ppm)).
2. SB = Site background.
3. NYSTAGM = New York State Technical and Administrative Guidance Memorandum, November, 1992.

STAGMIN.XLS 12/14/93

TABLE 8
MALTA ROCKET FUEL AREA SITE
NYSTAGM VALUES FOR SOIL
ORGANIC COMPOUNDS DETECTED IN SITE SOIL

Volatile Organic Compound	NYSTAGM	Semi-Volatile Organic Compound	NYSTAGM
Acetone	200	Acenaphthene	50000
Carbon Tetrachloride	600	Anthracene	50000
Chloroform	300	Benzo (a) Anthracene	220
Ethylbenzene	5500	Benzo (b) Fluoranthene	1100
Tetrachloroethene	1400	Benzo (a) Pyrene	61
Toluene	1500	Benzo (g,h,i) Perylene	50000
Trichloroethene	700	Benzo (k) Fluoranthene	1100
Xylene (Total)	1200	bis (2-Ethylhexyl) Phthalate	50000
Total VOCs	10000	Butylbenzylphthalate	50000
		Carbazole	50000*
		Chrysene	400
		Di-n-Butylphthalate	8100
		Dibenzo (a,h) Anthracene	14
		2,4-Dinitrotoluene	50000*
		Diethylphthalate	7100
		Fluoranthene	50000
		Fluorene	50000
		Indeno (1,2,3-cd) Pyrene	3200
		2-Methylnaphthalene	36400
		Naphthalene	13000
		Nitrosodiphenylamine	50000*
		Phenanthrene	50000
		Phenol	30
		Pyrene	50000
		Individual SVOCs	50000
		Total SVOCs	500000
Pesticide/PCB Compound	NYSTAGM		
Aldrin	41		
Heptachlor Epoxide	20		
delta-BHC	300		
4,4'-DDE	2100		
4,4'-DDD	2900		
Dieldrin	44		
Endosulfan I	900		
Endosulfan II	900		
Endosulfan Sulfate	1000		
Endrin	100		
4,4'-DDT	2100		
Methoxychlor	10000		
Endrin Ketone	none		
alpha-Chlordane	none		
gamma-Chlordane	540		
Total Pesticides	10000		
Total PCBs	1000 (surface) 10000 (subsurface)		

Notes:
1. All concentrations are in micrograms per kilogram (ug/kg = parts per billion (ppb)).
2. NYSTAGM = New York State Technical and Administrative Guidance Memorandum, November, 1992.
3. * No NYSTAGM listed. Individual NYSTAGM of 50000 ppb used.

TABLE 9
MALTA ROCKET FUEL AREA SITE
NYSSWS AND FEDERAL SURFACE WATER CRITERIA
INORGANIC ANALYTES

Analyte	NYSSWS	Federal Criteria	
		Acute	Chronic
Aluminum	none	pH dependent	pH dependent
Antimony	3 (g)	88	30
Arsenic	50	850(V) 360(III)	190(III)
Barium	1000	none	none
Beryllium	3 (g)	130	5.3
Cadmium	10	3.9*	1.1*
Calcium	none	none	none
Chromium	50	16(VI)* 1700(III)*	11(VI)* 210(III)*
Cobalt	5	none	none
Copper	200	18*	12*
Iron	300	none	1000
Lead	50	83*	3.2*
Magnesium	35000	none	none
Manganese	300	none	none
Mercury	2	2.4	0.012
Nickel	none	1400*	160*
Potassium	none	none	none
Selenium	10	20	5
Silver	50	4.1*	0.12
Sodium	none	none	none
Thallium	4 (g)	1400	40
Vanadium	none	none	none
Zinc	300	120*	110*
Cyanide	100	22	5.2
Boron	none	none	none

Notes:

1. All concentrations are in micrograms per liter (ug/l = parts per billion (ppb)).
2. NYSSWS = New York State Surface Water Standards.
3. g = guidance value
4. * = Hardness dependent. 100 mg/l of CaCO₃ used.

TABLE 10
MALTA ROCKET FUEL AREA SITE
NYSSC, ER-L AND ER-M SEDIMENT CRITERIA
INORGANIC ANALYTES

Analyte	NYSSC	Long & Morgan	
		ER-L	ER-M
Aluminum	none	none	none
Antimony	none	2	25
Arsenic	5	33	85
Barium	none	none	none
Beryllium	none	none	none
Cadmium	0.8	5	9
Calcium	none	none	none
Chromium	26	80	145
Cobalt	none	none	none
Copper	19	70	390
Iron	24000	none	none
Lead	27	35	110
Magnesium	none	none	none
Manganese	428	none	none
Mercury	0.11	0.15	1.3
Nickel	22	30	50
Potassium	none	none	none
Selenium	none	none	none
Silver	none	1	2.2
Sodium	none	none	none
Thallium	none	none	none
Vanadium	none	none	none
Zinc	85	120	270
Cyanide	none	none	none
Boron	none	none	none

Notes:

1. All concentrations are in milligrams per kilogram (mg/kg = parts per million (ppm)).
2. NYSSC = New York State Sediment Criteria.
3. ER-L and ER-M concentrations are the Effects Range-Low and Effects Range-Median, from Long and Morgan, 1990, "Potential for Biological Effects of Sediment-Sorbed Contaminants Tested in the National Status and Trends Program" in NOAA Technical Memorandum NOS OMA 52.

TABLE 11
MALTA ROCKET FUEL AREA SITE
NYSSC, ER-L AND ER-M SEDIMENT CRITERIA
FOR ORGANIC COMPOUNDS DETECTED IN SITE SEDIMENT

Volatile Organic Compound	NYSSC		Long & Morgan	
	Aquatic Toxicity	Human Health Residue	ER-L	ER-M
Ethylbenzene	none	none	none	none
Toluene	none	none	none	none
Xylene (Total)	none	none	none	none

Semi-Volatile Organic Compound				
Anthracene	none	none	85	96
Benzo (a) Anthracene	none	13	230	1600
Benzo (b) Fluoranthene	none	13	none	none
Benzo (a) Pyrene	none	13	400	2500
Benzo (g,h,i) Perylene	none	none	none	none
Benzo (k) Fluoranthene	none	13	none	none
Butylbenzylphthalate	none	none	none	none
Carbazole	none	none	none	none
Chrysene	none	13	400	2800
Di-n-Butylphthalate	none	none	none	none
Dibenzo (a,h) Anthracene	none	none	60	260
2,4-Dimethylphenol	5*	none	none	none
Fluoranthene	none	none	600	3600
Fluorene	none	none	35	640
Indeno (1,2,3-cd) Pyrene	none	13	none	none
2-Methylnaphthalene	none	none	65	670
2-Methylphenol	5*	none	none	none
4-Methylphenol	5*	none	none	none
Phenanthrene	1390	none	225	1380
Phenol	6**	none	none	none
Pyrene	none	none	350	2200
Total PAH	none	none	4000	35000

Pesticide/PCB Compound				
4,4'-DDE	<=500	0.1	2	15
4,4'-DDT	<=500	0.1	1	7
Methoxychlor	6	none	none	none
gamma-Chlordane	0.06	8x10E-7	0.5	6
Aroclor 1254	<2760	0.08	none	none
Aroclor 1260	<2760	0.08	none	none

Notes:

1. All concentrations are in micrograms per kilogram (ug/kg = parts per billion (ppb)).
2. NYSSC = New York State Sediment Criteria.
3. ER-L and ER-M concentrations are the Effects Range-Low and Effects Range-Median, from Long and Morgan, 1990, "Potential for Biological Effects of Sediment-Sorbed Contaminants Tested in the National Status and Trends Program" in NOAA Technical Memorandum NOS OMA 52.
4. * Total unchlorinated phenols.
5. ** Total phenols.

TABLE 12
MALTA ROCKET FUEL AREA SITE
FEDERAL AND STATE GROUND WATER CRITERIA
INORGANIC ANALYTES

Analyte	NPDWS	NSDWS	NYSGWS
Aluminum	none	50-200	none
Antimony	6	none	3*
Arsenic	50	none	25
Barium	2000	none	1000
Beryllium	4	none	3*
Cadmium	5	none	10
Calcium	none	none	none
Chromium	100	none	50
Cobalt	none	none	none
Copper	1300**	1000	200
Iron	none	300	300
Lead	15**	none	25
Magnesium	none	none	35000*
Manganese	none	50	300
Mercury	2	none	2
Nickel	100	none	none
Potassium	none	none	none
Selenium	50	none	10
Silver	50	100	50
Sodium	none	none	20000
Thallium	2	none	4*
Vanadium	none	none	none
Zinc	none	5000	300
Cyanide	200	none	100
Boron	none	none	none

Notes:

1. All concentrations are in micrograms per liter (ug/l = parts per billion (ppb)).
2. NPDWS = National Primary Drinking Water Standards.
3. NSDWS = National Secondary Drinking Water Standards.
4. NYSGWS = New York State Ground Water Standards.
5. * = Guidance value.
6. ** = Action level.

TABLE 13
MALTA ROCKET FUEL AREA SITE
FEDERAL AND STATE GROUND WATER CRITERIA
FOR ORGANIC COMPOUNDS DETECTED IN SITE GROUND WATER

Volatile Organic Compound	NPDWS	NSDWS	NYSGWS
Acetone	none	none	50
Benzene	5	none	0.7
Bromodichloromethane	none	none	50*
Carbon Disulfide	none	none	none
Carbon Tetrachloride	5	none	5
Chloroform	none	none	7
Chloromethane	none	none	5
1,1-Dichloroethene	7	none	5
Hexachlorobutadiene	none	none	none
2-Hexanone	none	none	none
Tetrachloroethene	5	none	5
1,2,3-Trichlorobenzene	70	none	none
1,1,1-Trichloroethane	200	none	5
Trichloroethene(TCE)	5	none	5
Trichlorofluoromethane	none	none	none

Semi-Volatile Organic Compound			
bis (2-Ethylhexyl) Phthalate	5	none	50
Di-n-Butylphthalate	none	none	50
Diethylphthalate	none	none	50*

Notes:

1. All concentrations are in micrograms per liter (ug/l = parts per billion (ppb)).
2. NPDWS = National Primary Drinking Water Standards.
3. NSDWS = National Secondary Drinking Water Standards.
4. NYSGWS = New York State Ground Water Standards.
5. * = Guidance value.

TABLE 14
MALTA ROCKET FUEL AREA SITE
HEALTH-BASED SOIL COMPARATIVE CRITERIA
INORGANIC ANALYTES

Analyte	Health-Based Comparative Criteria*
Aluminum	78300
Antimony	10.8
Arsenic	8.1
Barium	none**
Beryllium	none**
Cadmium	13.5
Calcium	500000
Chromium	135
Cobalt	none**
Copper	999
Iron	90000
Lead	500
Magnesium	500000
Manganese	2700
Mercury	8.1
Nickel	540
Potassium	525000
Selenium	none**
Silver	135
Sodium	325000
Thallium	1.89
Vanadium	189
Zinc	8100
Cyanide	540
Boron	2400

Notes:

1. All concentrations are in milligrams per kilogram (mg/kg = parts per million (ppm)).
2. * = These criteria were developed for this study, see Appendix A.
3. ** = Health-based comparative criteria were not developed for these analytes.

TABLE 15
MALTA ROCKET FUEL AREA SITE
MRFA COMPARATIVE CRITERIA - SURFACE SOIL
INORGANIC ANALYTES

Analyte	Maximum Background Concentration*	NYSTAGM	Health-Based Comparative Criteria**	MRFA Comparative Criteria
Aluminum	9596	SB	78300	78300
Antimony	10.5	SB	10.8	10.8
Arsenic	3.4	7.5 or SB	8.1	8.1
Barium	51.4	300 or SB	none	300
Beryllium	0.4	1.0 or SB	none	1.0
Cadmium	0.39	1 or SB	13.5	13.5
Calcium	573.4	SB	500000	500000
Chromium	7.7	10 or SB	135	135
Cobalt	3.36	30 or SB	none	30
Copper	8.6	25 or SB	999	999
Iron	11218	2000 or SB	90000	90000
Lead	23.8	30 or SB	500	500
Magnesium	1410	SB	500000	500000
Manganese	1035	SB	2700	2700
Mercury	0.12	0.1	8.1	8.1
Nickel	7.8	13 or SB	540	540
Potassium	563	SB	525000	525000
Selenium	0.42	2 or SB	none	2
Silver	0.78	SB	135	135
Sodium	141	SB	325000	325000
Thallium	0.14	SB	1.89	1.89
Vanadium	17.6	150 or SB	189	189
Zinc	29.2	20 or SB	8100	8100
Cyanide	0.11	none	540	540
Boron	11.6	none	2400	2400

Notes:

1. All concentrations are in milligrams per kilogram (mg/kg = parts per million (ppm)).
2. * = Maximum background concentration = background mean + 2 standard deviations.
3. NYSTAGM = New York State Technical and Administrative Guidance Memorandum, November, 1992.
4. ** = These criteria were developed for this study, see Appendix A.
5. SB = Site background.

TABLE 16
MALTA ROCKET FUEL AREA SITE
MRFA COMPARATIVE CRITERIA - SUBSURFACE SOIL
INORGANIC ANALYTES

Analyte	Maximum Background Concentration*	NYSTAGM	Health-Based Comparative Criteria**	MRFA Comparative Criteria
Aluminum	7243	SB	78300	78300
Antimony	13.2	SB	10.8	13.2
Arsenic	3.1	7.5 or SB	8.1	8.1
Barium	20.2	300 or SB	none	300
Beryllium	0.33	1.0 or SB	none	1.0
Cadmium	0.37	1 or SB	13.5	13.5
Calcium	7065	SB	500000	500000
Chromium	7.4	10 or SB	135	135
Cobalt	4.4	30 or SB	none	30
Copper	12.6	25 or SB	999	999
Iron	12424	2000 or SB	90000	90000
Lead	4.5	30 or SB	500	500
Magnesium	1931	SB	500000	500000
Manganese	318	SB	2700	2700
Mercury	0.03	0.1	8.1	8.1
Nickel	9.9	13 or SB	540	540
Potassium	1321	SB	525000	525000
Selenium	0.22	2 or SB	none	2
Silver	0.73	SB	135	135
Sodium	57.7	SB	325000	325000
Thallium	0.14	SB	1.89	1.89
Vanadium	14.1	150 or SB	189	189
Zinc	23.3	20 or SB	8100	8100
Cyanide	0.17	none	540	540
Boron	10.6	none	2400	2400

Notes:

1. All concentrations are in milligrams per kilogram (mg/kg = parts per million (ppm)).
2. * = Maximum background concentration = background mean + 2 standard deviations.
3. NYSTAGM = New York State Technical and Administrative Guidance Memorandum, November, 1992.
4. ** = These criteria were developed for this study, see Appendix A.
5. SB = Site background.

TABLE 17
MALTA ROCKET FUEL AREA SITE
MRFA COMPARATIVE CRITERIA - SURFACE WATER
INORGANIC ANALYTES

Analyte	Maximum Background Concentration		NYSSWS	Federal Criteria		MRFA Comparative Criteria
				Acute	Chronic	
Aluminum	47.00	B	none	pH dependent	pH dependent	47.00
Antimony	52.70	U J	3 (g)	88	30	3 (g)
Arsenic	1.90	B	50	850(V) 360(III)	190(III)	50
Barium	21.30	B	1000	none	none	1000
Beryllium	0.30	U	3 (g)	130	5.3	3 (g)
Cadmium	3.30	U	10	3.9*	1.1*	10
Calcium	57900		none	none	none	57900
Chromium	2.50	U	50	16(VI)* 1700(III)*	11(VI)* 210(III)*	50
Cobalt	4.90	U	5	none	none	5
Copper	4.40	B	200	18*	12*	200
Iron	231	J	300	none	1000	300
Lead	0.66	B	50	83*	3.2*	50
Magnesium	12100		35000	none	none	35000
Manganese	260		300	none	none	300
Mercury	0.07	U	2	2.4	0.012	2
Nickel	4.10	U	none	1400*	160*	none
Potassium	845	B	none	none	none	845
Selenium	1.30	B J	10	20	5	10
Silver	6.70	U	50	4.1*	0.12	50
Sodium	4840	B	none	none	none	4840
Thallium	1.20	U	4 (g)	1400	40	4 (g)
Vanadium	3.30	U	none	none	none	none
Zinc	150.00		300	120*	110*	300
Cyanide	1.20	U	100	22	5.2	100
Boron	99.90	U J	none	none	none	none

Notes:

1. All concentrations are in micrograms per liter (ug/l = parts per billion (ppb)).
2. NYSSWS = New York State Surface Water Standards.
3. U = Analyte was not detected.
4. J = Semi-quantitative value due to QA/QC data validation requirements.
5. B = Value is above the Instrument Detection Limit (IDL) but below the Contract Required Detection Limit (CRDL).
6. g = Guidance value.
7. * = Hardness dependent. 100 mg/l of CaCO₃ used.

TABLE 18
MALTA ROCKET FUEL AREA SITE
MRFA COMPARATIVE CRITERIA - SEDIMENT
INORGANIC ANALYTES

Analyte	Maximum Background Concentration	NYSSC	NOAA Technical Memorandum		MRFA Comparative Criteria
			ER-L	ER-M	
Aluminum	2890.00	none	none	none	2890.00
Antimony	12.10 U J	none	2	25	none
Arsenic	5.50	5	33	85	5
Barium	35.60	none	none	none	35.60
Beryllium	0.14 B	none	none	none	0.14
Cadmium	0.76 U	0.8	5	9	0.8
Calcium	5510	none	none	none	5510
Chromium	8.30	26	80	145	26
Cobalt	2.80 B	none	none	none	2.80
Copper	5.20	19	70	390	19
Iron	9520	24000	none	none	24000
Lead	1.80 J	27	35	110	27
Magnesium	1550	none	none	none	1550
Manganese	249	428	none	none	428
Mercury	0.05 U	0.11	0.15	1.3	0.11
Nickel	5.40 B	22	30	50	22
Potassium	297 B	none	none	none	297
Selenium	0.55 B	none	none	none	0.55
Silver	1.50 U	none	1	2.2	none
Sodium	15.10 U	none	none	none	none
Thallium	0.27 U	none	none	none	none
Vanadium	13.20 J	none	none	none	13.2
Zinc	19.00	85	120	270	85
Cyanide	0.11 U	none	none	none	none
Boron	22.90 U	none	none	none	none

Notes:

1. All concentrations are in milligrams per kilogram (mg/kg = parts per million (ppm)).
2. NYSSC = New York State Sediment Criteria.
3. ER-L and ER-M concentrations are the Effects Range-Low and Effects Range-Median, from Long and Morgan, 1990, "Potential for Biological Effects of Sediment-Sorbed Contaminants Tested in the National Status and Trends Program" in NOAA Technical Memorandum NOS OMA 52.
4. U = Analyte was not detected.
5. J = Semi-quantitative value due to QA/QC data validation requirements.
6. B = Value is above the Instrument Detection Limit (IDL) but below the Contract Required Detection Limit (CRDL).

TABLE 19
MALTA ROCKET FUEL AREA SITE
MRFA COMPARATIVE CRITERIA - SEDIMENT
ORGANIC COMPOUNDS

Volatile Organic Compound	NYSSC		MRFA Comparative Criteria
	Aquatic Toxicity	Human Health Residue	
Ethylbenzene	none	none	none
Toluene	none	none	none
Xylene (Total)	none	none	none

Semi-Volatile Organic Compound			
Anthracene	none	none	none
Benzo (a) Anthracene	none	13	13
Benzo (b) Fluoranthene	none	13	13
Benzo (a) Pyrene	none	13	13
Benzo (g,h,i) Perylene	none	none	none
Benzo (k) Fluoranthene	none	13	13
Butylbenzylphthalate	none	none	none
Carbazole	none	none	none
Chrysene	none	13	13
Di-n-Butylphthalate	none	none	none
Dibenzo (a,h) Anthracene	none	none	none
2,4-Dimethylphenol	5*	none	5*
Fluoranthene	none	none	10200***
Fluorene	none	none	none
Indeno (1,2,3-cd) Pyrene	none	13	13
2-Methylnaphthalene	none	none	none
2-Methylphenol	5*	none	5*
4-Methylphenol	5*	none	5*
Phenanthrene	1390	none	1200***
Phenol	6**	none	6**
Pyrene	none	none	none
Total PAH	none	none	none

Pesticide/PCB Compound			
4,4'-DDE	<=500	0.1	0.1
4,4'-DDT	<=500	0.1	0.1
Methoxychlor	6	none	6
gamma-Chlordane	0.06	8x10E-7	8x10E-7
Aroclor 1254	<2760	0.08	0.08
Aroclor 1260	<2760	0.08	0.08

Notes:

1. All concentrations are in micrograms per kilogram (ug/kg = parts per billion (ppb)).
2. NYSSC = New York State Sediment Criteria.
3. * Total unchlorinated phenols.
4. ** Total phenols.
5. *** Obtained from "Proposed Sediment Quality Criteria for the Protection of Benthic Organisms: Fluoranthene, Phenanthrene. USEPA, Office of Water and Office of Research and Development. November 1991.

TABLE 20
MALTA ROCKET FUEL AREA SITE
MRFA COMPARATIVE CRITERIA - GROUND WATER
INORGANIC ANALYTES

Analyte	MW-3 Unfiltered Range (a)	NPDWS	NSDWS	NYSGWS	MRFA Comparative Criteria
Aluminum	1630-5900	none	50-200	none	5900
Antimony	18.2-<37.8	6	none	3*	3*
Arsenic	<1.1-3.6	50	none	25	25
Barium	26.3-44.6	2000	none	1000	1000
Beryllium	<0.50	4	none	3*	3*
Cadmium	<1.9-<2.6	5	none	10	5
Calcium	58600-66200	none	none	none	66200
Chromium	2.5-17.7	100	none	50	50
Cobalt	<4.6-7.0	none	none	none	7
Copper	7.2-20.6	1300**	1000	200	200
Iron	6120-12500	none	300	300	300
Lead	4.0-6.7	15**	none	25	15**
Magnesium	9080-10700	none	none	35000*	35000*
Manganese	365-509	none	50	300	300
Mercury	<0.05-<0.06	2	none	2	2
Nickel	<6.0-22.2	100	none	none	100
Potassium	<2030-2280	none	none	none	2280
Selenium	<1.00	50	none	10	10
Silver	<3.8	50	100	50	50
Sodium	1440-1720	none	none	20000	20000
Thallium	<1.6	2	none	4*	2
Vanadium	4.1-13.0	none	none	none	13
Zinc	27.0-105	none	5000	300	300
Cyanide	<10	200	none	100	100
Boron	<99.9-<100	none	none	none	none

Notes:

1. All concentrations are in micrograms per liter (ug/l = parts per billion (ppb)).
2. a = Range is from two sampling events.
3. NPDWS = National Primary Drinking Water Standards.
4. NSDWS = National Secondary Drinking Water Standards.
5. NYSGWS = New York State Ground Water Standards.
6. * = Guidance value.
7. ** = Action level.

TABLE 21
MALTA ROCKET FUEL AREA SITE
MRFA COMPARATIVE CRITERIA - GROUND WATER
FOR ORGANIC COMPOUNDS DETECTED IN SITE GROUND WATER

Volatile Organic Compound	NPDWS	NSDWS	NYSGWS	MRFA Comparative Criteria
Acetone	none	none	50	50
Benzene	5	none	0.7	0.7
Bromodichloromethane	none	none	50*	50*
Carbon Disulfide	none	none	none	none
Carbon Tetrachloride	5	none	5	5
Chloroform	none	none	7	7
Chloromethane	none	none	5	5
1,1-Dichloroethene	7	none	5	5
Hexachlorobutadiene	none	none	none	none
2-Hexanone	none	none	none	none
Tetrachloroethene	5	none	5	5
1,2,3-Trichlorobenzene	70	none	none	70
1,1,1-Trichloroethane	200	none	5	5
Trichloroethene(TCE)	5	none	5	5
Trichlorofluoromethane	none	none	none	none

Semi-Volatile Organic Compound				
bis (2-Ethylhexyl) Phthalate	5	none	50	5
Di-n-Butylphthalate	none	none	50	50
Diethylphthalate	none	none	50*	50*

Notes:

1. All concentrations are in micrograms per liter (ug/l = parts per billion (ppb)).
2. NPDWS = National Primary Drinking Water Standards.
3. NSDWS = National Secondary Drinking Water Standards.
4. NYSGWS = New York State Ground Water Standards.
5. * = Guidance value.

TABLE 22
MALTA ROCKET FUEL AREA SITE
SURFACE SOIL SAMPLING PROGRAM

Location	Sample Designation	Location	Sample Designation
Storage Area S-1	SS-S1	Building 18	SS-18
Storage Area S-2	SS-S2	Building 20	SS-20/1
Storage Area S-3	SS-S3	Building 20	SS-20/2
Storage Area S-4	SS-S4	Building 20M	SS-20M
Storage Area S-5	SS-S5	Building 21	SS-21
Storage Area S-6	SS-S6	Building 23P	SS-23P
Storage Area S-8	SS-S8	Building 24	SS-24
Storage Area S-9	SS-S9	Building 25	SS-25
Storage Area S-10	SS-S10	Building 25S	SS-25S
Disposal Area D-1	SS-D1	Building 27A	SS-27A
Disposal Area D-2	SS-D2	Building 27B	SS-27B
Disposal Area D-4	SS-D4	Building 27C	SS-27C
Disposal Area D-5	SS-D5	Building 27D	SS-27D
Disposal Area D-6	SS-D6	Building 28	SS-28/1
Building 1	SS-1	Building 28	SS-28/2
Building 2	SS-2	GE/Exxon Building	SSEXNUC1
Building 3	SS-3	GE/Exxon Building	SSEXNUC2
Building 4	SS-4	Firing Range	SSARTRNG
Building 5	SS-5	Muggett's Pond	SSMUG1
Building 6	SS-6	Muggett's Pond	SSMUG2
Building 8	SS-8	Muggett's Pond Drainage Ditch	SS-DTINT
Building 9	SS-9	Isolde Project Area	SSISOLDE
Building 13	SS-13	Bldg. 20 (MTI) Lagoon	SSLAGOON
Building 15	SS-15		

TABLE 23
MALTA ROCKET FUEL AREA SITE
COMPARISON OF SITE SURFACE SOIL TO COMPARATIVE CRITERIA
INORGANIC ANALYTES

Analyte	BACKGROUND SURFACE SOIL (20 SAMPLES)					SITE SURFACE SOIL (53 SAMPLES)									
	No. of Detections	% Detections	Range	Mean	Standard Deviation	Maximum Background Concentration*	NYSTAGM	Health- Based Comparative Criteria	MRFA Comparative Criteria	No. of Detections	% Detections	No. of Samples > Mean +2 Std. Devs.	No. of Samples > NYS TAGM	No. of Samples > Health Based Crit.	No. of Samples > MRFA Comparative Criteria
Aluminum	20	100%	4850-9000	6926	1335	9596	SB	78300	78300	53	100%	2	-	0	0
Antimony	2	10%	<7.2-13.2	5.7	2.4	10.5	SB	10.8	10.8	5	9%	1	-	-	1
Arsenic	19	95%	<0.24-3.1	2.2	0.6	3.4	7.5 or SB	8.1	8.1	53	100%	14	2	-	1
Barium	20	100%	9.3-49	26	12.7	51.4	300 or SB	none	300	53	100%	7	0	-	0
Beryllium	20	100%	0.20-0.38	0.28	0.06	0.4	1.0 or SB	none	1.0	53	100%	26	0	-	0
Cadmium	0	0%	-	0.31	0.04	0.39	1 or SB	13.5	13.5	51	96%	51	39	0	0
Calcium	20	100%	197-622	377	98.2	573.4	SB	500000	500000	53	100%	48	-	0	0
Chromium	20	100%	4.2-8.0	5.7	1	7.7	10 or SB	135	135	53	100%	25	14	0	0
Cobalt	20	100%	1.2-3.3	2.3	0.53	3.36	30 or SB	none	30	24	45%	22	0	-	0
Copper	20	100%	4.2-8.7	6.4	1.1	8.6	25 or SB	999	999	53	100%	44	17	1	1
Iron	20	100%	6830-10500	8974	1122	11218	2000 or SB	90000	90000	53	100%	24	53	0	0
Lead	20	100%	10.5-23.9	17	3.4	23.8	30 or SB	500	500	53	100%	17	15	2	2
Magnesium	20	100%	652-1330	1002	204	1410	SB	500000	500000	53	100%	43	-	0	0
Manganese	20	100%	62-1180	407	314	1035	SB	2700	2700	53	100%	0	-	0	0
Mercury	17	85%	<0.03-0.16	0.06	0.03	0.12	0.1	8.1	8.1	38	72%	22	22	4	4
Nickel	20	100%	4.0-8.1	5.8	1	7.8	13 or SB	540	540	53	100%	32	16	0	0
Potassium	20	100%	170-582	341	111	563	SB	525000	525000	50	94%	19	-	0	0
Selenium	9	45%	<0.17-0.38	0.20	0.11	0.42	2 or SB	none	2	18	34%	4	0	-	0
Silver	0	0%	-	0.64	0.07	0.78	SB	135	135	12	23%	7	-	0	0
Sodium	20	100%	92-149	116	12.5	141	SB	325000	325000	9	17%	0	-	0	0
Thallium	0	0%	-	0.12	0.01	0.14	SB	1.89	1.89	0	0%	0	-	0	0
Vanadium	20	100%	11.0-16.9	14	1.8	17.6	150 or SB	189	189	52	98%	7	0	0	0
Zinc	20	100%	16.1-32.8	21	4.1	29.2	20 or SB	8100	8100	53	100%	39	52	0	0
Cyanide	2	10%	<0.08-0.14	0.05	0.03	0.11	none	540	540	1	2%	1	-	0	0
Boron	0	0%	-	9.4	1.1	11.6	none	2400	2400	1	2%	1	-	0	0

Notes:

1. All concentrations are in milligrams per kilogram (mg/kg = parts per million (ppm)).
2. One-half the Instrument Detection Limit (IDL) was used in all calculations where an analyte was not detected.
3. * = Maximum background concentration = background mean + 2 standard deviations.
4. NYSTAGM = New York State Technical and Administrative Guidance Memorandum, November, 1992.
5. SB = Site background.

TABLE 24
MALTA ROCKET FUEL AREA SITE
SURFACE SOIL SAMPLE LOCATIONS WITH
ANALYTES ABOVE MRFA COMPARATIVE CRITERIA

Area	Sample No.	Analyte/ Compound	Conc.	MRFA Comparative Criteria
S-1	SS-S1	Aroclor 1260	1200P	1000
Bldg. 3	DW-3-1	Arsenic	13	8.1
		Aroclor 1260	15000JNCD	1000
Bldg. 6	SS-6	Benzo (a) Pyrene	91J	61
Bldg. 20	SS-20/1	Mercury	24.4J	8.1
Bldg. 21	SS-21	Mercury	45.5J	8.1
		Aroclor 1260	1600PDCJ	1000
Bldg. 23P	SS-23P	Aroclor 1260	4100PDCJ	1000
Bldg. 24	SS-24	Benzo (a) Anthracene	2100	220
		Benzo (a) Pyrene	1800	61
		Benzo (b) Fluoranthene	2800	1100
		Chrysene	1900	400
		Dibenzo (a,h) Anthracene	400	14
Bldg. 25	SS-25	Antimony	11.4	10.8
		Copper	1000	999
		Lead	897J	500
Bldg. 25S	SS-25S	Lead	764	500
Bldg. 27B	SS-27B	Dibenzo (a,h) Anthracene	45J	14
Bldg. 27C	SS-27C	Benzo (a) Anthracene	380J	220
		Benzo (a) Pyrene	330J	61
		Dibenzo (a,h) Anthracene	93J	14
Muggett's Pond Drainage Ditch	SD-DD1	Mercury	124J	8.1
		Aroclors 1254, 1260	1280	1000
Muggett's Pond Drainage Ditch	SS-DTINT	Mercury	13	8.1

Notes:

1. Inorganics are in mg/kg (ppm), organics are in ug/kg (ppb).

SSABHBTG.XLS 1/7/94

TABLE 25
MALTA ROCKET FUEL AREA SITE
COMPARISON OF SITE SUBSURFACE SOIL TO COMPARATIVE CRITERIA
INORGANIC ANALYTES

BACKGROUND SUBSURFACE SOIL (21 SAMPLES)										SITE SUBSURFACE SOIL (136 SAMPLES)*						
Analyte	No. of Detections	% Detections	Range	Mean	Standard Deviation	Maximum Background Concentration**	NYSTAGM	Health-Based Comparative Criteria	MRFA Comparative Criteria	No. of Detections	% Detections	No. of Samples > Mean +2 Std. Devs.	No. of Samples > NYS TAGM	No. of Samples > Health Based Crit.	No. of Samples > MRFA Comparative Criteria	
Aluminum	21	100%	3270-7670	4955	1144	7243	SB	78300	78300	136	100%	33	-	0	0	
Antimony	5	24%	<4.9-13.8	6.0	3.6	13.2	SB	10.8	13.2	11	8%	0	-	-	0	
Arsenic	21	100%	1.1-3.1	2.1	0.51	3.1	7.5 or SB	8.1	8.1	136	100%	26	3	-	3	
Barium	21	100%	9.4-19.4	14.4	2.9	20.2	300 or SB	none	300	136	100%	54	0	-	0	
Beryllium	21	100%	0.19-0.34	0.25	0.04	0.33	1.0 or SB	none	1.0	136	100%	31	0	-	0	
Cadmium	0	0%	-	0.27	0.05	0.37	1 or SB	13.5	13.5	24	18%	22	11	1	1	
Calcium	21	100%	215-12200	1447	2809	7065	SB	500000	500000	136	100%	21	-	0	0	
Chromium	21	100%	3.9-8.0	5.2	1.1	7.4	10 or SB	135	135	136	100%	36	9	0	0	
Cobalt	21	100%	2.4-4.3	3.3	0.55	4.4	30 or SB	none	30	124	91%	14	0	-	0	
Copper	21	100%	6.4-12.2	8.8	1.9	12.6	25 or SB	999	999	136	100%	22	10	0	0	
Iron	21	100%	7570-11800	9684	1370	12424	2000 or SB	90000	90000	136	100%	22	136	1	1	
Lead	21	100%	2.0-6.0	2.8	0.87	4.5	30 or SB	500	500	133	98%	46	8	1	1	
Magnesium	21	100%	1170-1850	1541	195	1931	SB	500000	500000	136	100%	35	-	0	0	
Manganese	21	100%	180-321	231	43.6	318	SB	2700	2700	136	100%	18	-	0	0	
Mercury	0	0%	-	0.02	0.003	0.03	0.1	8.1	8.1	68	50%	52	12	3	3	
Nickel	21	100%	5.5-10.6	7.5	1.2	9.9	13 or SB	540	540	136	100%	18	8	0	0	
Potassium	21	100%	372-2080	621	350	1321	SB	525000	525000	135	99%	11	-	0	0	
Selenium	3	14%	<0.15-0.23	0.12	0.05	0.22	2 or SB	none	2	8	6%	7	0	-	0	
Silver	0	0%	-	0.55	0.09	0.73	SB	135	135	13	10%	9	-	0	0	
Sodium	20	95%	16.1-75.7	29.7	14.0	57.7	SB	325000	325000	81	60%	16	-	0	0	
Thallium	0	0%	-	0.10	0.02	0.14	SB	1.89	1.89	2	1%	2	-	0	0	
Vanadium	21	100%	6.4-15.2	9.5	2.3	14.1	150 or SB	189	189	136	100%	32	1	1	1	
Zinc	21	100%	13.9-24.3	18.1	2.6	23.3	20 or SB	8100	8100	136	100%	53	84	0	0	
Cyanide	0	0%	-	0.05	0.06	0.17	none	540	540	0	0%	0	-	-	0	
Boron	0	0%	-	8.4	1.1	10.6	none	2400	2400	2	1%	2	-	0	0	

Notes:

1. All concentrations are in milligrams per kilogram (mg/kg = parts per million (ppm)).
2. One-half the Instrument Detection Limit (IDL) was used in all calculations where an analyte was not detected.
3. * = Includes 102 soil boring, 21 test pit, and 13 dry well samples.
4. ** = Maximum background concentration = background mean + 2 standard deviations.
5. NYSTAGM = New York State Technical and Administrative Guidance Memorandum, November, 1992.
6. SB = Site background.

TABLE 26
MALTA ROCKET FUEL AREA SITE
SUBSURFACE SOIL SAMPLE LOCATIONS WITH
ANALYTES ABOVE MRFA COMPARATIVE CRITERIA

Area	Sample No.	Analyte/ Compound	Conc.	MRFA Comparative Criteria
S-2	S-84 0-2'	Acetone	300BJ	200
D-1	P-78 2'-4'	Tetrachloroethene	2200EDJ	1400
		Diphenyl Ether	96000J	50000
		Total VOCs	15962J	10000
D-2	P-19 2'-4'	Vanadium	914	189
		Benzo (a) Pyrene	160J	61
D-5	P-70 2'-4'	Cadmium	60.8	13.5
D-6	P-11 2'-4'	Arsenic	9.1	8.1
Bldg. 1	DW-1A-1	Mercury	40.7J	8.1
		Benzo (a) Anthracene	1100	220
		Benzo (a) Pyrene	550	61
		Benzo (b) Fluoranthene	1300	1100
		Chrysene	660	400
		Dibenzo (a,h) Anthracene	160J	14
		Aroclors 1254, 1260	23400	10000
Bldg. 2	DW-2-3	Arsenic	9.8	8.1
		Mercury	207J	8.1
		Benzo (a) Anthracene	810J	220
		Benzo (a) Pyrene	890J	61
		Benzo (b) Fluoranthene	1200J	1100
		Chrysene	1100J	400
		Dibenzo (a,h) Anthracene	350J	14
		4,4'-DDE	5700C	2100
		4,4'-DDD	25000BCD	2900
		4,4'-DDT	48000BCD	2100
Bldg. 4	DW-4-2	Total VOCs	12830J	10000
		Unknown C13-Alkanes	96000J	50000
		Unknown C14-Alkanes	176000J	50000
		Unknown C14H28-Aliphatic Hydrocarbons	56000J	50000
		Unknown C15-Alkanes	115000J	50000
		Unknown C16-Alkane	73000J	50000
		Total SVOCs	772000J	500000
Bldg. 14	S-39 0-2'	Total VOCs	12680J	10000
		Dodecane	87000JN	50000
		Eicosane	61000JN	50000
		Heptadecane	130000JN	50000
		Hexadecane	130000JN	50000
		Nonadecane	85000JN	50000
		Octadecane	110000JN	50000
		Pentadecane	130000JN	50000
		Pentadecane, 2,6,10,14-Tetramethyl	66000JN	50000
		Tetradecane	140000JN	50000
		Tridecane	96000JN	50000
		Undecane	80000JN	50000
		Unknown Alkanes	172000J	50000
		Total SVOCs	1287000	500000

Notes:

1. Inorganics are in mg/kg (ppm), organics are in ug/kg (ppb).

TABLE 26 (cont'd)
MALTA ROCKET FUEL AREA SITE
SUBSURFACE SOIL SAMPLE LOCATIONS WITH
ANALYTES ABOVE MRFA COMPARATIVE CRITERIA

Area	Sample No.	Analyte/ Compound	Conc.	MRFA Comparative Criteria
Bldg. 15	DW-15	Arsenic	22.3J	8.1
		Iron	91900	25312
		Lead	938J	500
		Mercury	1130J	8.1
Bldg. 25	S-75 2'-4'	Phenol	140J	30
Bldg. 25	S-80 0-2'	Phenol	46J	30
Bldg. 28	S-85 4'-6'	Acetone	580BJD	200
GE/Exxon Building	DW-2	Benzo (a) Anthracene	900	220
		Benzo (a) Pyrene	1000	61
		Chrysene	980	400
		Dibenzo (a,h) Anthracene	180J	14

Notes:

1. Inorganics are in mg/kg (ppm), organics are in ug/kg (ppb).

SBABHBTG.XLS 1/7/94

TABLE 27
MALTA ROCKET FUEL AREA SITE
SURFACE WATER SAMPLE LOCATIONS WITH
ANALYTES ABOVE MRFA COMPARATIVE CRITERIA

Area	Sample No.	Analyte	Conc.	MRFA Comparative Criteria
D-3 (Ravine 1b)	SWD301 headwater	Aluminum	307	47.0
		Calcium	98000	57900
		Iron	31500	300
		Manganese	4080	300
		Potassium	3490	845
Ravine 1b	SW-1B-01 headwater	Aluminum	171	47.0
		Calcium	116000	57900
		Iron	8340	300
		Manganese	2120	300
		Potassium	3910	845
		Sodium	5740	4840
Ravine 1b	SW-1B-02 midstream	Aluminum	71.5	47.0
		Potassium	932	845
		Sodium	5530	4840
Ravine 1b	SW-1B-03 downstream	Aluminum	113	47.0
		Iron	344	300
		Sodium	4930	4840
Bldg. 25	SWPTI01	Iron	1890	300
Muggett's Pond	SWMUG01	Iron	1340	300
		Manganese	1010	300

Note:

All results and criteria are in ug/l (ppb).

SWABTRTG.XLS 1/7/94

TABLE 28
MALTA ROCKET FUEL AREA SITE
SEDIMENT SAMPLE LOCATIONS WITH
INORGANIC ANALYTES ABOVE MRFA COMPARATIVE CRITERIA

Area	Sample No.	Analyte	Conc.	MRFA Comparative Criteria	Area	Sample No.	Analyte	Conc.	MRFA Comparative Criteria
D-3	SD-D3	Barium	51.7J	35.6	Bldg. 1 open sump	DW-1A-2	Cadmium	2.3	0.8
Ravine 1b		Lead	50.1J	27			Chromium	26.6J	26
		Manganese	2410	428			Copper	131J	19
Ravine 1b	SD-1B01	Aluminum	4960	2890	Bldg. 5	DW-5-1	Iron	28200	24000
		Barium	85.70	35.6			Lead	254J	27
		Beryllium	0.22B	0.14			Mercury	0.99J	0.11
		Cobalt	3.4B	2.8			Zinc	719J	85
		Copper	31.7J	19			Arsenic	5.1J	5.0
		Magnesium	1720	1550			Cadmium	2.2J	0.8
		Manganese	3210	428			Copper	41.0J	19
		Potassium	528B	297			Lead	56.6J	27
		Vanadium	14.5J	13.2	Bldg. 5	DW-5-2	Mercury	3.0J	0.11
Ravine 1b	SD-1B03	Aluminum	3120	2890			Zinc	171J	85
		Potassium	437B	297			Cadmium	12.6J	0.8
Bldg. 3	SD-3	Cadmium	2.8BJ	0.8			Copper	85.2J	19
		Copper	294J	19			Lead	85.9J	27
		Lead	46.2J	27			Mercury	5.2J	0.11
		Zinc	1430J	85			Nickel	27.1	22
Bldg. 25	SD-PTI	Arsenic	20.3J	5.0	Bldg. 20	DW-20H	Zinc	95.9J	85
		Cadmium	38.4J	0.8			Lead	34.5J	27
		Chromium	101J	26	Bldg. 24	DW-24-1	Mercury	0.16J	0.11
		Copper	642J	19			Arsenic	8.3	5.0
		Iron	307000J	24000			Copper	38.7	19
		Lead	5710J	27			Lead	44.4	27
		Manganese	987J	428			Manganese	554	428
		Mercury	0.27BJ	0.11			Mercury	0.11J	0.11
		Nickel	141J	22			Zinc	288	85
		Zinc	6940J	85	Bldg. 24	DW-24-2	Arsenic	9.1	5.0
Muggett's Pond	SD-MP1	Cadmium	1.2	0.8			Cadmium	0.97B	0.8
		Copper	61.0	19			Copper	38.9	19
		Lead	71.7	27			Lead	43.2	27
		Mercury	1.1J	0.11			Manganese	570	428
		Nickel	32.8	22			Mercury	0.11J	0.11
		Zinc	219	85			Nickel	23.1	22
Muggett's Pond	SD-MP2	Cadmium	1.4B	0.8			Zinc	375	85
		Copper	56.1	19					
		Lead	57.7	27					
		Mercury	4.0J	0.11					
		Nickel	26.6	22					
		Zinc	261	85					

SDINABBK.XLS 1/7/94

Note:

All results and criteria are in mg/kg (ppm).

TABLE 29
MALTA ROCKET FUEL AREA SITE
SEDIMENT SAMPLE LOCATIONS WITH
ORGANIC COMPOUNDS ABOVE APPLICABLE CRITERIA

Area	Sample No.	Compound	Conc.	NYSSC	
				Aquatic Criteria	Human Health Criteria
Bldg. 3	SD-3	Aroclor-1260	1200	<2760	0.08
Bldg. 4	SD-4	Benzo (a) Anthracene	4600J	-	13
		Benzo (b) Fluoranthene	3000J	-	13
		Benzo (k) Fluoranthene	3600J	-	13
		Benzo (a) Pyrene	6300J	-	13
		Chrysene	4000J	-	13
		Indeno (1,2,3-cd) Pyrene	4700J	-	13
		Phenanthrene	12000J	1200	-
		Phenol (total unchlorinated)	68000J	5	-
Bldg. 25	SD-PTI	Methoxychlor	85J	6	-
		Aroclor-1254	7400	<2760	0.08
		Aroclor-1260	13000	<2760	0.08
Muggett's Pond	SD-MP1	Benzo (b) Fluoranthene	64J	-	13
		Benzo (k) Fluoranthene	51J	-	13
		Benzo (a) Pyrene	70J	-	13
		Indeno (1,2,3-cd) Pyrene	75J	-	13
		Phenol (total unchlorinated)	210J	5	-
		Aroclor-1260	280	<2760	0.08
Muggett's Pond	SD-MP2	Benzo (a) Anthracene	700J	-	13
		Benzo (b) Fluoranthene	740J	-	13
		Benzo (k) Fluoranthene	390J	-	13
		Benzo (a) Pyrene	560J	-	13
		Chrysene	480J	-	13
		Indeno (1,2,3-cd) Pyrene	320J	-	13
		Aroclor-1260	1300	<2760	0.08
Bldg. 1 open sump	DW-1A-2	Aroclor-1260	430	<2760	0.08
Bldg. 5	DW-5-1	4,4'-DDE	7	<50	0.1
		4,4'-DDT	7.5	<50	0.1
		Aroclor-1254	10	<2760	0.08
		Aroclor-1260	170J	<2760	0.08
Bldg. 5	DW-5-2	4,4'-DDE	23J	<50	0.1
		Endosulfan II	71J	0.3	-
		4,4'-DDT	70J	<50	0.1
		Aroclor-1260	210J	<2760	0.08
Bldg. 20	DW-20H	Benzo (a) Anthracene	38J	-	13
		Benzo (b) Fluoranthene	29J	-	13
		Benzo (k) Fluoranthene	41J	-	13
		Benzo (a) Pyrene	32J	-	13
		Chrysene	38J	-	13
Bldg. 24	DW-24-1	Benzo (a) Anthracene	79J	-	13
		Benzo (b) Fluoranthene	97J	-	13
		Benzo (k) Fluoranthene	45J	-	13
		Benzo (a) Pyrene	54J	-	13
		Chrysene	64J	-	13
		Indeno (1,2,3-cd) Pyrene	36J	-	13
		Phenol (total unchlorinated)	110J	5	-
		4,4'-DDT	4.3J	<50	0.1
		Aroclor-1260	110	<2760	0.08
Bldg. 24	DW-24-2	Benzo (a) Anthracene	84J	-	13
		Chrysene	80J	-	13
		Phenol (total unchlorinated)	550J	5	-
		Aroclor-1260	160	<2760	0.08

All concentrations are in ug/kg (ppb).

SDORABK.XLS 1/7/94

TABLE 30
MALTA ROCKET FUEL AREA SITE
GROUND WATER SAMPLE LOCATIONS WITH
ANALYTES ABOVE MRFA COMPARATIVE CRITERIA
JUNE 1992 UNFILTERED

Monitoring Well	Analyte/Compound	Conc.	MRFA Comparative Criteria	Monitoring Well	Analyte/Compound	Conc.	MRFA Comparative Criteria
MW-1	Aluminum	11300	5900	2S	Aluminum	43000	5900
	Antimony	19.0B	3		Calcium	364000	66200
	Calcium	175000	66200		Chromium	62.0	50
	Cobalt	24.9	7		Cobalt	37.1B	7
	Iron	35000	300		Iron	87500	300
	Lead	24.6	15		Lead	47.9	15
	Manganese	2770	300		Magnesium	35500	35000
	Vanadium	27.9	13		Manganese	3320	300
14D	Iron	2370	300		Potassium	11100	2280
MW-2	Aluminum	10200	5900		Vanadium	93.1	13
	Calcium	143000	66200		Carbon Tetrachloride	140	5
	Cobalt	17.0B	7		Trichloroethene	21	5
	Iron	30700	300	2D	Iron	4020	300
	Lead	20.5	15		Zinc	596	300
	Manganese	1600	300		Carbon Tetrachloride	90J	5
	Vanadium	26.0B	13		Trichloroethene	68J	5
MW-3	Antimony	18.2B	3	3S	Aluminum	13400	5900
	Iron	6120	300		Calcium	180000	66200
	Manganese	365	300		Cobalt	13.3B	7
MW-4	Aluminum	42900	5900		Iron	26200	300
	Antimony	22.6B	3		Manganese	1130	300
	Beryllium	3.2B	3		Potassium	3960B	2280
	Calcium	465000	66200		Vanadium	28.0B	13
	Chromium	53.7	50		Carbon Tetrachloride	22	5
	Cobalt	50.2	7		Trichloroethene	44	5
	Iron	86900	300	3D	Calcium	71400	66200
	Lead	56.5	15		Iron	19700	300
	Manganese	6220	300		Lead	61	15
	Potassium	12800	2280		Zinc	1560	300
	Vanadium	97.5	13		Carbon Tetrachloride	7.0J	5
					Trichloroethene	16	5
1D	Iron	1340	300	4S	Aluminum	40700	5900
	Carbon Tetrachloride	11	5		Calcium	323000	66200
	Trichloroethene	11	5		Chromium	60.2	50
	bis (2-Ethylhexyl) Phthalate	89B	5		Cobalt	38.9B	7
M-23	Aluminum	36300	5900		Iron	86300	300
	Calcium	241000	66200		Lead	44.5	15
	Chromium	81.0	50		Manganese	3480	300
	Cobalt	27.1B	7		Potassium	10100	2280
	Copper	972	200		Vanadium	87.1	13
	Iron	60800	300	4D	Iron	51500	300
	Lead	273	15		Manganese	1240	300
	Magnesium	67700	35000		Potassium	2520B	2280
	Manganese	1930	300		Zinc	884	300
	Potassium	11100	2280				
	Vanadium	67.1	13				
	Zinc	647	300				
	Carbon Tetrachloride	16	5				

GWAB692U.XLS 1/7/94

All concentrations are in ug/l (ppb).

TABLE 30 (Cont'd)
MALTA ROCKET FUEL AREA SITE
GROUND WATER SAMPLE LOCATIONS WITH
ANALYTES ABOVE MRFA COMPARATIVE CRITERIA
JUNE 1992 UNFILTERED

Monitoring Well	Analyte/Compound	Conc.	MRFA Comparative Criteria	Monitoring Well	Analyte/Compound	Conc.	MRFA Comparative Criteria
10S	Aluminum	6320	5900	M-17	Aluminum	130000	5900
	Calcium	109000	66200		Antimony	40.3B	3
	Iron	11700	300		Barium	1280	1000
	Manganese	450	300		Beryllium	9.8	3
	Potassium	2670B	2280		Calcium	1270000	66200
	Vanadium	13.4B	13		Chromium	394.0	50
10D	Iron	953	300		Cobalt	154	7
11S	Aluminum	8320	5900		Copper	910	200
	Calcium	205000	66200		Iron	331000	300
	Cobalt	17.3B	7		Lead	185	15
	Iron	28000	300		Magnesium	138000	35000
	Lead	31.6	15		Manganese	20600	300
	Manganese	2070	300		Nickel	491	100
	Vanadium	20.6B	13		Potassium	26100	2280
11D	Trichloroethene	14	5		Vanadium	311	13
	Iron	1980	300		Zinc	1030	300
13S	Trichloroethene	9J	5		Boron	170	<100
	Aluminum	7040	5900		Carbon Tetrachloride	27	5
	Antimony	25.0BJ	3		Trichloroethene	16	5
	Calcium	111000	66200	M-18	Aluminum	14000	5900
	Chromium	504	50		Calcium	151000	66200
	Cobalt	7.2B	7		Iron	38300	300
	Iron	14300	300		Lead	34.1	15
	Manganese	495	300		Magnesium	37700	35000
	Potassium	7530	2280		Manganese	7440	300
	Vanadium	16.0B	13		Tetrachloroethene	9J	5
	Carbon Tetrachloride	6J	5	M-19	Aluminum	227000	5900
13D	Chromium	98.4	50		Antimony	64.7	3
	Iron	1160	300		Barium	3440	1000
M-15	Aluminum	68700	5900		Beryllium	20.7	3
	Beryllium	5.1	3		Calcium	1150000	66200
	Calcium	674000	66200		Chromium	263	50
	Chromium	92.8	50		Cobalt	243	7
	Cobalt	62.0J	7		Copper	942	200
	Copper	261J	200		Iron	416000	300
	Iron	144000	300		Lead	187	15
	Lead	95.5	15		Magnesium	114000	35000
	Magnesium	64300	35000		Manganese	48100	300
	Manganese	7710	300		Nickel	506	100
	Nickel	140J	100		Potassium	37200	2280
	Potassium	15300	2280		Vanadium	400	13
	Vanadium	151	13		Zinc	1350	300
	Zinc	409	300		Boron	302	<100
	Boron	135	<100		Carbon Tetrachloride	140	5
M-16	Calcium	131000	66200		Trichloroethene	140	5
	Iron	6440	300				
	Manganese	412	300				
	Zinc	391	300				

GWAB692U.XLS 1/7/94

All concentrations are in ug/l (ppb).

TABLE 30 (Cont'd)
MALTA ROCKET FUEL AREA SITE
GROUND WATER SAMPLE LOCATIONS WITH
ANALYTES ABOVE MRFA COMPARATIVE CRITERIA
JUNE 1992 UNFILTERED

Monitoring Well	Analyte/Compound	Conc.	MRFA Comparative Criteria	Monitoring Well	Analyte/Compound	Conc.	MRFA Comparative Criteria
M-20	Aluminum	93800	5900	M-24S	Aluminum	88100	5900
	Beryllium	6.3	3		Beryllium	5.4	3
	Calcium	656000	66200		Calcium	348000	66200
	Chromium	273.0	50		Chromium	121	50
	Cobalt	98.6J	7		Cobalt	68.7	7
	Copper	715J	200		Copper	278	200
	Iron	213000	300		Iron	181000	300
	Lead	123	15		Lead	92.4	15
	Magnesium	81500	35000		Magnesium	68900	35000
	Manganese	8440	300		Manganese	6170	300
	Nickel	303J	100		Nickel	156	100
	Potassium	16700	2280		Potassium	19300	2280
	Vanadium	208.0	13		Vanadium	186	13
	Zinc	638	300		Zinc	468	300
M-21	Aluminum	87200	5900	M-24D	Boron	109	<100
	Antimony	31.2B	3		Iron	662	300
	Arsenic	27.4J	25		Potassium	2320B	2280
	Beryllium	5.6	3		Zinc	724	300
	Calcium	550000	66200	M-25S	Carbon Tetrachloride	10	5
	Chromium	330.0	50		Aluminum	28100	5900
	Cobalt	89.2J	7		Antimony	35.0B	3
	Copper	331J	200		Calcium	176000	66200
	Iron	193000	300		Cobalt	23.0B	7
	Lead	89.1	15		Iron	60300	300
	Magnesium	94000	35000		Lead	34	15
	Manganese	8220	300		Manganese	2050	300
	Nickel	322J	100		Potassium	7250	2280
	Potassium	15500	2280		Sodium	21700	20000
	Sodium	22600	20000		Vanadium	59.2	13
	Vanadium	185	13		Boron	140	<100
	Zinc	590	300		Trichloroethene	6J	5
M-22	Aluminum	61800	5900	M-25D	Zinc	568	300
	Beryllium	4.6B	3		Boron	140	<100
	Calcium	547000	66200		Carbon Tetrachloride	48	5
	Chromium	94.9	50	M-26S	Aluminum	80300	5900
	Cobalt	72.1J	7		Beryllium	5.8	3
	Copper	266J	200		Calcium	665000	66200
	Iron	138000	300		Chromium	121	50
	Lead	84.4	15		Cobalt	91.3	7
	Magnesium	50900	35000		Copper	308	200
	Manganese	6480	300		Iron	170000	300
	Nickel	147J	100		Lead	82.6	15
	Potassium	12100	2280		Magnesium	47200	35000
	Vanadium	139	13		Manganese	9430	300
	Zinc	402	300		Nickel	178	100
					Potassium	20900	2280
					Vanadium	181	13
					Zinc	472	300
					Boron	134	<100

All concentrations are in ug/l (ppb).

TABLE 30 (Cont'd)
MALTA ROCKET FUEL AREA SITE
GROUND WATER SAMPLE LOCATIONS WITH
ANALYTES ABOVE MRFA COMPARATIVE CRITERIA
JUNE 1992 UNFILTERED

Monitoring Well	Analyte/Compound	Conc.	MRFA Comparative Criteria	Monitoring Well	Analyte/Compound	Conc.	MRFA Comparative Criteria
M-26D	Iron	342	300	M-30	Aluminum	77400	5900
	Zinc	518	300		Beryllium	5	3
M-27S	Calcium	87800	66200		Calcium	261000	66200
	Cobalt	9.7B	7		Chromium	111	50
	Iron	13700	300		Cobalt	61.8J	7
	Manganese	1220	300		Copper	256J	200
	Chloromethane	40	5		Iron	128000	300
M-27D	Zinc	544	300		Lead	73.6	15
	Carbon Tetrachloride	75	5		Magnesium	67400	35000
	Chloromethane	28	5		Manganese	6080	300
M-28S	Aluminum	20600	5900		Nickel	144J	100
	Antimony	16.7B	3		Potassium	17900	2280
	Cadmium	127	5		Vanadium	143	13
	Calcium	181000	66200		Zinc	316	300
	Cobalt	21.7B	7		Boron	116	<100
	Iron	44400	300		Carbon Tetrachloride	14	5
	Lead	30.1	15		Trichloroethene	11	5
	Manganese	2110	300	M-31S	Aluminum	49500	5900
	Potassium	6170	2280		Beryllium	4.0B	3
	Vanadium	46.2B	13		Calcium	142000	66200
	Boron	114	<100		Chromium	78.6	50
	Carbon Tetrachloride	46	5		Cobalt	29.8B	7
	Trichloroethene	47	5		Copper	240	200
M-28D	Zinc	625	300		Iron	81000	300
	Carbon Tetrachloride	31	5		Lead	60.2	15
	1,1,1-Trichloroethane	37	5		Manganese	1780	300
M-29S	Aluminum	49600	5900		Potassium	9450	2280
	Antimony	19.8BJ	3		Vanadium	170	13
	Beryllium	3.2B	3	M-32	Aluminum	32200	5900
	Calcium	284000	66200		Antimony	17.7B	3
	Chromium	169	50		Calcium	200000	66200
	Cobalt	47.5B	7		Cobalt	23.1B	7
	Iron	114000	300		Iron	52900	300
	Lead	49.8	15		Lead	21.6	15
	Magnesium	51900	35000		Magnesium	45000	35000
	Manganese	4730	300		Manganese	1950	300
	Nickel	166	100		Potassium	9340	2280
	Potassium	12500	2280		Vanadium	60	13
	Vanadium	111	13		Carbon Tetrachloride	56	5
	Zinc	306	300		Tetrachloroethene	8J	5
	Carbon Tetrachloride	21	5		Trichloroethene	76	5
	Trichloroethene	24	5				
M-29D	Antimony	17.5BJ	3				
	Iron	388	300				
	Zinc	831	300				
	Carbon Tetrachloride	79	5				
	Trichloroethene	19	5				

GWAB692U.XLS 1/7/94

All concentrations are in ug/l (ppb).

TABLE 31
MALTA ROCKET FUEL AREA SITE
GROUND WATER SAMPLE LOCATIONS WITH
ANALYTES ABOVE MRFA COMPARATIVE CRITERIA
NOVEMBER 1992 UNFILTERED

Monitoring Well	Analyte/ Compound	Conc.	MRFA Comparative Criteria	Monitoring Well	Analyte/ Compound	Conc.	MRFA Comparative Criteria
MW-1	Aluminum	19200	5900	2S	Aluminum	39500	5900
	Calcium	140000	66200		Calcium	355000	66200
	Cobalt	21.1B	7		Chromium	58.3	50
	Iron	38600	300		Cobalt	29.5B	7
	Lead	20.2J	15		Iron	76200	300
	Manganese	2090	300		Lead	37.3	15
	Potassium	5850	2280		Magnesium	35200	35000
	Vanadium	43.3B	13		Manganese	2980	300
14D	Iron	2420	300		Potassium	11200	2280
MW-2	Aluminum	12800	5900		Vanadium	84.0	13
	Antimony	45.6BJ	3	Carbon Tetrachloride	67	5	
	Calcium	88200	66200	Chloroform	8	5	
	Cobalt	9.7B	7	Trichloroethene	18	5	
	Iron	23500	300	2D	Iron	2040	300
	Manganese	765	300		Carbon Tetrachloride	44	5
	Potassium	4110B	2280		Trichloroethene	49	5
	Vanadium	27.5B	13	3S	Calcium	176000	66200
MW-3	Iron	12500	300		Cobalt	8.4B	7
	Manganese	509	300		Iron	9710	300
MW-4	Aluminum	18700	5900		Manganese	1080	300
	Calcium	235000	66200		Carbon Tetrachloride	24	5
	Cobalt	21.2B	7		Trichloroethene	59	5
	Iron	39800	300	3D	Calcium	69200	66200
	Lead	22.6J	15		Iron	20000	300
	Manganese	2590	300		Lead	17.2	15
	Potassium	5910	2280		Zinc	815	300
	Vanadium	47.9B	13		Carbon Tetrachloride	10	5
1D	Iron	4130	300		Trichloroethene	24	5
	Zinc	342	300	4S	Aluminum	45800	5900
	Carbon Tetrachloride	16	5		Calcium	285000	66200
	Trichloroethene	7	5		Chromium	63.9	50
M-23	Aluminum	22700	5900		Cobalt	34.2B	7
	Calcium	166000	66200		Iron	77100	300
	Cobalt	12.1B	7		Lead	33.1	15
	Iron	35100	300		Manganese	2870	300
	Manganese	1130	300		Potassium	14100	2280
	Potassium	7450	2280		Vanadium	94.7	13
	Vanadium	42.6B	13	4D	Aluminum	8390	5900
	Carbon Tetrachloride	14	5		Chromium	153.0	50
All concentrations are in ug/l (ppb).					Iron	135000	300
					Lead	17.8	15
					Manganese	2780	300
					Potassium	3270B	2280
					Vanadium	18.0B	13
					Zinc	1130J	300
					bis (2-Ethylhexyl) Phthalate	320B	5

TABLE 31 (Cont'd)
MALTA ROCKET FUEL AREA SITE
GROUND WATER SAMPLE LOCATIONS WITH
ANALYTES ABOVE MRFA COMPARATIVE CRITERIA
NOVEMBER 1992 UNFILTERED

Monitoring Well	Analyte/Compound	Conc.	MRFA Comparative Criteria	Monitoring Well	Analyte/Compound	Conc.	MRFA Comparative Criteria
10S	Aluminum	14600	5900	M-16	Aluminum	11500	5900
	Calcium	147000	66200		Calcium	151000	66200
	Cobalt	12.5B	7		Chromium	67.6J	50
	Iron	28700	300		Cobalt	10.2B	7
	Manganese	974	300		Iron	20500	300
	Potassium	5760	2280		Manganese	649	300
	Vanadium	34.9B	13		Potassium	4380B	2280
10D	Iron	953	300		Vanadium	24.2B	13
11S	Aluminum	7200	5900		Carbon Tetrachloride	8	5
	Calcium	252000	66200	M-17	Aluminum	50200	5900
	Cobalt	19.8B	7		Beryllium	3.4B	3
	Iron	25300	300		Calcium	441000	66200
	Lead	27.9	15		Chromium	228.0	50
	Manganese	2560	300		Cobalt	52.7	7
	Vanadium	21.1B	13		Copper	286J	200
	Trichloroethene	17	5		Iron	106000	300
11D	Calcium	76500	66200		Lead	61.9	15
	Iron	1350	300		Magnesium	60100	35000
	Zinc	322J	300		Manganese	6990	300
	Carbon Tetrachloride	6	5		Nickel	240	100
	Trichloroethene	7	5		Potassium	13800	2280
13S	Aluminum	10100	5900		Vanadium	114	13
	Calcium	133000	66200		Zinc	494	300
	Chromium	748J	50		Carbon Tetrachloride	22	5
	Cobalt	7.3B	7		Trichloroethene	14	5
	Iron	19800	300	M-18	Calcium	67400	66200
	Manganese	598	300		Iron	4220	300
	Potassium	5640	2280		Manganese	2530	300
	Vanadium	21.7B	13		Potassium	2940B	2280
	Carbon Tetrachloride	18	5		Tetrachloroethene	6	5
13D	Iron	703	300				
M-15	Aluminum	32500	5900				
	Calcium	298000	66200				
	Chromium	56.4J	50				
	Cobalt	26.8B	7				
	Iron	68600	300				
	Lead	31.7J	15				
	Manganese	3000	300				
	Potassium	9100	2280				
	Vanadium	71	13				
	Carbon Tetrachloride	7J	5				

GWA1192U.XLS 1/7/94

All concentrations are in ug/l (ppb).

TABLE 31 (Cont'd)
MALTA ROCKET FUEL AREA SITE
GROUND WATER SAMPLE LOCATIONS WITH
ANALYTES ABOVE MRFA COMPARATIVE CRITERIA
NOVEMBER 1992 UNFILTERED

Monitoring Well	Analyte/Compound	Conc.	MRFA Comparative Criteria	Monitoring Well	Analyte/Compound	Conc.	MRFA Comparative Criteria
M-19	Aluminum	92100	5900	M-22	Aluminum	35100	5900
	Antimony	40.9B	3		Calcium	280000	66200
	Arsenic	27.1	25		Chromium	156J	50
	Beryllium	6.5	3		Cobalt	36.1B	7
	Calcium	216000	66200		Iron	79100	300
	Chromium	199	50		Lead	41.9J	15
	Cobalt	83	7		Manganese	3080	300
	Copper	311J	200		Nickel	111J	100
	Iron	167000	300		Potassium	9030	2280
	Lead	94.2	15		Vanadium	78.2	13
	Magnesium	41000	35000		Zinc	379J	300
	Manganese	13700	300	M-24S	Aluminum	23300	5900
	Nickel	237	100		Calcium	124000	66200
	Potassium	21900	2280		Chromium	137J	50
	Vanadium	182	13		Cobalt	19.8B	7
	Zinc	538	300		Iron	45500	300
	Boron	330	<100		Lead	23.15	15
	Carbon Tetrachloride	220	5		Manganese	1460	300
	Chloroform	32	5		Nickel	114J	100
	Trichloroethene	280	5		Potassium	5970	2280
					Vanadium	52.9	13
M-20	Aluminum	21700	5900	M-24D	Iron	423	300
	Antimony	59.8	3		Zinc	795J	300
	Calcium	298000	66200	M-25S	Aluminum	25900	5900
	Cobalt	44.0B	7		Calcium	165000	66200
	Iron	50200	300		Chromium	55.7	50
	Lead	57.9	15		Cobalt	17.4B	7
	Manganese	4330	300		Iron	48900	300
	Potassium	3410B	2280		Lead	23.6	15
	Vanadium	41.8B	13		Manganese	1660	300
					Potassium	8000	2280
M-21	Aluminum	36000	5900		Vanadium	55.1	13
	Calcium	185000	66200		Boron	163	<100
	Chromium	120J	50		Carbon Tetrachloride	22J	5
	Cobalt	33.1B	7		Trichloroethene	13J	5
	Iron	73400	300	M-25D	Sodium	20800	20000
	Lead	32.5J	15		Zinc	536	300
	Manganese	2560	300		Boron	98.9J	<100
	Nickel	126J	100	M-26S	Aluminum	6410	5900
	Potassium	8770	2280		Calcium	397000	66200
	Vanadium	74.8	13		Cobalt	30.8B	7
	Zinc	402J	300		Iron	21400	300
					Lead	63	15
					Manganese	3870	300
					Vanadium	18.2B	13
				M-26D	Zinc	939J	300

All concentrations are in ug/l (ppb).

TABLE 31 (Cont'd)
MALTA ROCKET FUEL AREA SITE
GROUND WATER SAMPLE LOCATIONS WITH
ANALYTES ABOVE MRFA COMPARATIVE CRITERIA
NOVEMBER 1992 UNFILTERED

Monitoring Well	Analyte/Compound	Conc.	MRFA Comparative Criteria	Monitoring Well	Analyte/Compound	Conc.	MRFA Comparative Criteria
M-27S	Aluminum	38000	5900	M-30	Aluminum	28500	5900
	Antimony	37.4B	3		Calcium	96800	66200
	Calcium	156000	66200		Cobalt	17.8B	7
	Chromium	57.4	50		Iron	38200	300
	Cobalt	28.7B	7		Lead	17.2	15
	Iron	72100	300		Manganese	1610	300
	Lead	31.2	15		Potassium	9240	2280
	Manganese	2920	300		Vanadium	49.1B	13
	Potassium	10100	2280		Carbon Tetrachloride	14	5
	Vanadium	83.4	13		Trichloroethene	11	5
M-27D	Iron	461	300	M-31S	Aluminum	22100	5900
	Zinc	913	300		Cadmium	9.6	66200
	Carbon Tetrachloride	23	5		Cobalt	8.8B	7
M-28S	Aluminum	12800	5900		Iron	35500	300
	Cadmium	211	5		Manganese	739	300
	Calcium	392000	66200		Potassium	7200	2280
	Cobalt	38.8B	7		Vanadium	69.3	13
	Iron	53200	300	M-31D	Iron	607	300
	Lead	1340	15		Zinc	446J	300
	Magnesium	36300	35000	M-32	Aluminum	6850	5900
	Manganese	5050	300		Calcium	102000	66200
	Potassium	2690B	2280		Iron	9490	300
	Vanadium	33.9B	13		Manganese	349	300
	Zinc	534J	300		Potassium	2560	2280
	Carbon Tetrachloride	33	5		Boron	102	<100
	Trichloroethene	49	5		Carbon Tetrachloride	63	5
M-28D	Zinc	456J	300		Tetrachloroethene	18.0	5
	Carbon Tetrachloride	42	5		Trichloroethene	95	5
	1,1,1-Trichloroethane	51	5				
M-29S	Aluminum	11100	5900				
	Calcium	195000	66200				
	Cobalt	22.0B	7				
	Iron	29900	300				
	Lead	27.6	15				
	Manganese	2630	300				
	Vanadium	24.8B	13				
	Carbon Tetrachloride	43	5				
M-29D	Trichloroethene	28	5				
	Zinc	1430J	300				
	Carbon Tetrachloride	84	5				
	Chloroform	14	5				
	Trichloroethene	24	5				

GWA1192U.XLS 1/7/94

All concentrations are in ug/l (ppb).

TABLE 32
MALTA ROCKET FUEL AREA SITE
GROUND WATER SAMPLE LOCATIONS WITH
ANALYTES ABOVE MRFA COMPARATIVE CRITERIA
JUNE 1992 FILTERED

Monitoring Well	Analyte/Compound	Conc.	MRFA Comparative Criteria
2S	Calcium	70800	66200
3S	Calcium	79500	66200
3D	Calcium	69700	66200
10S	Calcium	69100	66200
13S	Antimony	22.4B	3
	Calcium	70700	66200
	Chromium	512	50
	Potassium	4440B	2280
M-16	Calcium	99800	66200
M-17	Calcium	95700	66200
M-19	Calcium	67600	66200
	Iron	546	300
	Boron	136	<100
M-21	Calcium	99000	66200
	Sodium	20900	20000
M-22	Calcium	103000	66200
M-24D	Zinc	537J	300
M-25S	Sodium	21400	20000
	Boron	106	<100
M-25D	Zinc	589	300
	Boron	140	<100
M-26S	Calcium	74400	66200
M-26D	Zinc	365J	300
M-27D	Zinc	531J	300
M-28S	Antimony	17.7	3
	Cadmium	19	5
	Iron	379	300
M-28D	Zinc	549	300
M-29S	Calcium	70500	66200
M-29D	Potassium	2610B	2280
	Zinc	727J	300
M-31S	Iron	1486	300
	Manganese	313	300
M-32	Calcium	70500	66200

All concentrations are in ug/l (ppb).

GWAB692F.XLS 1/7/94

TABLE 33
MALTA ROCKET FUEL AREA SITE
GROUND WATER SAMPLE LOCATIONS WITH
ANALYTES ABOVE MRFA COMPARATIVE CRITERIA
NOVEMBER 1992 FILTERED

Monitoring Well	Analyte/Compound	Conc.	MRFA Comparative Criteria
2S	Calcium	82900	66200
3S	Calcium	68200	66200
3D	Calcium	66600	66200
13S	Calcium	80800	66200
	Chromium	834J	50
	Potassium	3660B	2280
M-16	Calcium	98900	66200
M-17	Calcium	88600	66200
	Zinc	355	300
M-19	Boron	225	<100
M-21	Calcium	75800	66200
M-22	Calcium	101000	66200
M-24D	Zinc	731J	300
M-25S	Boron	107	<100
M-25D	Sodium	20100	20000
	Zinc	492	300
	Boron	1295	<100
M-26D	Zinc	778J	300
M-27D	Zinc	817	300
M-28D	Zinc	608J	300
M-29S	Antimony	48.5BJ	3
	Calcium	73000	66200
M-29D	Zinc	1660J	300
M-31S	Iron	4170	300
	Manganese	394	300
M-31D	Zinc	393J	300
M-32	Calcium	75700	66200

All concentrations are in ug/l (ppb).

GWA1192F.XLS 1/7/94

TABLE 34
MALTA ROCKET FUEL AREA SITE
PROPOSED SAMPLING PROGRAMS

Area	Proposed Sampling	Analysis	Rationale
S-2	1 boring to water table at S-93; sample 4'-6'; archive just above water table	Trichloroethene	Trichloroethene in S-93 (4'-6') = 220 ppb (700); Trichloroethene drum near S-93
S-7	2 borings to water table; sample 2 foot interval with highest headspace	full TCL/TAL	Insufficient borings (USEPA comment #136, 8 July, 1993)
D-1	3 borings to water table around former bum pit; sample 4'-6', 8'-10'; archive just above water table	full TCL/TAL	Insufficient borings (USEPA comment #147, 8 July, 1993)
D-2	1 boring to water table at P-19; sample 6'-8'; archive 10'-12' and 2 foot interval immed. above water table; 3 borings to water table around P-19; sample 2'-4'; archive 6'-8' and 2 foot interval immed. above water table	Vanadium, Benzo (a) Pyrene	Vanadium in P-19 (2'-4') = 914 ppm (189); Benzo (a) Pyrene = 1601 ppb (61)
D-5	1 boring to water table at P-70; sample 6'-8'; archive 10'-12' and 2 foot interval immed. above water table; 3 borings to water table around P-70; sample 2'-4'; archive 6'-8' and 2 foot interval immed. above water table	Cadmium	Cadmium in P-70 (2'-4') = 60.8 ppm (13.5)
Bldg. 1	Resample DW-1A-1 (floor drain); attempt to sample 2'-4'	Mercury, SVOCs, PCBs	Mercury in DW-1A-1 = 40.71 ppm (8.1); Total PCBs = 23400 ppb (10000); several SVOCs above MRFA Comparative Criteria
Bldg. 2	Resample DW-2-3 (floor drain); attempt to sample 2'-4'	Mercury, SVOCs, pesticides	Mercury in DW-2-3 = 2071 ppm (8.1); several SVOCs and several pesticides above MRFA Comparative Criteria
Bldg. 3	1 surface soil sample within dry well to confirm level of Aroclor 1260	PCBs	Aroclor 1260 in DW-3-1 = 15000JNCD ppb (1000)
Bldg. 3	3 borings to 10' below water table around quench pit; sample 2 foot interval immediately below base of quench pit	full TCL/TAL	To determine if quench pit effects surrounding soil
Bldg. 3	1 deep surface water sample in quench pit	full TCL/TAL	To determine quality of quench pit (sediment can't be sampled)
Bldg. 4	1 boring to water table at DW-4-2; sample 12'-14'; archive 16'-18' and 2 foot interval immed. above water table; 3 borings to water table around DW-4-2; sample 10'-12'; archive 12'-14' and 2 foot interval immed. above water table	VOCs, SVOCs	Total VOCs in DW-4-2 (8'-10') = 128301 ppb (10000); several individual SVOCs above MRFA Comparative Criteria, total SVOCs = 7720001 ppb (5000000)
Bldg. 4	3 borings to 10' below water table around quench pit; sample 2 foot interval immediately below base of quench pit	full TCL/TAL	To determine if quench pit effects surrounding soil
Bldg. 4	1 deep surface water sample in quench pit	full TCL/TAL	To determine quality of quench pit (sediment can't be sampled)
Bldg. 5	2 borings to 10' around each catch basin (4 total borings); sample 4'-6'; archive 8'-10'	Arsenic, cadmium, copper, lead, mercury, nickel, zinc, pest/PCBs	Inorganics, pes/PCBs above MRFA Comparative Criteria in both catch basins
Bldg. 14	1 boring to water table at S-39; sample 4'-6'; archive 8'-10' and 2 foot interval immed. above water table; 3 borings to water table around S-39; sample 2'-4'; archive 6'-8' and 2 foot interval immed. above water table	VOCs, SVOCs	Total VOCs in S-39 (0-2') = 12680 ppb (10000); several SVOC TTCs above MRFA Comparative Criteria, total SVOCs = 1287000 ppb (5000000)
Bldg. 14	1 boring to water table in septic tank leach field; sample 2 foot interval with highest headspace; archive 2 foot interval immed. above water table	full TCL/TAL	one boring needed in septic leach field (USEPA comment #208, 8 July, 1993)

Note: Numbers in parentheses are MRFA Comparative Criteria.

TABLE 34 (cont'd)
MALTA ROCKET FUEL AREA SITE
PROPOSED SAMPLING PROGRAMS

Area	Proposed Sampling	Analysis	Rationale
Bldg. 15	1 boring at DW-15 outfall location to 8'; sample 0-2'; archive 6'-8'; 2 borings around outfall to 6'; sample 4'-6'	Arsenic, iron, lead, mercury	4 inorganics in DW-15 above MRFA Comparative Criteria
Bldg. 20	1 boring to 10' at SS-20/1; sample 2'-4' and 4'-6'; archive 8'-10' 3 surface soil samples around SS-20/1	Mercury	Mercury in SS-20/1 = 24.4J (8.1)
Bldg. 20H	1 boring to water table at DW-20H; sample 6'-8' and 10'-12'; archive 2 foot interval immed. above water table	Lead, mercury, SVOCs	Lead in DW-20H = 34.5J ppm (27); mercury = 0.16J ppm (0.11); several SVOCs above MRFA Comparative Criteria
Bldg. 21	1 boring to 10' at SS-21; sample 2'-4' and 4'-6'; archive 8'-10' 3 surface soil samples around SS-21	Mercury	Mercury in SS-21 = 45.5J ppm (8.1)
Bldg. 24	1 boring to 12' at SS-24; sample 2'-4' and 6'-8'; archive 8'-10' and 10'-12' 3 borings to 8' around SS-24; sample 0-2' and 2'-4'; archive 6'-8'	SVOCs	5 SVOCs in SS-24 above MRFA Comparative Criteria
Bldg. 24	2 borings to 10' around each catch basin (4 total borings); sample 4'-6'; archive 8'-10'	Arsenic, copper, lead, zinc, manganese, mercury, SVOCs	Inorganics and SVOCs above MRFA Comparative Criteria in both catch basins
Bldg. 25	1 boring to water table at S-75; sample 6'-8'; archive 10'-12' and 2 foot interval immed. above water table; 3 borings to water table around S-75; sample 2'-4'; archive 6'-8' and 2 foot interval immed. above water table	Phenols	Phenol in S-75 (2'-4') = 140J ppb (30)
Bldg. 25	3 borings to 10' below water table around quench pit; sample 2 foot interval immediately below base of quench pit	full TCL/TAL	To determine if quench pit effects surrounding soil
Bldg. 25	1 deep surface water sample in quench pit	full TCL/TAL	To determine quality of quench pit (sediment can't be sampled)
Bldg. 25S	1 boring to 10' at SS-25S; sample 2'-4'; archive 4'-6' and 8'-10' 3 surface soil samples around SS-25S	Lead	Lead in SS-25S = 764 ppm (500)
Bldg. 28	1 boring to water table at S-85; sample 8'-10'; archive 12'-14' and 2 foot interval immed. above water table; 3 borings to water table around S-85; sample 4'-6'; archive 8'-10' and 2 foot interval immed. above water table	VOCs	Acetone in S-85 (4'-6') = 580BJD ppb (200)
Mug. Pond	1 boring to 10' at SD-DD1 and SS-DTINT; sample 2'-4'; archive 4'-6' and 8'-10'; 3 surface soil samples around SD-DD1 (SS-DTINT)	Mercury	Mercury in SD-DD1 = 124J ppm (8.1)
D. Ditch	1 boring to water table at DW-GE/EX-2; sample 2 foot interval immed. below bottom of dry well; archive 2 foot interval immed. above water table;	SVOCs	Mercury in SS-DTINT = 13 ppm (8.1)
GE/Exxon Building	3 borings to water table around DW-GE/EX-2; sample 2 foot interval 2 feet below bottom of dry well; archive 2 foot interval immed. above water table		4 SVOCs in DW-2 above MRFA Comparative Criteria

Note: Numbers in parentheses are MRFA Comparative Criteria.

TABLE 35
MALTA ROCKET FUEL AREA SITE
PROPOSED SAMPLING SUMMARY

Media	Total	Full TCL/TAL	Inorganic Subset Only	Organics Only	Inorganic Subset + Organics
Soil	88 samples 76 archived samples	18 samples 4 archived samples	25 samples 15 archived samples	29 samples 40 archived samples	16 samples 17 archived samples
Surface Water	3 samples	3 samples	-	-	-
Ground Water	6 samples	6 samples	-	-	-

Appendix A
Development of Toxicity Criteria and Health-Based
Comparative Criteria

***DEVELOPMENT OF HEALTH BASED SOIL COMPARATIVE
CRITERIA FOR INORGANIC SUBSTANCES OF INTEREST AT THE
MRFA SITE***

**I. HEALTH-BASED SOIL COMPARATIVE CRITERIA FOR
INORGANIC SUBSTANCES WITH USEPA TOXICITY CRITERIA**

Guidance for the development of risk based chemical-specific PRGs for carcinogenic and noncarcinogenic risk-based concentrations for relevant media is provided in RAGs part B (USEPA 1991). This guidance (RAGs part B) was consulted to create health-based criteria which were used to screen the existing RI soil data and determine the need for further characterization of soil at the site. Under residential land use, risk of the contaminant from soil is assumed to be due to direct ingestion of soil only, i.e., total risk from soil = risk from ingestion of soil (child to adult). Because the soil ingestion rate is different for children and adults, the risk due to direct ingestion of soil is calculated using an age-adjusted ingestion factors which takes into account the difference in daily soil ingestion rates, body weights, and exposure durations for two exposure groups - children one to six years and other of seven to 31 years. The exposure frequency is assumed to be the same for the two exposure groups (USEPA 1991).

As the route of exposure for development of the residential chemical-specific PRGs is oral, only non-carcinogenic risk-based concentrations were calculated for the MRFA site as none of the relevant inorganics, i.e., cadmium, chromium VI and nickel is carcinogenic by the oral route. The health-based comparative criteria were developed following USEPA guidance (USEPA 1991) for only those inorganic substances with USEPA toxicity criteria. The noncarcinogenic hazard quotient was set at 0.1 rather than 1 (personal communication with USEPA Region II technical staff). USEPA Region II determined that in order to use PRGs for screening, any health-based criteria would need to account for potential additive effects of

exposure to multiple noncarcinogenic substances. Although some of the substances may not have such effects, other substances have similar mechanisms of action and/or toxic end-points and thus the more conservative target hazard quotient is appropriate. All of these substances do not act by the same mechanism, e.g., cadmium and arsenic, and thus the effects are most likely not additive. In addition, the uncertainty and modifying factors that are applied in the development of an RfD serve as safety factors. The following terms and values were used in the calculations:

Exposure Variables	Value	Name
1-General:		
Reference dose oral (mg/kg/d):	*	RfD _o
Target hazard quotient:	0.1	THQ
Body weight, adult (kg):	70	BW _a
Body weight, age 1-6 (kg):	15	BW _c
Averaging time non-carcinogens (d):	ED*365	AT _n
Soil ingestion, adult (mg/d)	100	IRS _a
Soil ingestion, age 1-6 (mg/d)	200	IRS _c
Soil ingestion factor, age adjusted (mg-y/kg-d):	114.29	IFS _{adj}
2-Residential:		
Exposure frequency (d/y):	350	EF _r
Exposure duration, total (y):	30	EF _{tot}
Exposure variables		
Exposure duration, age 1-6 (y):	6	ED _c
Note: * Contaminant-specific toxicity parameters		

Equations:

Soil ingestion ([mg*y]/[kg*d]):

$$IFS_{adj} = \frac{ED_c * IRS_c}{BW_c} + \frac{(ED_{tot} - ED_c) * IRS_a}{BW_a}$$

Non-carcinogens:

$$\frac{THQ * RfD_o * BW_a * AT_n}{EF_o * ED_o * \frac{IRS_a}{10^6 \frac{mg}{kg}}}$$

Soil residential (mg/kg):

Non-carcinogens: Calculations were based on childhood exposure only.

$$\frac{THQ * RfD_o * BW_c * AT_n}{EF_r * ED_c * \frac{IRS_c}{10^6 \frac{mg}{kg}}}$$

The resultant HBSSLs for those substances with USEPA verified toxicity criteria are shown below.

Substance	RfD	CSF	Souurce	Health-Based Comparative Criteria (mg/kg)
Aluminum	2.9e+00	N/R	o	78,300
Boron	9.0e-02	N/R	i	2,400
Cadmium	5.0e-04	N/R	i	13.5
Chromium VI	5.0e-03	N/R	i	135
Copper	3.7e-02	N/R	i	999
Cyanide	2.0e-02	N/R	i	540
Lead	N/A	N/R	o	500
Manganese	1.0e-01	N/R	i	2,700
Mercury	3.0e-04	N/R	i	8.1
Nickel	2.0e-02	N/R	i	540
Silver	5.0e-03	N/R	i	135
Thallium	7.0e-05	N/R	i	1.89
Vanadium	7.0e-03	N/R	i	189
Zinc	3.0e-01	N/R	i	8,100

- i USEPA Integrate Risk Information System (IRIS)
- o Other USEPA documents

II. HEALTH-BASED SOIL COMPARATIVE CRITERIA FOR ESSENTIAL MINERALS WITH NO USEPA TOXICITY CRITERIA

In deriving the Health-Based Soil Comparative Criteria for the essential minerals, National Research Council's Recommended Daily Allowances was reviewed (NRC, 1989). The assumption was made that the toddler consumed 200 mg per day of soil (USEPA Factors Exposure Handbook, 1990) containing the equivalent amount of calcium, iron and magnesium of a One-A-Day Plus Mineralstm tablet (Compendium of Drug Therapy 1983), the equivalent amount of sodium contained in a half of cup of skim milk (Scientific Tables, 1971) and the equivalent amount of potassium in one quarter of a banana (Scientific Tables, 1971). These equivalent amounts are shown below.

SUBSTANCE	INTAKE (mg/day)
Calcium	100
Iron	18
Magnesium	100
Potassium	105
Sodium	65

The amount of the essential element that is given to children routinely was converted to the corresponding concentration in soil, assuming a child consumes 200 mg of soil per day (USEPA Exposure Factors Handbook, 1991), using the following equation.

Equation 4: Conversion to soil concentrations

$$C_s = (D/SL_c) \times CF$$

Where:

C_s = Soil concentration (mg)/kg)

D = Dose equivalent of essential mineral (mg)

CF = Conversion factor (10^6 mg to kg)

SI_c = Amount of soil ingested per day by a child (mg)

The results of the soil conversion, i.e., health-based comparative criteria for the essential minerals, is shown below.

SUBSTANCE	SOIL CONCENTRATION
	(mg/kg)
Calcium	500,000
Iron	90,000
Magnesium	500,000
Potassium	525,000
Sodium	325,000

III. SUMMARY

Using USEPA guidance, the respondents have developed health-based soil comparative criteria as chemical-specific PRGs for the inorganic substances of interest on the MRFA site. Two methods were employed. For those constituents that have USEPA toxicity criteria, RAGs Part B guidance (USEPA 1991) were followed with modification (Target Hazard Quotient was set conservatively at 0.1 rather than 1.0). For those essential elements without USEPA toxicity criteria, health-based soil comparative criteria were developed from amounts routinely provided in nutritional food items, e.g., milk and bananas, or pediatric vitamins. The health-based comparative criteria derived from these two methods are shown below.

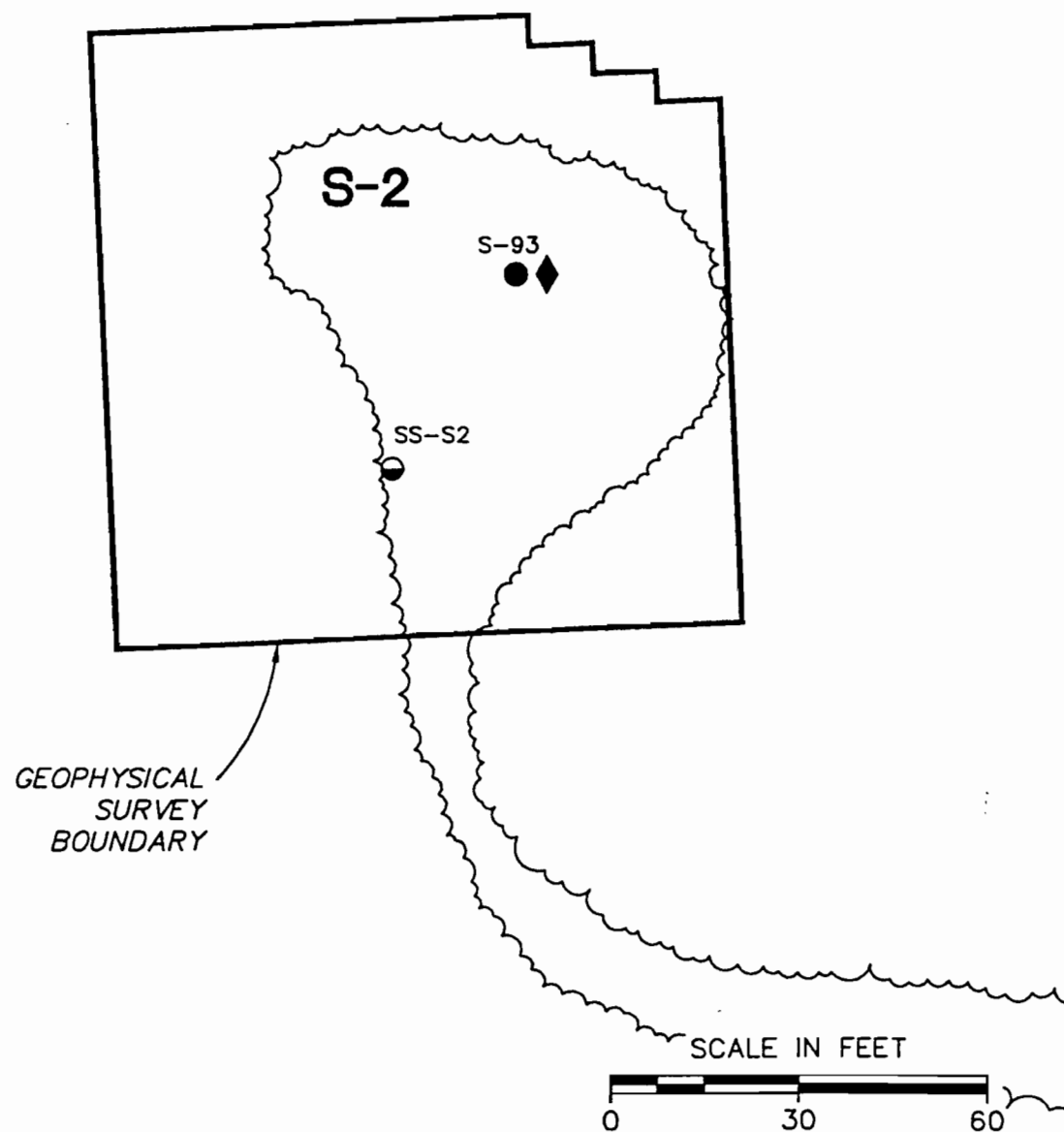
Substance	RfD	CSF	Source	Health-Based Comparative Criteria (mg/kg)
Aluminum	2.9e+00	N/R	o	78,300
Boron	9.0e-02	N/R	i	2,400
Cadmium	5.0e-04	N/R	i	13.5
Calcium	N/A	N/R	d	500,000
Chromium VI	5.0e-03	N/R	i	135
Copper	3.7e-02	N/R	i	999
Cyanide	2.0e-02	N/R	i	540
Iron	N/A	N/R	d	90,000
Lead	N/A	N/R	o	500
Magnesium	N/A	N/R	d	500,000
Manganese	1.0e-01	N/R	i	2,700
Mercury	3.0e-04	N/R	i	8.1
Nickel	2.0e-02	N/R	i	540
Potassium	N/A	N/R	d	525,000
Silver	5.0e-03	N/R	i	135
Sodium	4.0e-03	N/R	d	325,000
Thallium	7.0e-05	N/R	i	1.89
Vanadium	7.0e-03	N/R	i	189
Zinc	3.0e-01	N/R	i	8,100

i USEPA Integrate Risk Information System (IRIS)

o Other USEPA documents

d Derived by ENVIRON

Appendix B
Proposed Sampling Locations



LEGEND

-  PROPOSED SOIL BORING LOCATION
-  S-84 SOIL BORING LOCATION & ID#
-  SS-S2 SURFACE SOIL SAMPLE LOCATION & ID#

SAMPLING LOCATIONS FOR AREA S-2

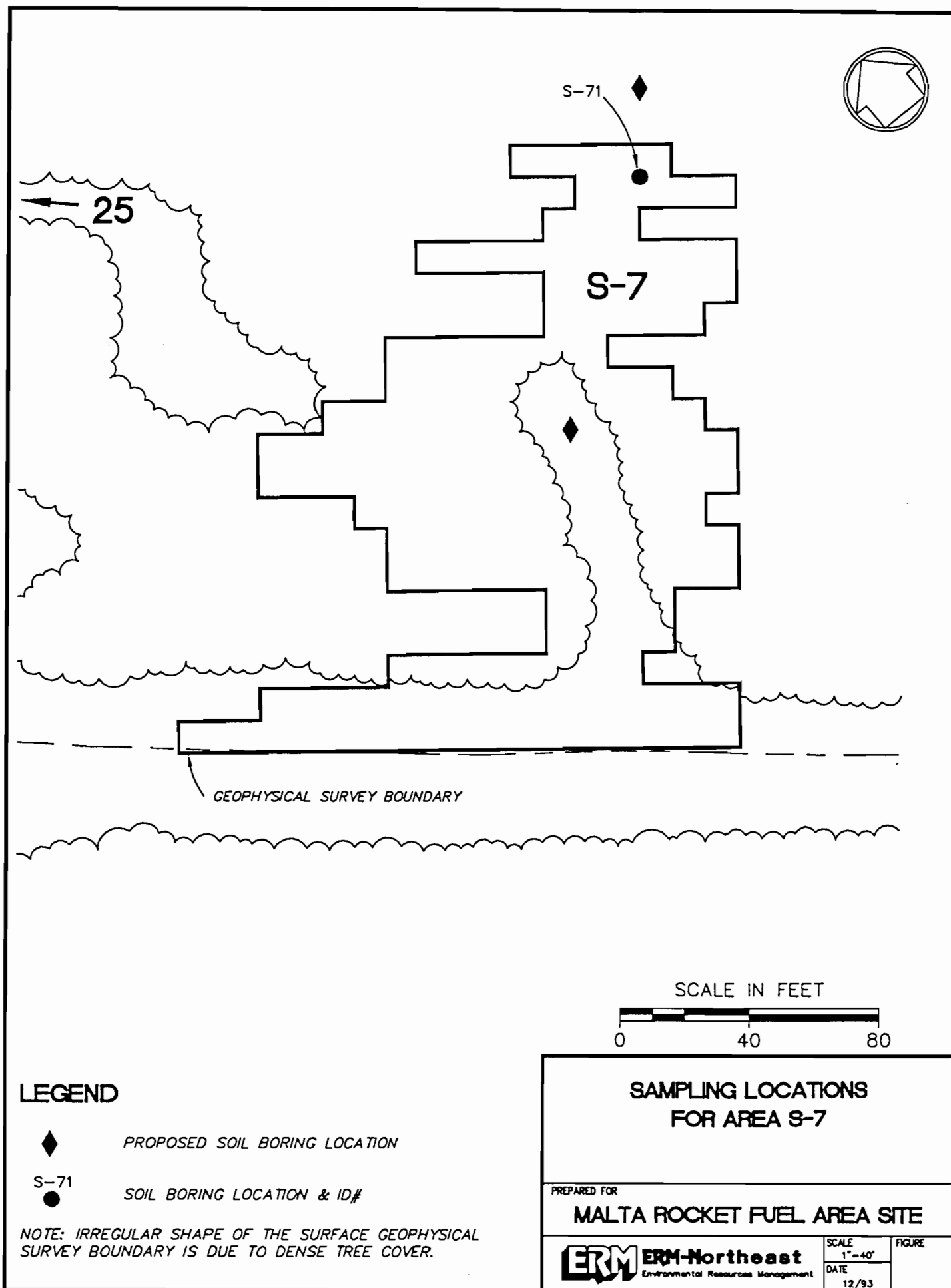
PREPARED FOR

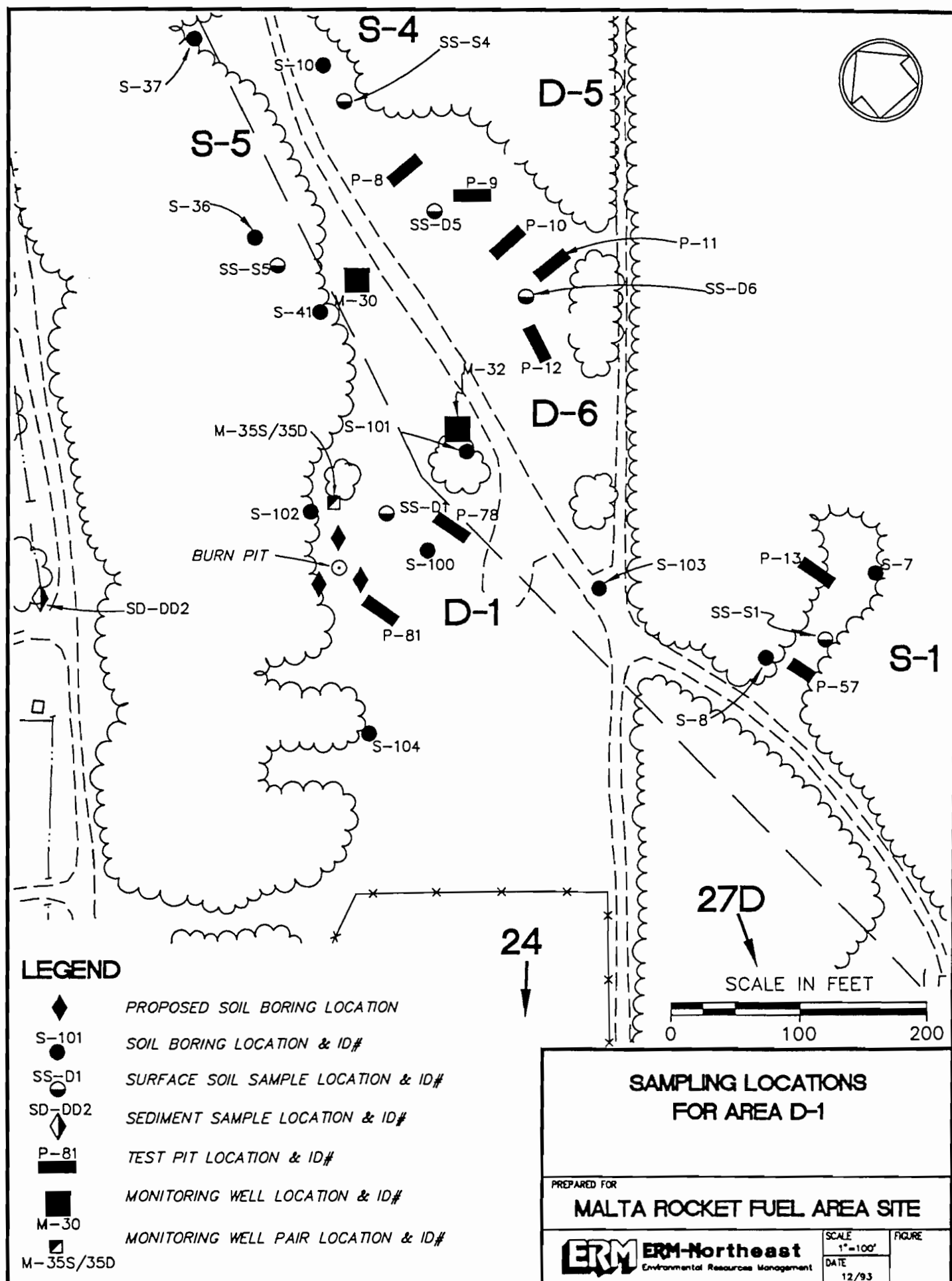
MALTA ROCKET FUEL AREA SITE

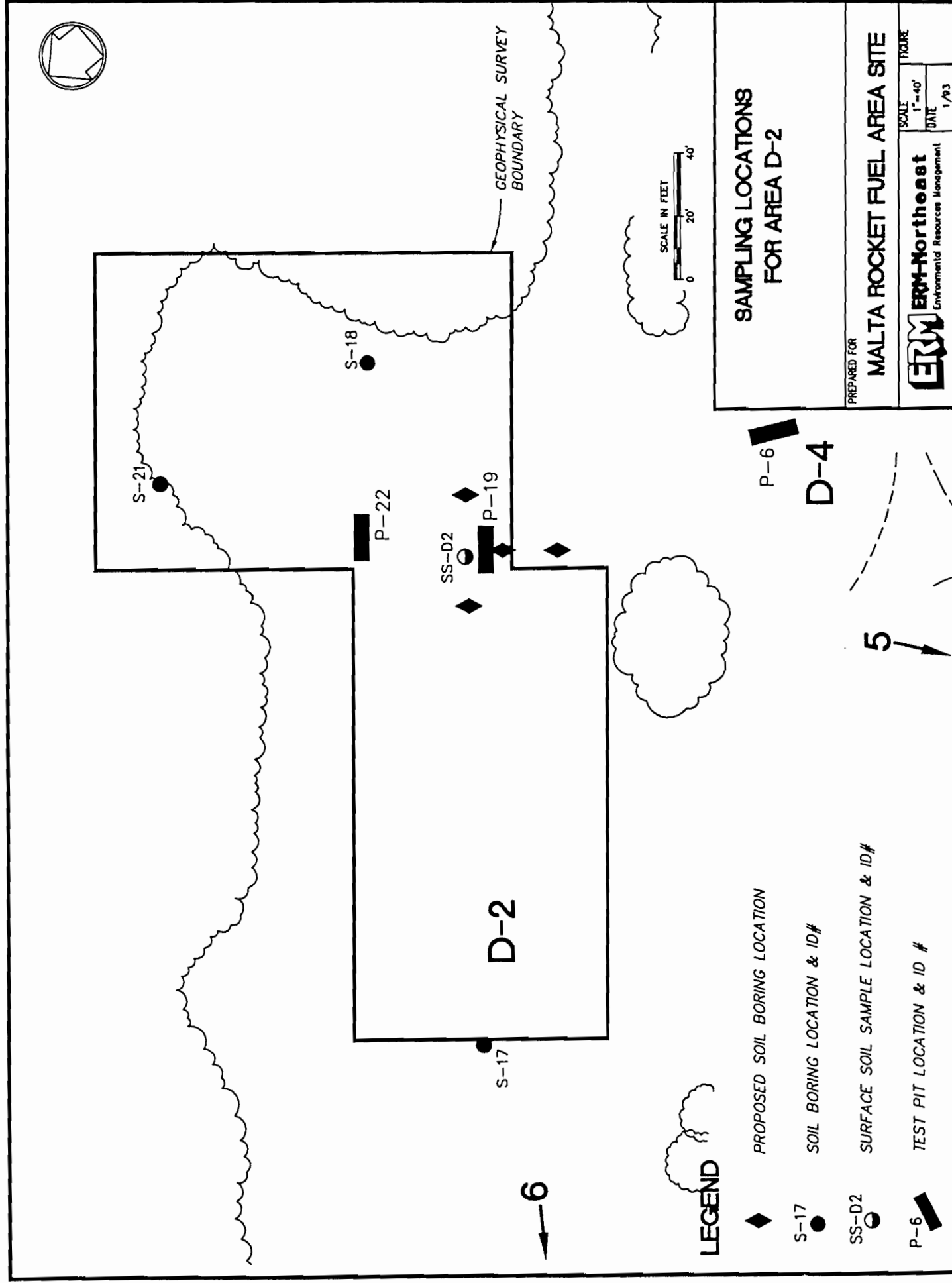
ERM **ERM-Northeast**
Environmental Resources Management

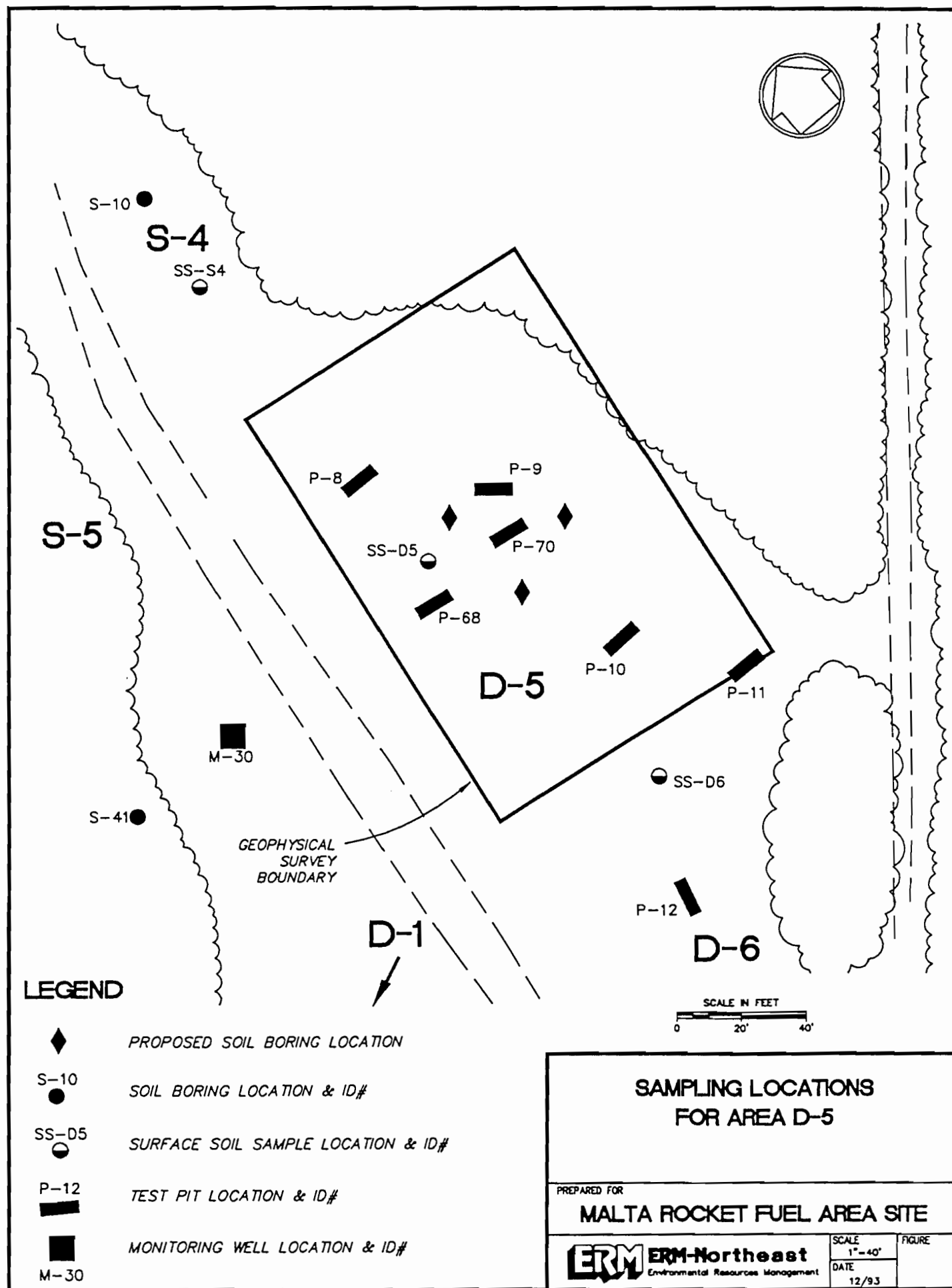
SCALE
1"=30'
DATE
12/93

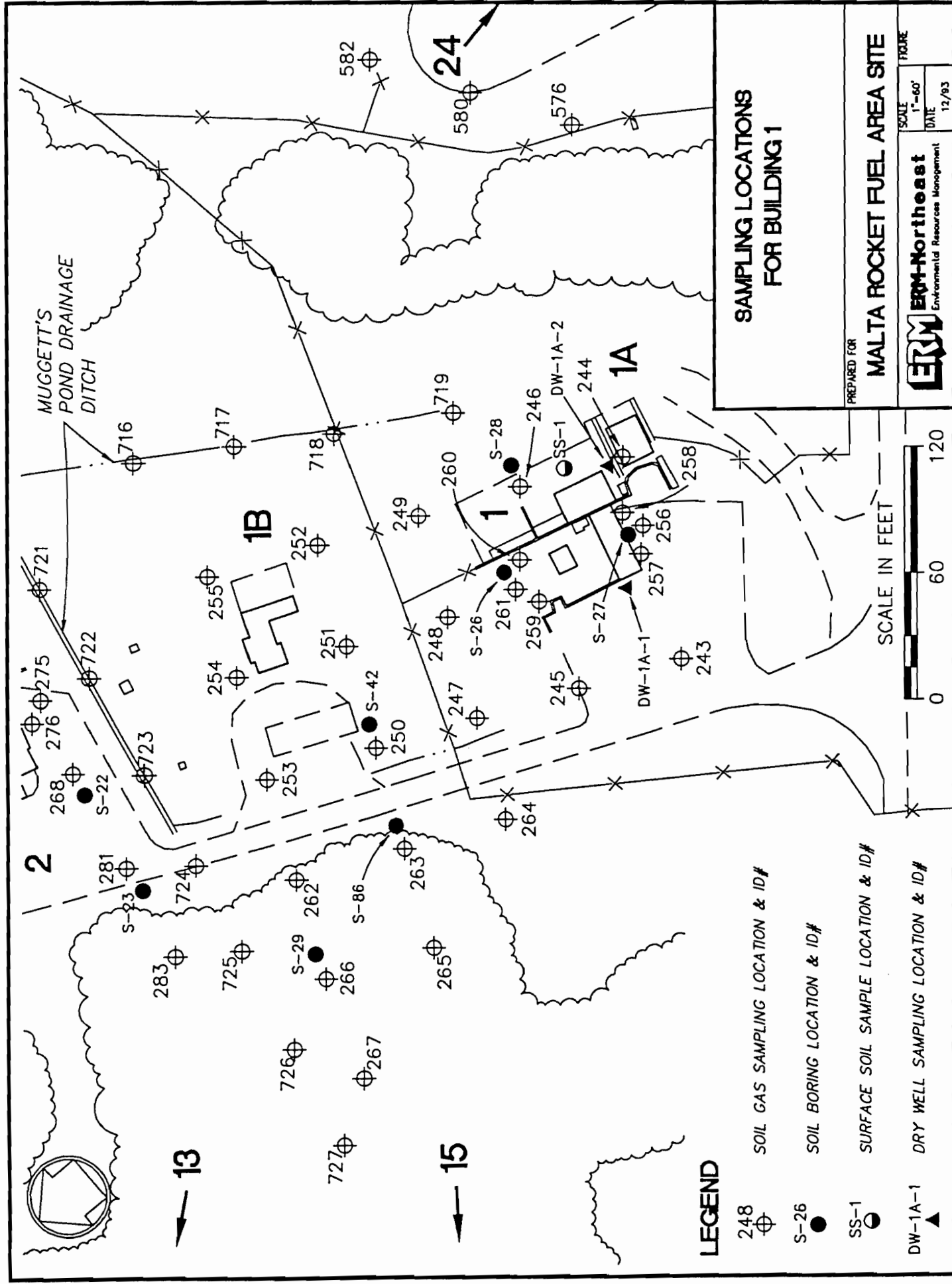
FIGURE

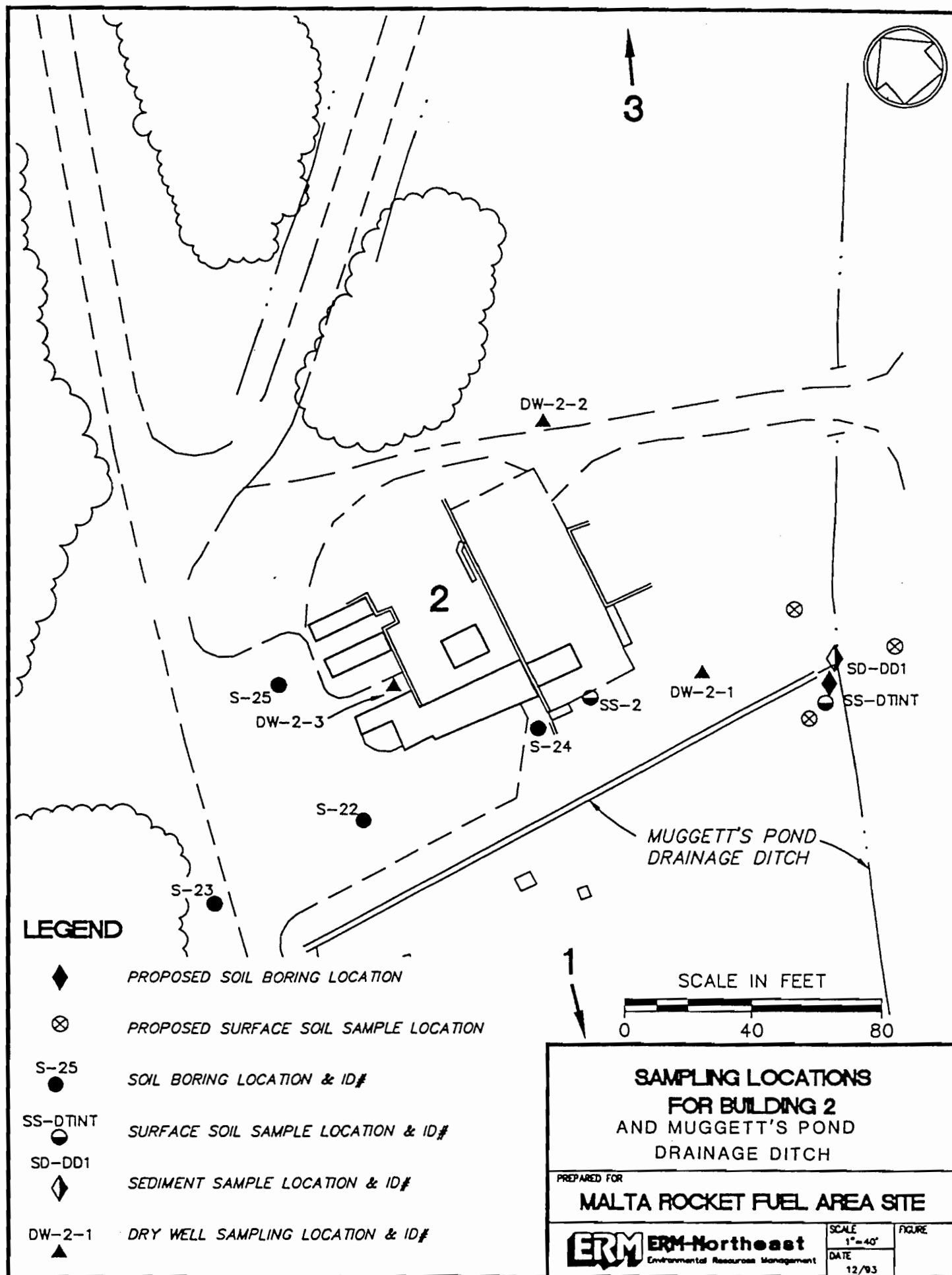


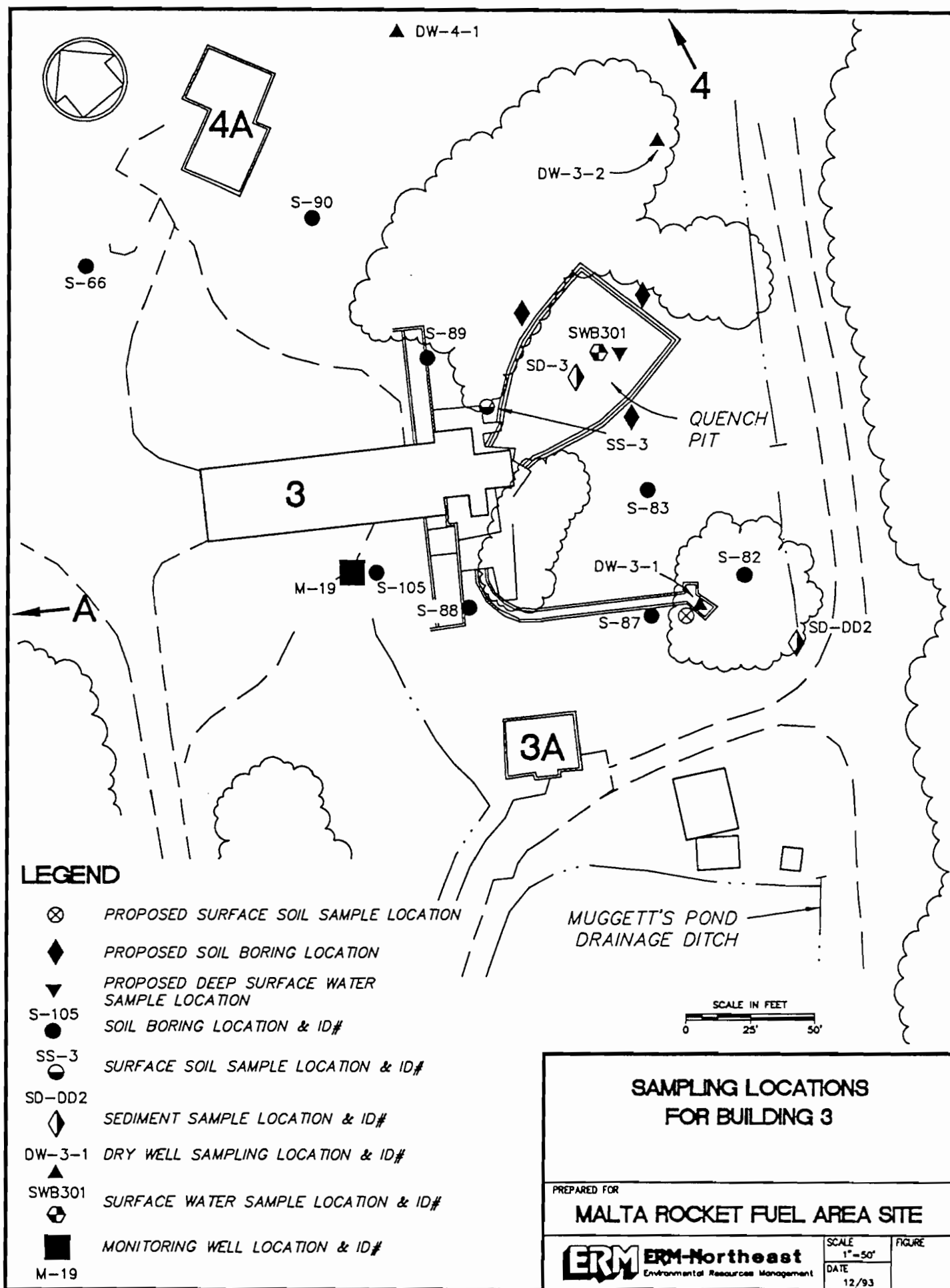


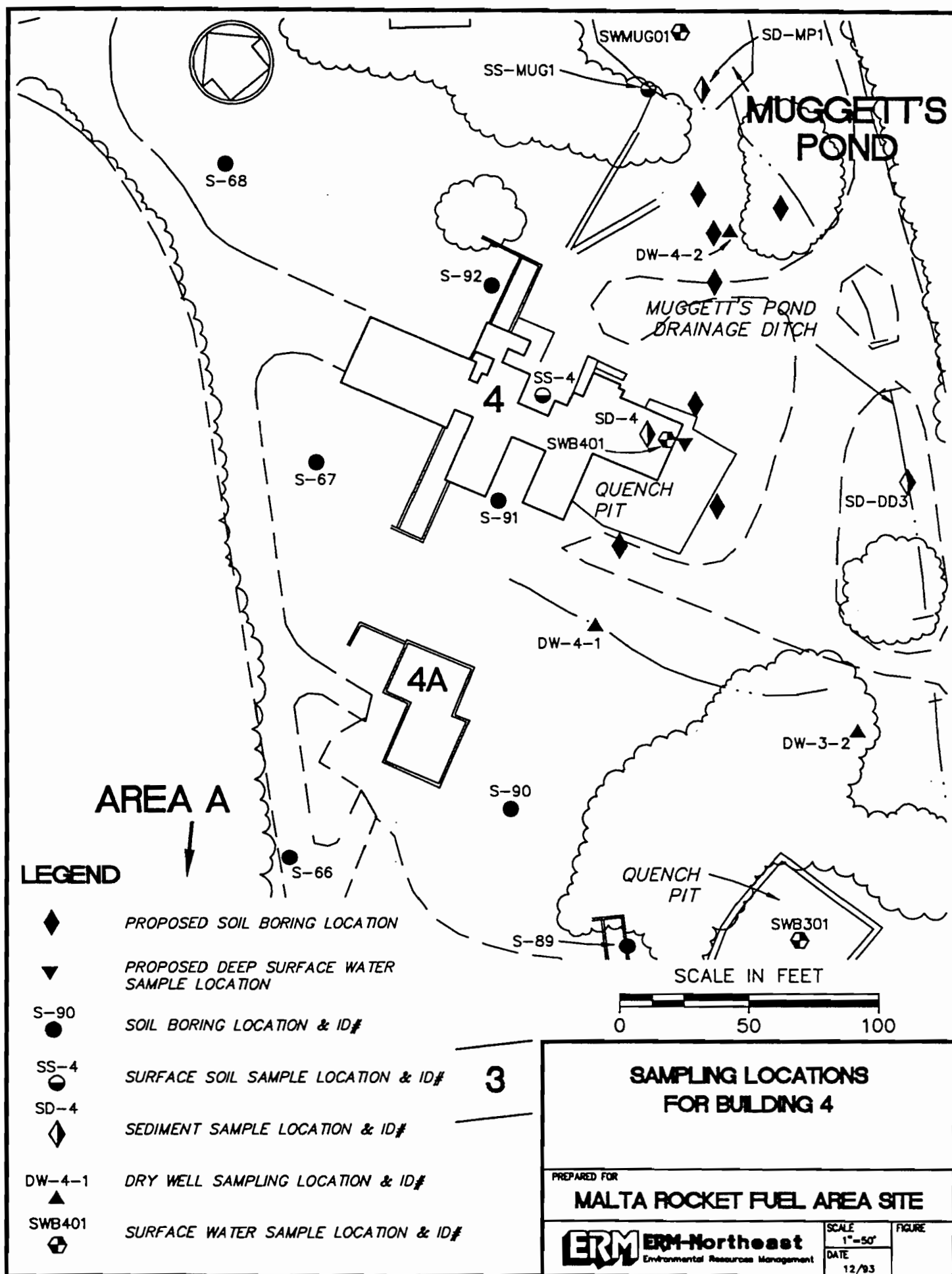


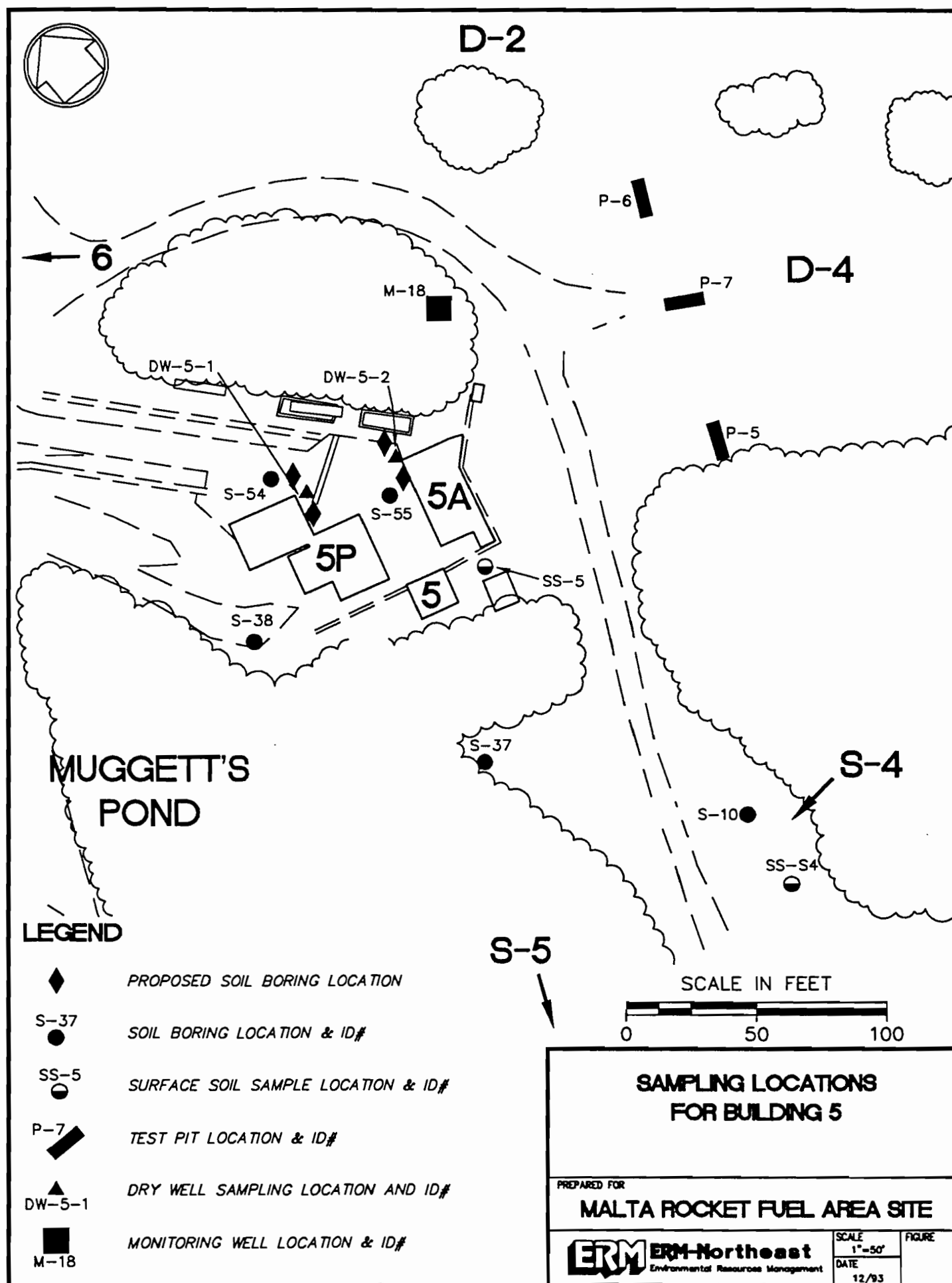


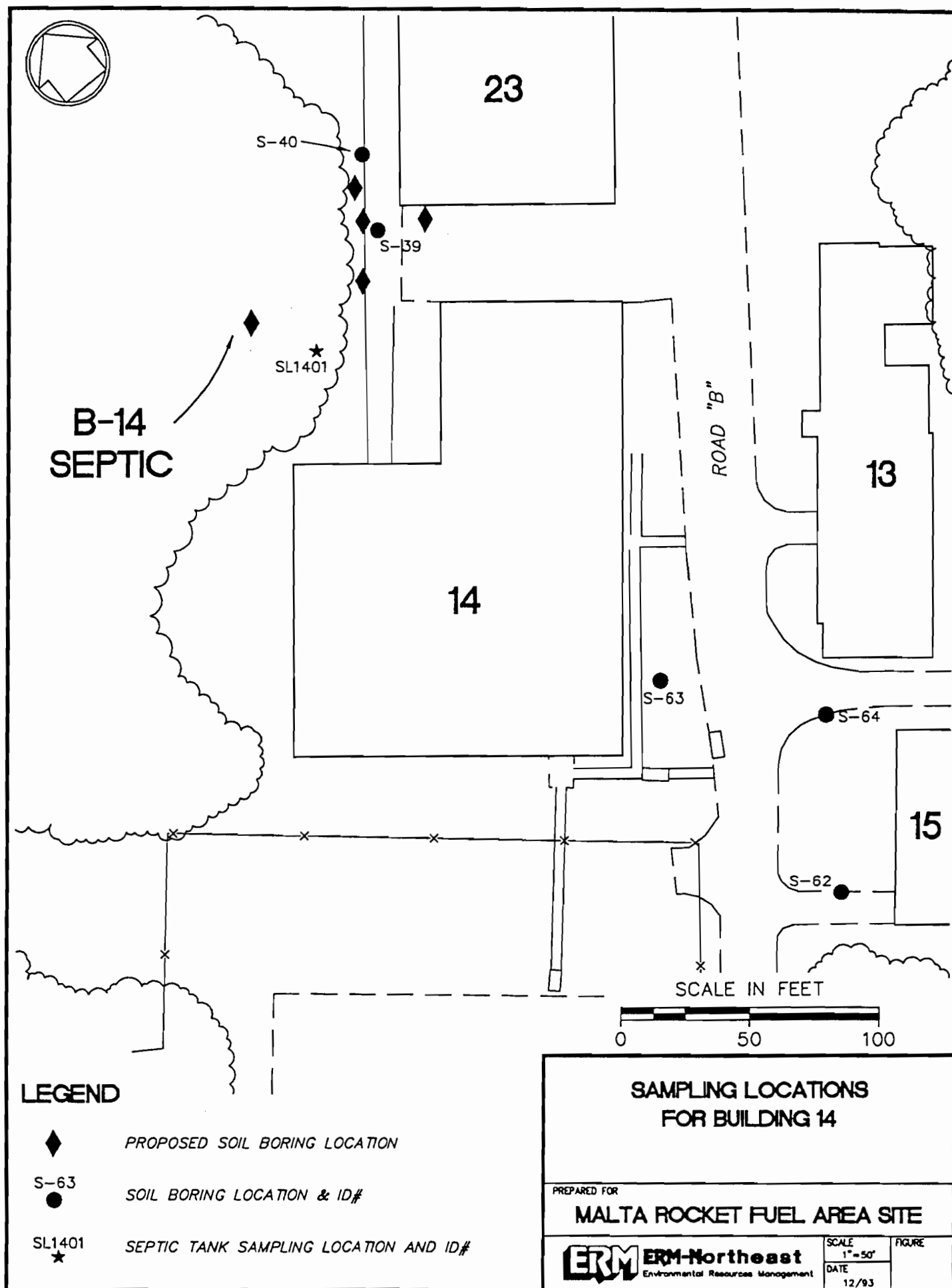


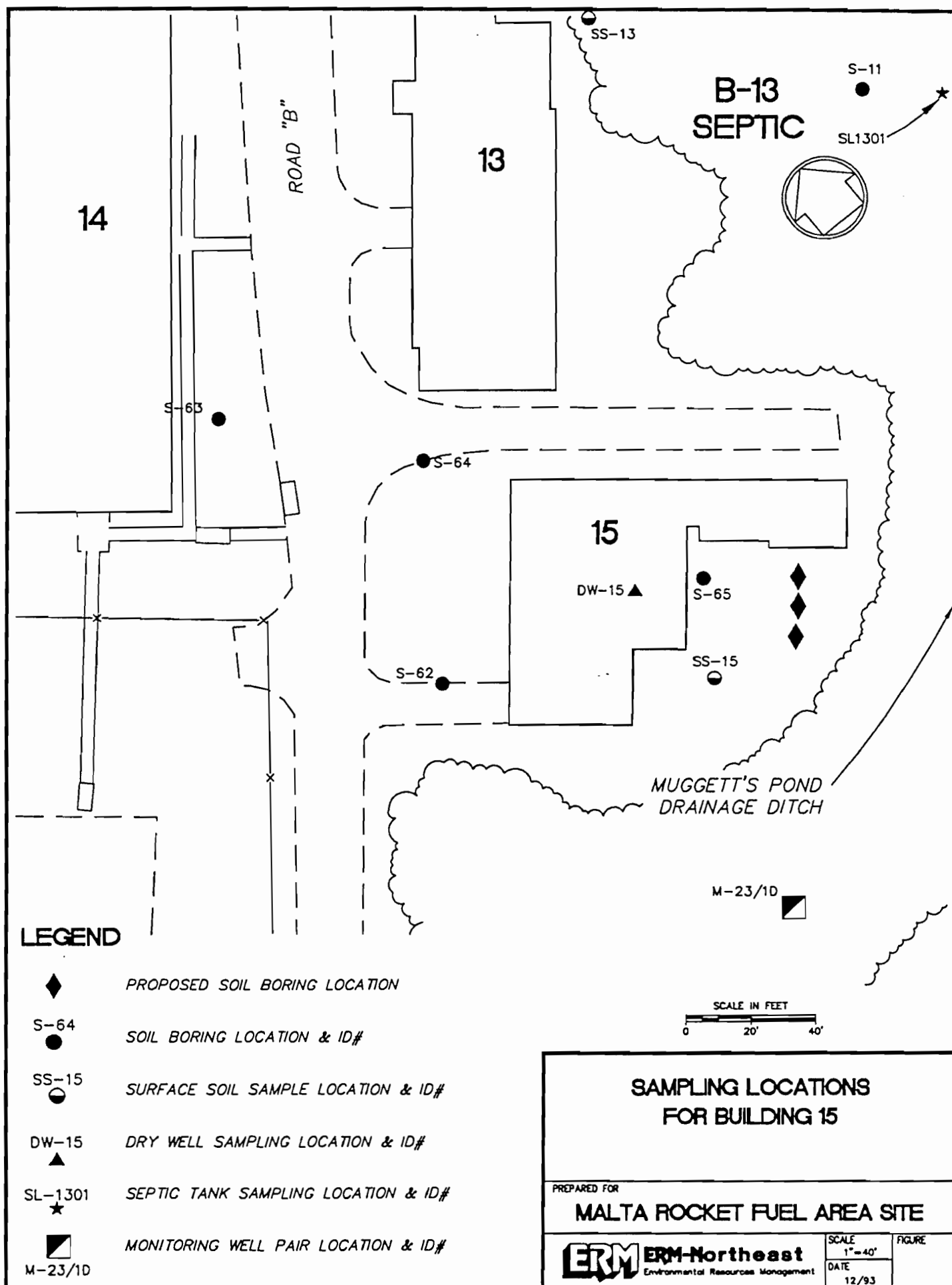


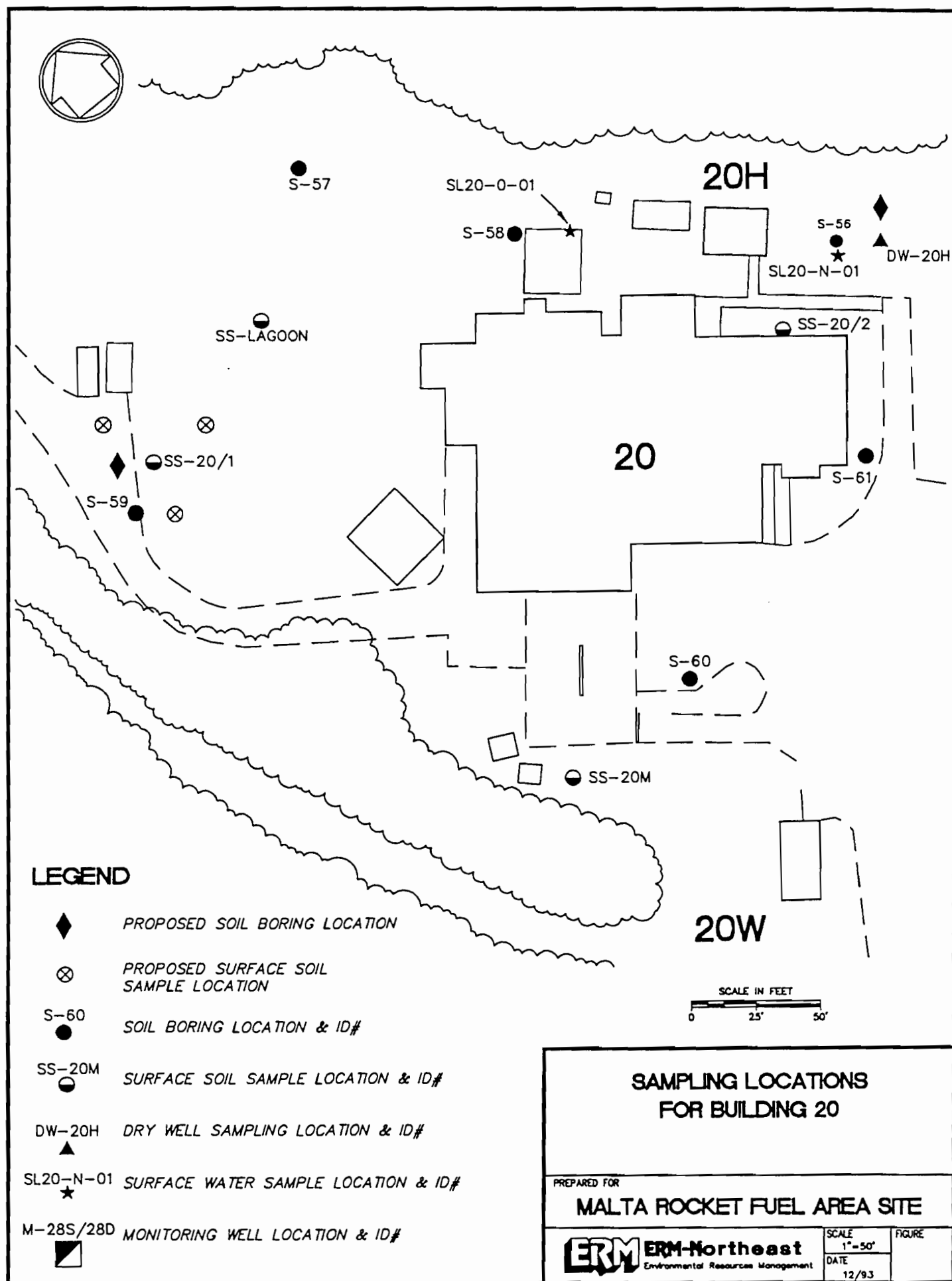


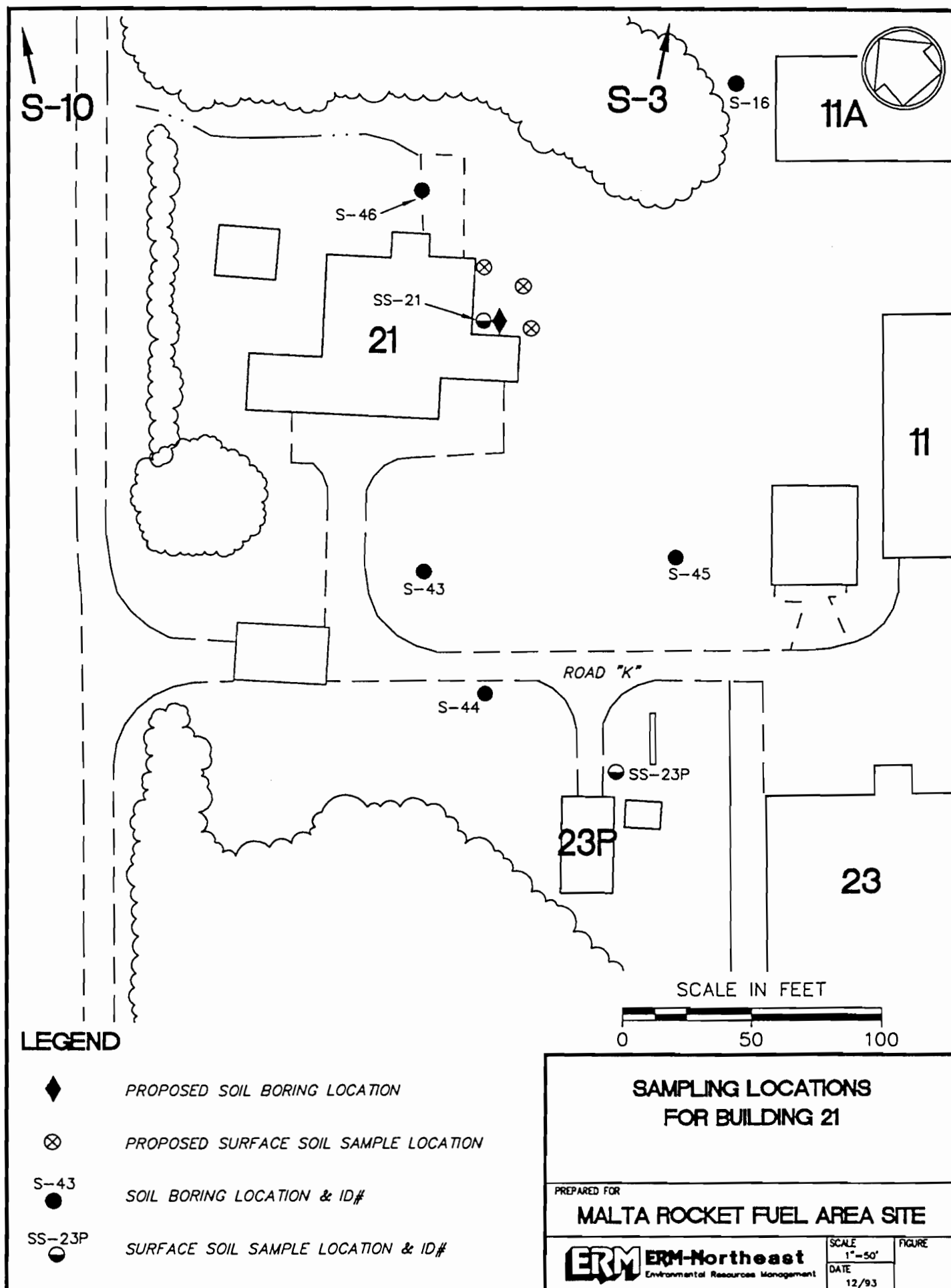


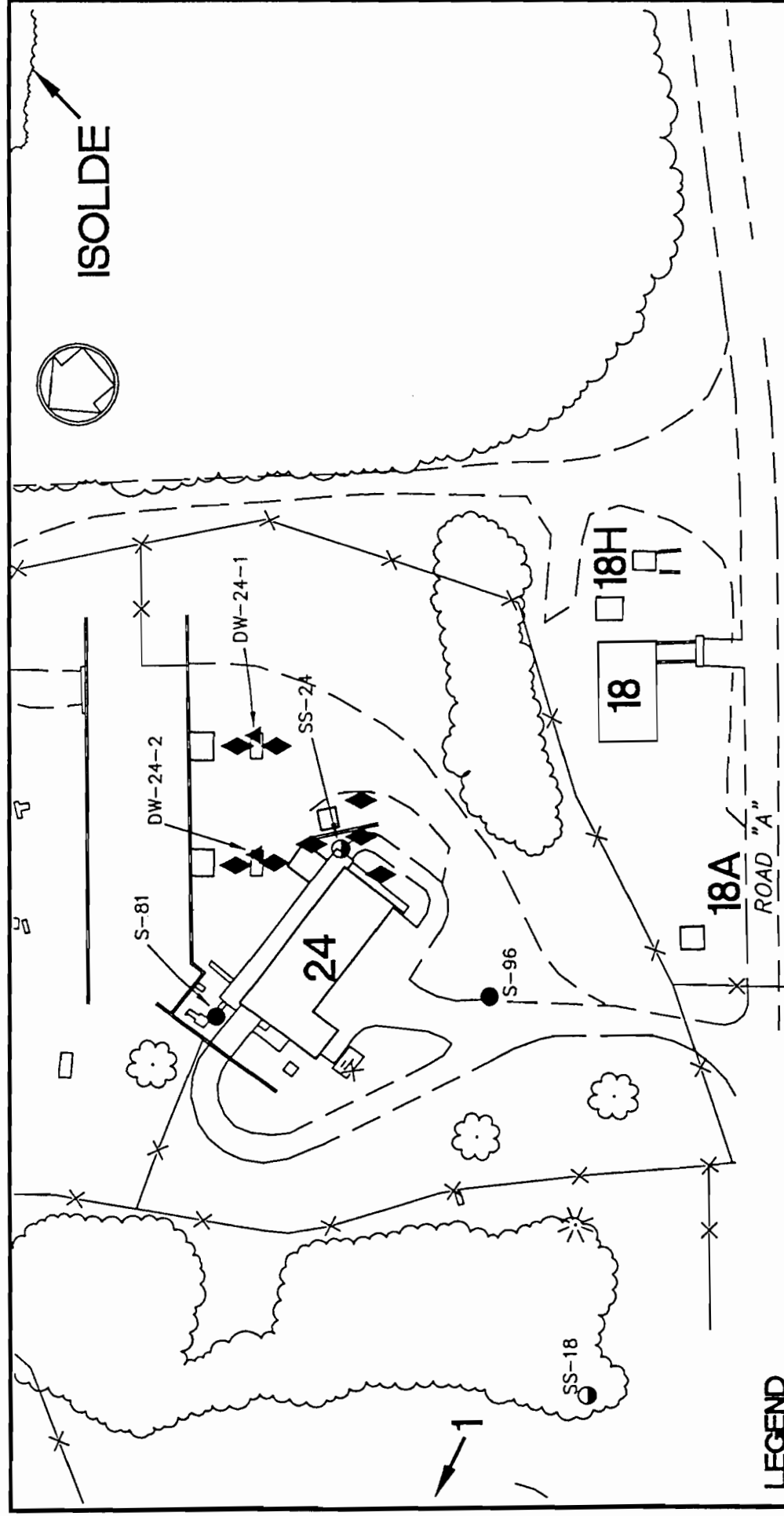












LEGEND

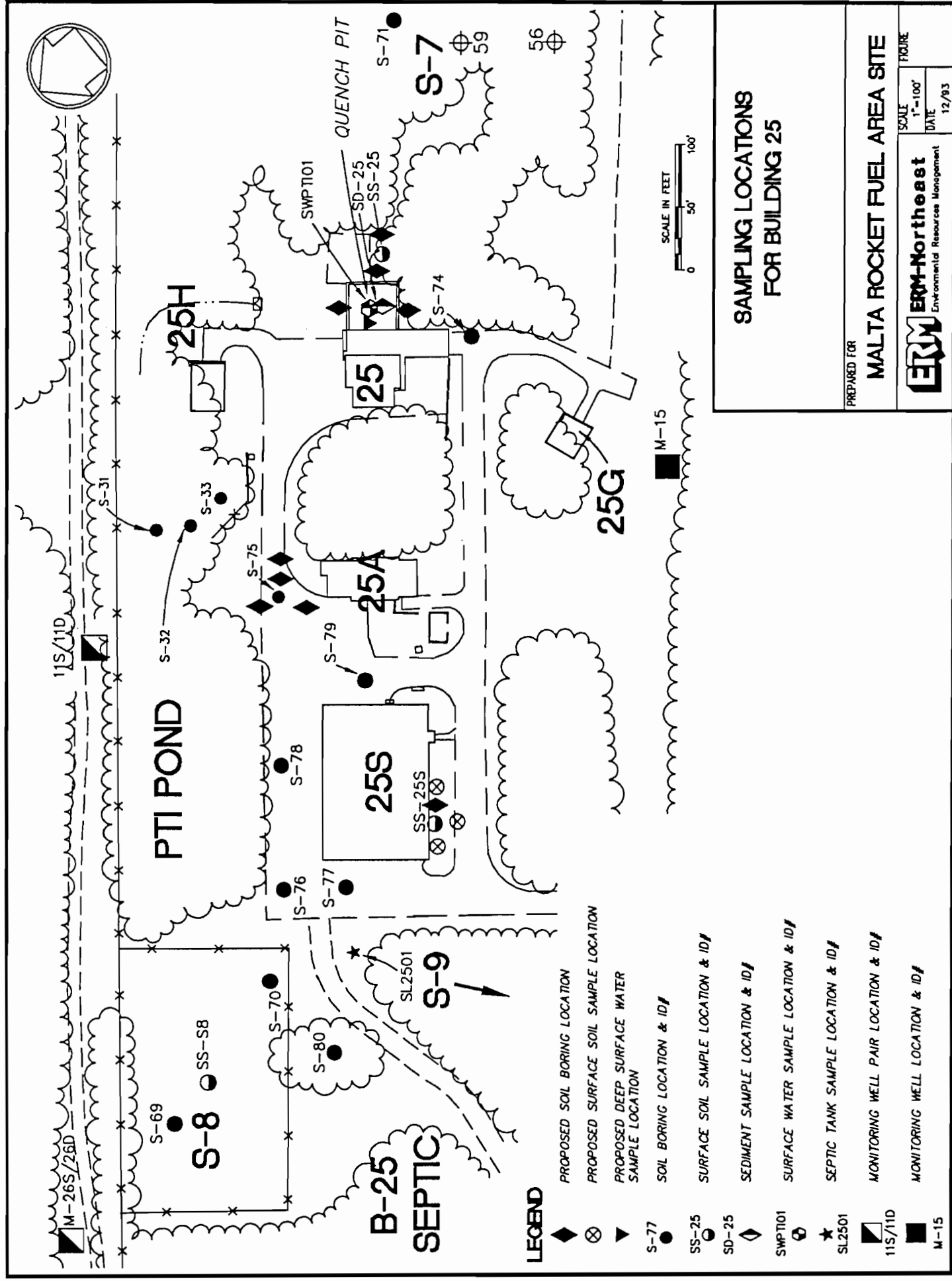
- ◆ PROPOSED SOIL BORING LOCATION
- S-96 SOIL BORING LOCATION & ID#
- SS-24 SURFACE SOIL SAMPLE LOCATION & ID#
- ▲ DW-24-1 DRY WELL SAMPLING LOCATION AND ID#
- ▣ 13S/13D MONITORING WELL PAIR LOCATION & ID#

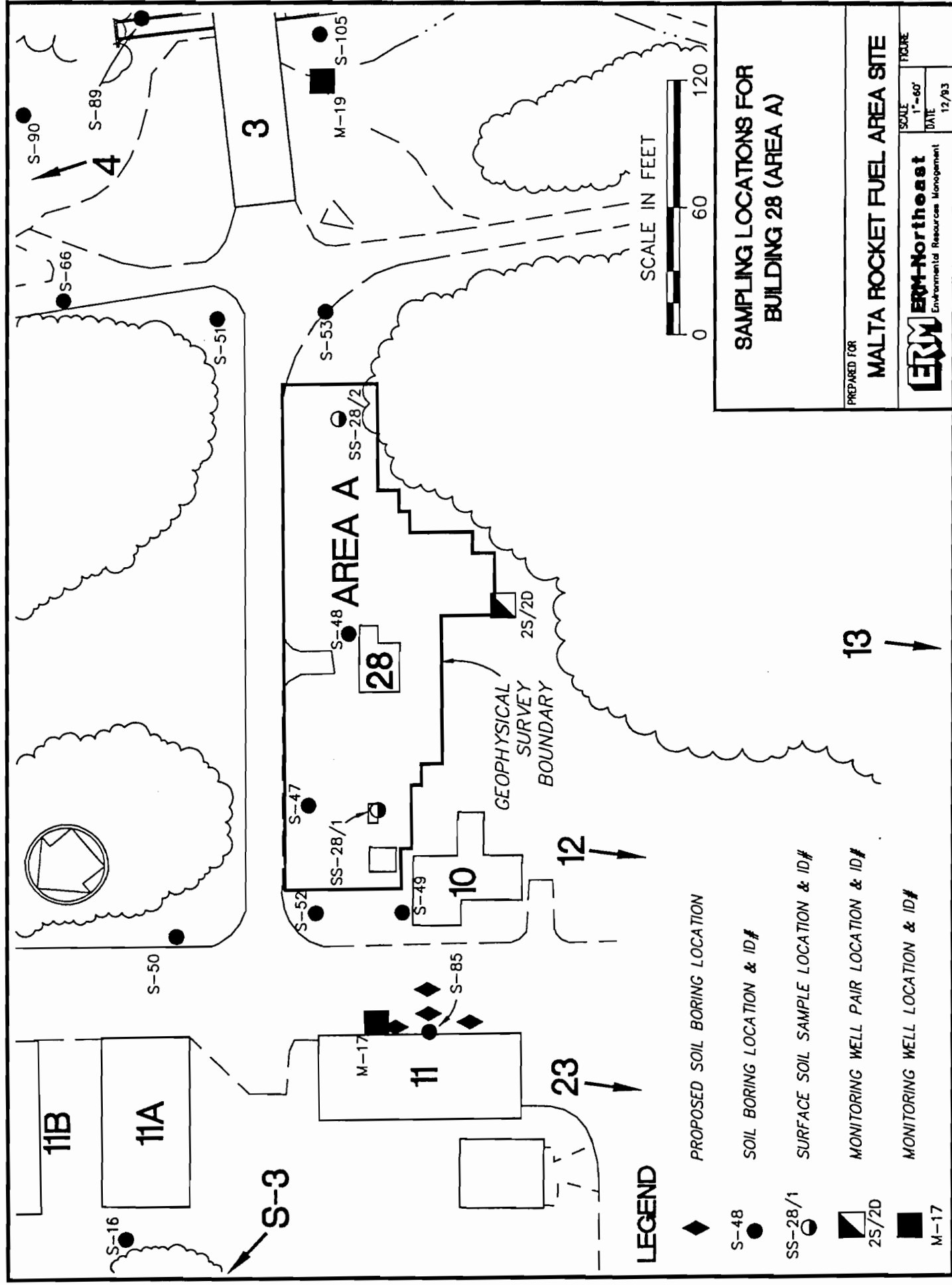
SAMPLING LOCATIONS FOR BUILDINGS 18 AND 24

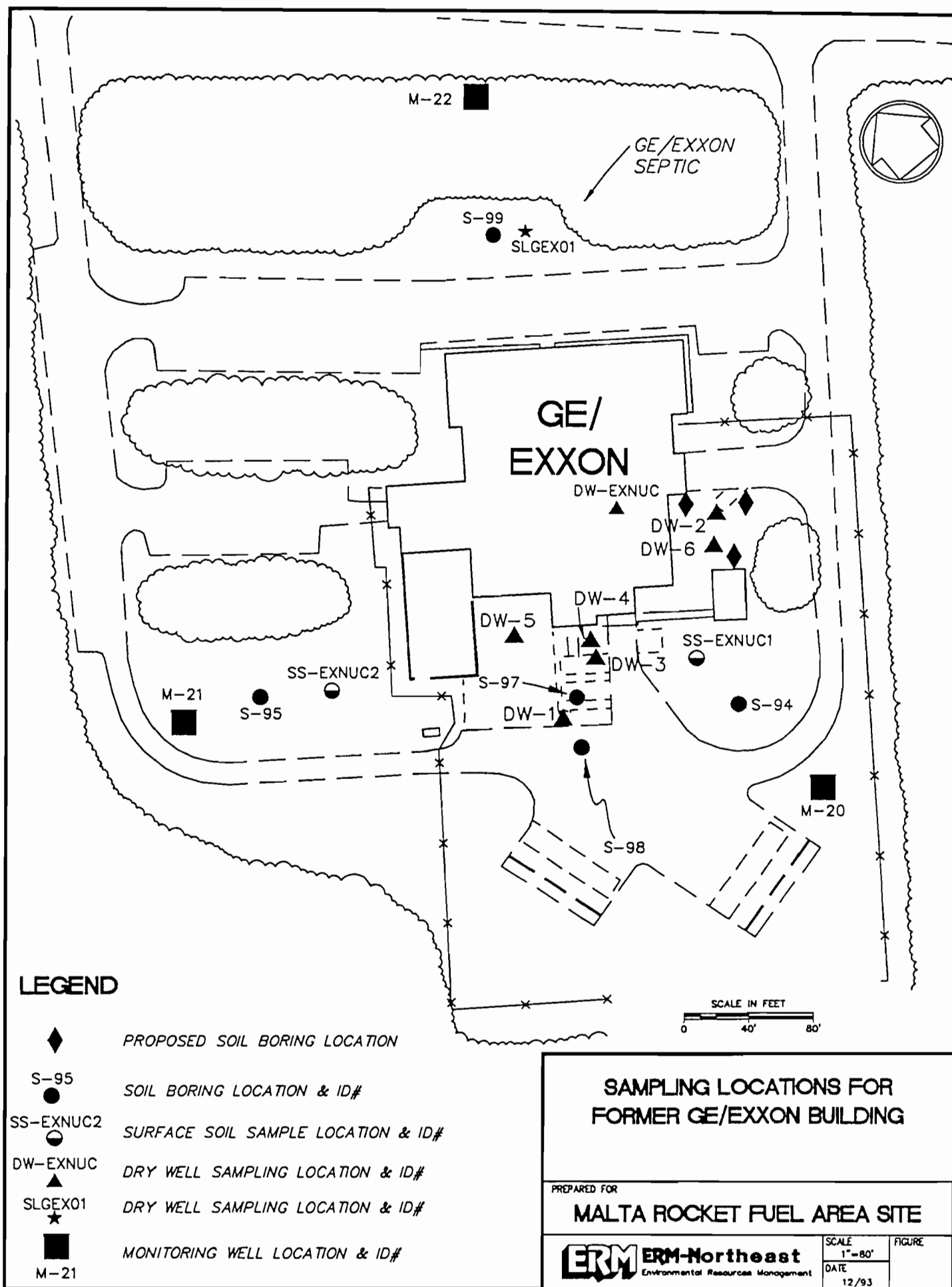
PREPARED FOR
MALTA ROCKET FUEL AREA SITE

ERM-Northeast
Environmental Resource Management

SCALE
1"=60'
DATE
12/93







1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25