FINAL WORK PLAN

PHASE III REMOVAL ACTION
TANAPAG VILLAGE, ISLAND OF SAIPAN
COMMONWEALTH OF THE NORTHERN MARIANA ISLANDS

Prepared for:

Environmental/DoD Support Branch
United States Army Corps of Engineers
Honolulu Engineer District
Building 230
Fort Shafter, Hawaii 96858-5440

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Contract No. DACW62-00-D-0001
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LIST OF ACRONYMS AND ABBREVIATIONS

ARAR	Applicable or Relevant and Appropriate Requirements
bgs	below ground surface
BRL	Below Reporting Limit
CEPOD	United States Army Corps of Engineers, Pacific Ocean Division
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
cm	Centimeters
CNMI	Commonwealth of the Northern Mariana Islands
COC	Chain of Custody
COR	Contracting Officers Representative
DEQ	Department of Environmental Quality
DF	Dilution Factor
DI	De-ionized
DoD	Department of Defense
ECC	Environmental Chemical Corporation
ECD	Electron Capture Detector
EPA	Environmental Protection Agency (United States)
FFS	Focused Feasibility Study
FUDS	Formerly Used Defense Sites
FV	Final Volume
GC	Gas Chromatograph
ID	Identification
IV	Initial Volume
kg	Kilograms
L	Liter
LCS	Laboratory Control Sample
m	Meters
mg/L	Milligrams Per Liter
mL	Milliliter
mm	Millimeters
MS	Matrix Spike
MSD	MS Duplicate
OSHA	Occupational Safety and Health Administration
PCBs	Polychlorinated Biphenyls
PM	Project Manager
PPE	Personal Protective Equipment
ppm	Parts per million
QA	Quality Assurance
QC	Quality Control
RCRA	Resource, Conservation, and Recovery Act
RF	Response Factor
RPD	Relative Percent Difference
RSD	Relative Standard Deviation

SC	Sample Concentration
SSHP	Site Health and Safety Plan
SOP	Standard Operating Procedure
SOW	Scope of Work
TSDF	Transfer, Storage, and Disposal Facility
TV	Total Volume
USACE	United States Army Corps of Engineers
USACEHD	USACE - Honolulu District
UXO	Unexploded Ordnance
WP	Work Plan

LIST OF SYMBOLS

^{o}C	Degrees Celsius
m	Micron
mg/kg	Micrograms per kilogram
mL	Micro-liter

1.0 INTRODUCTION

This Draft Work Plan (WP) has been prepared in accordance with the requirements of the December 20, 2000 RCRA Section 7003 Unilateral Administrative Order to the Department of Defense/Department of the Army to Clean up Polychlorinated Biphenyl Contamination in Tanapag Village, Saipan (RCRA 7003 Order). It is prepared for review and comment by USEPA, Region 9, and is subject to revision pursuant to the USEPA comments. It has been revised in response to USEPA comments dated 19 April 2001.

A Focused Feasibility Study (FFS) and Proposed Plan are being prepared in accordance with the public participation requirements of the RCRA 7003 Order and 10 USC 2701, in a manner subject to and consistent with section 120 of the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA).

This WP addresses the soil removal portion of Phase III, Tanapag Cemetery, Tanapag, Island of Saipan, Commonwealth of the Northern Mariana Islands (CNMI). Environmental Chemical Corporation (ECC) will conduct the work under United States Army Corps of Engineers (USACE) Contract No. DACW62-00-D-0001, Task Order No. 0002. The purpose of Phase III Removal Action is to identify and excavate soils contaminated with Polychlorinated Biphenyls (PCBs) at Cemetery 2, and at 21 other sites located mostly in Tanapag Village.

Work conducted during the previous phase (Phase II) succeeded in removing contaminated soils delineated at 16 locations around Tanapag to a cleanup criterion of less than 10 parts per million (ppm) PCBs. Preliminary characterization occurred in one additional area, Cemetery 2, in preparation for remedial action in the current phase.

Since the conclusion of Phase II in August 1999, the USEPA has collected soil screening samples in Tanapag, which have augmented the information obtained during Phase II; and established new areas of PCB contamination that were not identified previously.

ECC has been tasked to delineate areas in Cemetery 2, and the areas with soils identified by the USEPA, the Department of Environmental Quality (DEQ) and local residents at Tanapag Village and vicinity that exceed 1-ppm PCBs. The soil that has been excavated from the sites will be stockpiled in holding cells for treatment at a later date. The treatment process will be addressed in other documents.

2.0 BACKGROUND

The sites addressed in this WP are Cemetery 2 (Site C2) and 21 other sites, most of which are located in Tanapag Village. Two sites located in Dandan and San Antonio were added during the earlier stages of the Phase III investigation. Refer to Table 2-1 for List of Phase III Removal Action Sites.

2. 1 Site Location

The locations of Site C2 and the Tanapag Village sites are shown in Figure 2-1.

Of the Phase III Sites, the largest Site is located in the Main Cemetery (Cemetery 2 or C2), which is located directly between Tanapag Village and Garapan, approximately 1.6 miles northeast of the Navy Hill intersection in Garapan. C2 is a rectangular area consisting of approximately 2.3 acres. The remaining Sites are in clusters throughout the Village at locations near the shoreline, inland, and to the north of the Village, and in Dandan and San Antonio.

2. 2 Identification of Phase III Sites

The Phase III Removal Action sites have been grouped as follows:

- Cemetery 2 (C2) – Main cemetery area and narrow areas across the road on the west and south;
- Beach/Park Areas in Tanapag Village – Sites near the shoreline, mostly in public areas;
- Public Properties in Tanapag Village – Head Start Center, Cemetery 1, and adjacent Sites;
- Private Residences – Numerous private residences with lots in Tanapag Village; and
- Potted Plants and Planters – Sites to which soil was transported from C2.

Table 2-1
List Of Phase III Removal Action Sites

Site C2 (Main Cemetery)	Beach / Park Areas in Tanapag Village	Inland Village Sites	Potted Plant and Planter Sites
Area 1	Site AA /CC	Site A	Site Property 65
Area 2	Site BB	Site YY	Site UU
Area 3	Site SS / TT	Site C1	Site Rox Kani
Adjacent Areas Across the Road	Site E	Site J	Site XX
Kim Enterprises	Site Z	Site M / N	Site 65-dd (Dandan)
		Site Q	Site 65-sa (San Antonio)
		Site EE / JJ	
		Site LL	
		Site NN	
		Site VV	

2. 3 Cemetery 2 Site Description

Cemetery 2 is roughly rectangular and consists of approximately 2.3 acres (Figure 2-2). The area is generally flat, with an elevation of four feet above sea level. Soil berms, which previously surrounded the site on three sides, were removed and treated or disposed off Saipan during Phase II. The berms contained numerous capacitors that are presumed to be the source of PCB contamination at the site. There is an access road entrance on the northwest side of the site, and an asphalt-paved road bounds the south side of the site. Soil in this area consists of a thin, 0-10 cm thick layer of loose topsoil underlain by hard coral. The entire Cemetery 2 is considered a single site for this project.

2. 4 Tanapag Village Sites

Tanapag Village covers approximately 1.2 square miles (Figure 2-1). The topography of the area is moderately sloped from east to west toward the ocean. Elevation of the village ranges from sea level to roughly 12 feet above sea level. During previous investigations, soil found near the surface consisted of sand near the ocean, and mixed clay and silty clay further inland. Nineteen sites were previously investigated in Phase II. Sixteen of the sites were excavated, and three were confirmed free of contamination. Phase III will address new sites identified by the EPA, from their sampling conducted in the year 2000, and information received from the DEQ and local residents.

2. 5 Site History

The following site history is summarized from the Final Project Report, Remedial Action, Tanapag Village Contamination, Phase II, Tanapag, Island of Saipan, CNMI (ECC, 1999).

Soils in and around Tanapag have been contaminated with PCBs that leaked from electrical capacitors stored in the area. The affected soils include sand, crushed-coral fill, and clay. The PCB solution originally contained in the capacitors has been chemically characterized as Aroclor®1254 (Monsanto Corporation, St. Louis, Missouri).

The U.S. Department of Defense (DoD) had originally purchased the capacitors in the early 1960s. Thus, the USACE - Pacific Ocean Division (CEPOD, now the USACE-Honolulu District) determined in February 1991 that funding for the remediation of the Tanapag Village site and environs qualified under DoD's Defense Environmental Restoration Program - Formerly Used Defense Sites.

The known capacitors were removed from Tanapag Village in 1988/89 by Saipan's Department of Environmental Quality (DEQ). The extent of soil contamination was partially defined by a Site Investigation project in 1990 conducted by Woodward-Clyde and Associates.

In 1992 and 1993, additional site characterization was performed, and contaminated soil and capacitor debris were packaged and removed from selected sites in Tanapag Village, Cemetery 2, and the Department of Public Works-Lower Base Yard. Approximately 180 tons of PCB-contaminated soil was transported to a U.S. Mainland Transfer, Storage and Disposal Facility (TSDF) for incineration in February 1993. Although several sites were successfully remediated, a combination of poor weather and continued difficulty in defining the extent of contamination (due to the diffuse nature of the contamination) caused CEPOD to suspend further soil investigation and remediation efforts.

CEPOD estimated that further remediation would produce over 500 additional cubic yards of PCB-contaminated soil. Off-site disposal costs were deemed prohibitive; and therefore, alternative solutions were investigated, including on-site, in-situ treatment options. In early 1995, CEPOD authorized its contractor, Industrial Technology, to initiate a pilot study of a biotreatment approach. Pilot study results suggested that none of the five biological treatment approaches produced significant reductions or transformations in the tested soil batches.

An alternative remediation technology was sought, resulting in the selection of thermal desorption using "Thermal Blanket" technology for the Phase II cleanup. During Phase II, 20 sites were characterized and/or remediated during the project's two-year activity period. PCB soil contamination was found in close proximity to residences, churches and schools, and surrounding burial sites at two local cemeteries. Many sites required multiple rounds of soil sampling and excavation to delineate and remove the diffuse PCB contamination to below the 10-ppm project action level.

Excavated soil was transferred to a prepared soil storage cell adjacent to the treatment area in Lower Base, where it was held prior to thermal treatment. Remediated sites were either backfilled with quarry-supplied crushed, coral fill; or with thermally treated soil.

Of the 20 sites investigated and/or remediated, 16 were excavated with all contamination greater than 10-ppm removed, three were confirmed free of contamination, and one, Cemetery 2, is still contaminated with PCB levels greater than 10-ppm.

Numerous PCB capacitors or capacitor parts were discovered during excavation activities. The majority of these capacitors and capacitor parts were found in soil piles bordering Cemetery 2. All capacitors and capacitor parts were either thermally treated or were packaged and shipped to a U.S. Mainland TSDF for incineration.

Three sites in Tanapag village (LL, RR and Z) were confirmed dioxin contaminated. In aggregate, these sites produced 74 tons of dioxin-contaminated soil. Dioxin-contaminated soil was excavated and temporarily stored in one of the four treatment cells at the site (Lower Base). In July and August of 1999, this material was packaged and shipped to a U.S. Mainland TSDF for incineration.

In August of 1997, a thermal desorption system operated by TerraTherm Environmental Services was constructed at Lower Base in an area adjacent to and north of Cemetery 2. Over the next year, the system successfully treated 1,181 tons of PCB-contaminated soil to less than 1-ppm. In March 1999, the USACE modified the scope of work to have ECC perform a preliminary assessment of existing PCB contamination at Cemetery 2. The assessment of the area showed

PCB concentrations ranging from less than 10-ppm to greater than 20,000-ppm. At project demobilization, areas exhibiting levels of PCB contamination greater than 10-ppm were cordoned off with orange construction fence and posted with signs warning the general public to keep out.

In April 1999, the soil remediation approach was changed from on-site thermal desorption to off-site transport and disposal to a TSDF on the U.S. Mainland. A total of 547 tons of PCB-contaminated soil was shipped and disposed. Contaminated soil removal, site restoration and demobilization of all site equipment was completed by August 1999.

In May 2000, EPA collected soil screening samples in Tanapag, which have augmented the information obtained during Phase II; and established new areas of PCB contamination previously not identified.

The goal of Phase III is to delineate and remediate PCB contaminated soils greater than 1-ppm at the Cemetery 2 and selected sites in Tanapag Village. The excavated soil will be stockpiled in soil holding cells for future treatment projected to commence in early 2001.

3.0 SCOPE OF THE PROJECT

The scope of the PCB Removal Action supported by this Work Plan consists of the following major elements:

- Coordination of removal action by USACE-Honolulu District (USACE-HD) Environmental Branch with USEPA Region IX;
- Prepare an SSHP (to be submitted separately);
- Conduct soil sampling to characterize the PCB contamination;
- Conduct excavation of PCB-contaminated materials;
- Stockpile PCB-contaminated materials in containment cells for final disposition;
- Conduct treatment or disposal of PCB-contaminated soils (Indirect Thermal Desorption Work Plans for the Treatment and Disposal Tasks are being submitted concurrently under Separate Cover); and
- Prepare a project report.

In addition, the following elements will be addressed in separate documents:

- Prepare a Focused Feasibility Study and a Proposed Plan (to be submitted in May 2001 by *Wil-Chee Planning*);
- Perform a ground water investigation (Work Plan submitted April 15, 2001 by *Wil-Chee Planning*);
- Revise the Community Meeting Schedule (to be provided by USADEH).

3. 1 Current Site Status

Data from Phase II site characterization shows that Cemetery 2 contains areas contaminated well over one-ppm PCB. Preliminary data collected recently by the USEPA indicates that areas in Tanapag Village are also contaminated over 1-ppm PCB. A portion of Cemetery 2 has been designated for excavation without additional site characterization; the remaining portions of Cemetery will be characterized. A site characterization sampling and analysis will be performed at selected sites in Tanapag Village, the location of which was determined upon finalization of the preliminary USEPA data.

3. 2 Project Organization

The goal of this project is timely removal of impacted soil at the Tanapag site in an effective and safe manner. The project organization has been established to facilitate these goals.

3.2.1 Program Manager

Dave Cavagnol is the Program Manager. Mr. Cavagnol is responsible for: overall contract performance; communication with the USACE Contracting Officer's Representative (COR) regarding all contractual matters; development and final review of all plans and estimates; and oversight/direction of all project activities.

3.2.2 Project Manager

Mr. Kevin McCaskill is the Project Manager (PM). Mr. McCaskill is responsible for developing the plans, supervising site activities, implementing the sampling program, and coordinating with subcontractors and the onsite laboratory.

3.2.3 Site Supervisor

Kevin McCaskill is also the Site Supervisor. Mr. McCaskill will direct on-site activities including but not limited to sampling, soil excavation, and soil stockpile area preparation.

3.2.4 Project Engineer

Ryan Nelson will be the Project Engineer. Mr. Nelson will be responsible for conducting sampling activities and proper sample handling and documentation. Mr. Nelson will interface with both the onsite and offsite laboratories, and will be responsible for maintaining adequate inventories of all sampling supplies.

3.2.5 Site Safety and Health Officer

Mr. Morris Riddenour is the Site Safety and Health Officer (SSHO). He will ensure that work at the site occurs in a safe manner, and will ensure the proper implementation of the SSHP.

3.2.6 Analytical Services

ECC's Cincinnati Laboratory will be providing analytical equipment and an experienced Chemist to conduct on-site analysis of the soil for PCBs. An off-site laboratory will be used to provide analytical services for Quality Assurance (QA) samples collected during the characterization and verification phases of the project. QA samples will be submitted on a 10% basis. The laboratory chosen for the project is Sequoia Analytical, located in Petaluma, California. This laboratory has been validated by the USACE and accredited by the California EPA.

4.0 PRE-CONSTRUCTION ACTIVITIES

The following will be satisfied before the commencement of any onsite sampling or excavation.

4. 1 Survey of the Job Site

The ECC PM will survey the prevailing site conditions before commencing operations in order to evaluate site conditions that may have changed since the last site visit. This survey will include:

- Safe access and movement within work areas, walkways, runways, and passage ways;
- Heavy equipment turn space, parking areas, mud areas on roads; safety operation in material storage areas and dump areas;
- Necessary signs and signals to route vehicles on the job;
- Location of temporary buildings;
- Location and identification of high-voltage lines;
- Location of sanitary facilities and drinking water;
- Providing personal protective equipment (PPE) on the job, such as hard hats, Tyvek™ suits, and ear plugs, and adhering strictly to Occupational Safety and Health Administration (OSHA) requirements for site operations;
- Operational procedures of heavy equipment such as backhoes, trucks and loaders;
- Sufficient overhead clearance, particularly for power and telephone lines;
- Supply, maintenance and inspection of tools;
- Plans for maintaining safety;
- Safety meetings.

4. 2 Permits and Licenses

Because this project has been designated as a Comprehensive Environmental Response Compensation and Liability Act (CERCLA) removal action, no permits for on-site treatment are required. ECC will perform all removal operations in compliance with all applicable United States Federal Regulations, including Title 40, Code of Federal Regulations (CFR) Part 761 - *Polychlorinated Biphenyls Manufacturing, Processing, Distribution in Commerce, and Use Prohibitions*. In addition, the work will be performed to meet with the substantive requirements of State or local laws, rules and regulations. See Appendix A for the synopsis of Applicable or Relevant and Appropriate Requirements (ARARs).

Section 106 compliance has been met and work will be done in accordance with the National Historic Preservation Act.

4. 3 Protection of Existing Structures and Utilities

ECC will take necessary measures to protect existing structures, their appurtenances, or utilities that may be effected by removal and cleanup activities. Before initiating any excavation or digging, the local authorities will be contacted to mark the location of any underground utility lines.

4. 4 Safety Requirements

ECC will take all necessary preventive measures for safe site characterization and soil excavation activities. ECC's Emergency Response Plan is highlighted in the SSHP. The SSHP outlines personnel risk minimization through compliance with OSHA and USACE safety regulations.

4.4.1 4.4.1 Unexploded Ordnance

If unexploded ordnance (UXO) is discovered at any point during the project, site work at the point of discovery will stop immediately, and the Saipan Emergency Management Office will be contacted for UXO removal. A full-time UXO specialist will be assigned to implement UXO procedures at sites, if required. The beach sites at Tanapag Village are expected to require such control.

4.4.2 Community Safety

ECC will conduct operations in such a manner as to protect human health and the environment. ECC will erect wire-mesh construction fencing and the appropriate danger and hazardous site warning signs in English, Chamorro and Carolinian languages around each of the project sites and around the soil holding cells to be constructed. The fencing and signs will discourage the public from venturing into areas of potential PCB contamination. During the project implementation, the four-foot high perimeter fencing at Site C2 will be upgraded to six-foot high, welded steel mesh fencing, attached to wooden posts grouted into the ground. This will further discourage trespassers from entering the contaminated areas after ECC demobilizes. At the Village sites, all excavations will be fenced off and posted.

Air monitoring results will be reported in the community relations meetings. If necessary, traffic control will be provided. Road closures will be also be announced, as required, to minimize inconvenience to residents and, most importantly, to avoid traffic accidents when heavy equipment are working in public areas. Work progress and safety-related technical information will be shared with the public through fact sheets and presentations in community relations meetings.

Cemetery 2 has been ordered closed by the Governor of the CNMI, and will not be available for used until 15 October 2000. However, as an added precaution, a security guard will be retained to patrol the Cemetery 2 site for the duration of the project. The guard will be onsite when the crew is not working, and will aid in preventing the public from entering prohibited areas when the site is not active. ECC personnel will be working 10-hour shifts, six days a week at the site.

5.0 COMMUNITY RELATIONS PLAN

The Community Relations Plan for this project, summarized in this section, describes the methods ECC will employ to provide the general public timely and reasonable information on project activities and results.

The project takes place near residences and in a cemetery which has cultural significance. Protection of the community from hazard is the purpose of, and foremost consideration during project activities. The community will be kept informed, provided with a forum for discussions and questions, and be informed of project activities and results. The community relations plan includes elements that address dissemination of information on public health and safety.

The USADEH on-site representative will function as the project spokesperson. The USADEH project spokesman will serve to receive all information requests and to coordinate the public communications, meetings, and right-of-entries. In the absence of the on-site USACE representative, the USACE PM will remain the spokesperson for the project. Depending on the level of activity, periodic updates and press releases will be provided to the community members.

5. 1 Meetings

Monthly meetings will be held, depending on the USADEH evaluation of the community attendance and project status, to provide project status information. The DEQ, USEPA and other government entities will participate and facilitate discussions and coordination with the community members. Community leaders will be invited to act as intermediaries or points of contact for dissemination of information.

5. 2 Information Distribution

Information regarding project specifics, in the form of fact sheets, will be distributed at the weekly meetings. Fact sheets will provide contact information for the project spokesman, project status information, and key upcoming scheduling milestones. Information may be provided through periodic updates to the community as well as press releases.

5. 3 Rights-of-Entry

Rights-of-entry will be obtained from each property owner prior to any work commencing on the property. All property owners will be informed of the project's purpose and the potential hazards. The Tanapag Action Group may be requested to assist in contacting property owners.

5. 4 Monitoring to Ensure Safety and Health of the Public

The potential hazards to the public from the planned activities are 1) physical hazards created by an excavation and the equipment utilized; 2) air-borne dust and PCBs; and, direct dermal contact with PCB-contaminated materials.

ECC will mitigate physical hazards by controlling access to work areas by coordinating with the public. Dust hazards will be mitigated by water mist and monitoring by an air-monitoring program. The results from the air-monitoring program will be communicated to the public at the monthly meetings with the fact sheets. ECC will inform the public of the air monitoring data periodically and respond to questions in community meetings. Air monitoring will occur on a full-time basis during all excavation activities. Air monitoring devices will be equipped with alarms, which will be set to sound at levels below the allowable exposure limits for residents. This will enable ECC to stop work and mitigate any potential health hazards. Details of the air-monitoring program are presented in the SSHP.

5. 5 Project Planning to Address Cultural Concerns

The project has been planned to accommodate cultural concerns. A portion of the Cemetery 2 will be made available to the public by October 15, as shown on Figure 2-2. Public communication obtained during the project status meetings will be considered for subsequent project planning.

5. 6 Grave Excavation

A grave excavation procedure has been developed to protect the public from future exposure to contaminated soil and to prevent disturbance of any remains. The grave excavation procedure is described in Section 7.2. One week prior to any excavation being started at any grave location, the Tanapag Action Group will be informed so that they may notify relatives.

5. 7 Unexpected Events

Persons to be notified by the spokesperson in case of unexpected events are CNMI DEQ, the EPA Pacific Insular Program, the EPA On-Scene Coordinator, and the Tanapag Action Committee. An example of an unexpected event is a spill.

6.0 SITE CHARACTERIZATION

Sites will be characterized prior to excavation to establish the lateral extent of PCB contamination greater than 1-ppm. Site characterization will involve surface sampling; at Cemetery 2, limited pothole sampling will also be performed. Site characterization may also involve soil sampling below coral roads and concrete chip sampling of concrete foundations.

6. 1 Vegetation Clearing

Some sites, such as Cemetery 2, will require clearing prior to sampling. Vegetative cover, such as brush, will be cut using weed-whackers. Brush will be removed during excavation and placed in the soil containment cells.

6. 2 Concrete

At Cemetery 2, there are several concrete slabs throughout the site. During the Phase II investigation, chip samples from one of the slabs were analyzed for PCBs, and the concrete pad was determined to be contaminated with PCBs greater than 1-ppm. This pad is shown in Figure 2-2. Therefore, the concrete pad will be treated as contaminated material. The pad will be broken up using a backhoe or track-mounted excavator equipped with a hydraulic hoe-ram. Dust suppression will be used during this operation to limit the potential for an inhalation hazard. The concrete rubble will be treated as contaminated material, and as such will be transported with a front-end loader to the soil cells for stockpiling. Stockpiling is further discussed in Section 7.3.

Concrete pads and foundations encountered during Phase III work, and located within or adjacent to the contaminated soil, will be sampled. If contaminated above 1-ppm, the concrete will be removed and stockpiled as described above. Details of concrete sampling are discussed in Sections 11.1.4 and 11.1.5.

The concrete slab to be used as the support zone at Cemetery 2 was determined to be below the action level during Phase II. The support zone is shown in Figure 2-2. There will be no further sampling of this slab during Phase III.

6. 3 Sub-surface Sampling at Cemetery 2

Test pits (pothole excavation) will be performed in Cemetery 2 to allow for sub-surface sampling as described in Sections 6.4 and 11.2.2. A small tracked excavator will be used to pothole the sample locations. The excavator bucket will be decontaminated between sample locations.

6. 4 Site Characterization Sampling

Two different sampling protocols will be used during site characterization. One method will be used at Cemetery 2, due to its large size and anticipated extent of contamination; and a second method will be used at all other sites. Soil samples will be analyzed at ECC's field analytical laboratory to be located within the DEQ laboratory. Where appropriate, sample results will be available on a 24-hour turnaround basis, and sample results from a previous day of sampling will be used to dictate additional sample locations the following day.

ECC will follow the EPA sampling protocol established in 40 CFR Part 761 for the Tanapag Village sites. The protocol involves establishing square grids at a 3-meter (m) interval. Samples are collected from the grid intersections. At Cemetery 2, which is in excess of 22,000 m^2 in size, less dense sampling is required. Less concentrated sampling at Cemetery 2 is justified because:

1) Contamination has been present at the surface of Cemetery 2 for approximately 30 years, subjected to weather, traffic, significant re-grading with heavy equipment, and grave excavation activities - all of which are expected to have created a uniform concentration of PCBs in the ground surface;
2) The topography of the site is flat, precluding the possibility of erosion forces consolidating contaminated soils into specific areas;
3) Being a cemetery, no residences or constant occupancy structures are expected to be constructed in the area and human exposure is limited; and
4) A large-scale excavation effort is planned for the area and tightly grouped samples are not needed - any detected contamination will be excavated within the sample's large area of inference.

In an area at the center of the Cemetery 2 site, historical surface data already exists and it is known that excavation and removal of PCB-contaminated soil is required. This area is referred to as the Footprint (hatched area in Figure 2-2). The remainder of Cemetery 2, outside of the Footprint, is referred to as the perimeter (area around hatched area in Figure 2-2).

Characterization sampling protocols differ between the footprint and perimeter areas. Sampling in the perimeter area of Site C2 will progress until bounded by sample grids testing at less than 1-ppm PCBs. Details of Cemetery 2 sampling are discussed in Section 11.1.1.

The other sites around Tanapag Village are mostly small in size, and in many cases, known PCB contamination is limited to one or two sample locations. In Tanapag Village, the sites will be located using sampling information supplied by the EPA, the DEQ and local residents. At each site, a sample grid will be established, centered at the previous sample point. If the original data identify multiple points of contamination, one grid will be established to encompass the multiple points. New soil samples will be collected at the grid nodes.

As at Cemetery 2, the sampling grids will be expanded until the contamination is bounded by a contiguous series of samples with concentrations below 1-ppm PCBs. Details of sampling the Tanapag Village sites, other than Cemetery 2, are discussed in Section 11.1.2.

7.0 SOIL REMOVAL PROCEDURES

Soil with PCB contamination greater than 1-ppm will be excavated at each site, loaded into dump trucks or front-end-loaders, and transported to soil holding cells constructed in Cemetery 2. The stockpiled soil will later be disposed off-site or treated. After soil excavation, each site will be sampled to verify that all PCB contamination has been removed to less than 1-ppm. If contamination remains at or above 1-ppm PCBs, further excavation will occur, followed by additional verification sampling. This process will continue until soil sample results have verified that all PCB contamination has been removed to less than 1-ppm. Excavation boundaries will extend to peripheral sample locations testing below 1-ppm PCBs. Final excavation depths will be determined by sampled excavation surfaces testing at below 1-ppm PCBs.

7. 1 Soil Holding Cells

Soil holding cells will be constructed in Cemetery 2 (Figure 7-1). Cell construction will occur concurrently with site characterization, so that a cell will be ready to accept soil once site characterization is complete.

The cells will be designed to safely hold soil for the duration of the removal effort, and will be designed to with stand high winds and rain associated with severe storms. The manufacturer's liner specifications guarantee against deterioration from ultra-violet radiation. Each soil cell will be approximately 49-m long and 12-m wide, and will accommodate 1,150m^3 (1,500 cubic yards of soil) (Figure 7-2). The soil cells will be built side-by-side, in a modular fashion. Once a cell is filled to capacity, another will be built next to it, and the process continued.

The cells will be recessed approximately zero to one meter into the ground depending on site conditions, so that a full soil cell will maintain a relatively low profile. The height of the soil cells above ground will be approximately 4 to 8m. Excavation is not anticipated to reach groundwater, which was observed at 1m bgs during the previous phase of work. If groundwater is encountered, the excavation will be back filled to one foot above the depth of the groundwater, and the liner replaced.

A portion of the material excavated to create the cell will be used to build a 1m high by 1.5m wide berm around the perimeter of the cell. The remaining material, if found to be less than 1-ppm PCBs, will be temporarily stockpiled for use as cover over the PVC liner, once the cell is filled with soil. The excavated soil will be tested for PCBs. Once a soil cell area has been excavated, verification sampling will be performed at the floor of the excavation for PCBs.

Each soil cell will be lined with a 30-mil PVC liner, which will extend up and over the berms surrounding the cell. Two cells will be active for soil placement at any one time. One cell will be protected by a temporary structure designed by Omni Structures International, Inc. (Figure 7-2). This covered cell will be used during light to moderate rain events. With a structure in place, repeated covering and uncovering of the soil cell between shifts, or during inclement weather (common in Saipan during the rainy season) will be unnecessary. Soil will be transported to and placed in this cell with front-end loaders. The overhead restrictions of the structure prohibit the use of dump trucks. The other cell will not be covered with a temporary structure. This uncovered cell will be utilized during non-rain events. At the end of every shift and/or when rain is expected, this entire cell will be covered with the 30-mil PVC liner. This will allow for higher productivity by eliminating the overhead restrictions of the structure and by allowing the use of dump trucks in addition to front-end loaders. The structure will be 12m wide, 49m long and 6m tall along its centerline. The structure has a galvanized-steel frame and a cord-reinforced laminated polyfilm covering. The structure is secured to the ground by anchor posts. In preparation for severe weather conditions, the structure can be dismantled. Soil will be transferred from the covered cell to the uncovered cell during non-rain periods in order to maintain capacity in the covered cell for rainy weather work.

Once a cell is filled to capacity, a 30-mil PVC liner will be placed over top of the stockpile to prevent rainwater intrusion. Soil will be placed around the base of the stockpile and partially up the sides of the stockpile in a one-foot-thick depth to secure the liner in place. Upon ECC's demobilization from the site, provisions will be made for monthly inspections of the soil holding cells.

USACE or ECC engineers will inspect the holding cells on a monthly basis, and after each typhoon or major earthquake, for integrity. If contaminated soil is exposed through the liner or spilled outside of the cell, ECC will mobilize a response team to contain the release and repair the liner and berm. USACE will inform the DEQ and the USEPA of the incident and the proposed response action within 24 hours of discovery.

The liner specifications have been submitted by USADEH to the USEPA. It is ECC's understanding that if the soils are still in the cells on September 2001, additional effort will be taken to reinforce the cells. ECC will determine cell integrity on a cell by cell basis and cells will be repaired and reinforced as needed.

7. 2 Excavation

All excavation will be conducted in accordance with EPA’s PCB spill cleanup policy, outlined in 40 CFR, Part 761, Subpart G; and by the SOW. Soil with PCB concentrations greater than 1-ppm will be excavated and removed.

Before any excavation will commence, an exclusion zone, contamination reduction corridor and a support zone will be established to control the spread of contamination. The excavation will be performed carefully as to not disrupt any utility or petroleum-containing pipes. The equipment used for excavation will be tested for safety requirements and the excavation operations will be conducted in accordance with USACE and OSHA specifications. ECC will use a track-mounted excavator or rubber-tired backhoe for these excavation operations. The excavation operations will be performed as per the specifications for each site. The excavation tasks include the following:

- The excavations will be of the required width and length to maintain excavation side slopes less than or equal to the maximum allowable side slope based on angle of repose of the excavated materials. The excavations will be stepped where there is not enough room for sloping.

- Surface water will be diverted to prevent entry into the excavation by use of ditches, banks and sloping, as appropriate. Due to the apparent transmissivity of the lithologic units at Cemetery 2 (i.e. coral gravel and sand), standing water is not anticipated.
- At the Tanapag Village sites, ECC will load soil directly into the standby dump trucks, for transportation directly to the soil holding cell.
- The excavation will be conducted in a manner that will limit the mixing of potentially contaminated soil with uncontaminated soil.
- The excavation operations will comply with the requirements by EM 385-1-1; Safety and Health Requirements Manual, published by the USACE; and applicable OSHA requirements.

The area of excavation will be determined during the characterization phase for each site (Section 5.0). Each contaminated area will initially be excavated to approximately 0.5-m below ground surface (bgs). After excavation, verification sampling will be conducted to determine whether contamination has been successfully removed. If PCB contamination of greater than 1-ppm persists, excavation and verification sampling will continue at 0.5-m vertical intervals, until PCBs are reported less than or equal to 1-ppm in samples collected from the excavation floor.

If excavation is required in a grid containing a grave, the following steps will be implemented:

- The Tanapag Action Group (TAG) will be notified and TAG will communicate with relatives
- Shoring is not anticipated to be required for the narrow excavations adjacent to existing graves
- Within the limits of a grave contaminated soil will be excavated to a depth not to exceed 60 cm

Removing soil to 60-cm bgs within the footprint of the grave will not disturb the human remains, but should provide adequate margin of safety for preserving the integrity of the grave, while removing the PCB contamination to protect visitors.

7. 3 Stockpiling of Soil

All soil removed from the excavation area will be transported to the soil cell(s) by front-end loader (Cemetery 2) or by 5 CY dump truck (Tanapag Village sites) fitted with a tarp. If a spill occurs, the residual soil will be removed immediately. For the dump trucks, a tarp will cover soil during transportation. Any loose soil on the exterior of a truck will be brushed off before transport to the storage cell. Finally, during any soil loading, dust suppression will be utilized to ensure that airborne particulates are kept to a minimum. Air monitoring for dust will be continuously performed.

7. 4 Verification Sampling

After the identified contaminated area has been excavated to approximately 0.3-m bgs at each site, verification samples will be collected to determine if any contamination remains. As with characterization sampling, two different verification sample protocols will be used at Cemetery 2 and all other Tanapag Village sites. Verification sampling details are described in Section 11.0.

A verification-sampling scheme has been designated for Cemetery 2 after excavation, which will place sample locations based on the variation in the data. If the data shows a less-than-expected uniformity, the post-excavation samples will be collected closer together, to ensure all contamination is removed. A detailed discussion of the sampling approach is presented in Section 11.0.

Samples will be analyzed in the field laboratory for PCBs. If analytical results determine that PCB contamination is still above 1-ppm, an additional 0.3m will be excavated in the affected areas, another grid established, and additional samples collected. This process will continue until verification samples confirm PCBs at less than 1-ppm.

7. 5 Backfill

Backfill will be accomplished using non-contaminated soil and/or crushed clean coral fill. All excavated areas will be back-filled to their previous grade.

7. 6 Presence of Groundwater

If groundwater is encountered in the excavation pits near the shoreline during high tide, excavation work will be halted for a 12-hour period or until the tide recedes. Site-specific methodologies to enable further excavation will be evaluated on a site-by-site basis, considering site characteristics - including the soil PCB concentrations, geology, location, weather conditions, and any other pertinent considerations.

7. 7 Resurfacing of Excavations

The surface of all excavations will be smooth graded and vegetated to match the pre-excavation condition, if required.

8.0 SPILL PREVENTION AND CONTROL PLAN

ECC will be responsible for any spills or leaks during the performance of this contract. ECC will follow the reporting procedures specified in the USACE technical memorandum for spill response. ECC will provide contingency measures for potential spills and discharge from trucks handling off-site transportation and any other potentially hazardous materials on-site. ECC will:

- Provide methods, means, and facilities to prevent contamination of soil, water, air, structures, equipment, or material from a release due to ECC's operations;
- Provide equipment and personnel to perform emergency measures to mitigate spills and control their spreading; and
- Properly dispose of contaminated materials.

8. 1 Required Equipment

ECC will have the following equipment on-site at all times in order to handle hazardous material releases:

- Noncombustible absorbent
- Backhoe
- 55-gallon drums
- Shovels and other hand tools.
- Appropriate PPE

8. 2 Contingency Plan

As per USACE instructions the following requirements will be met during a spill response action:

- Notify the COR immediately;
- Take immediate measures to control and contain the spill;
- Affected community members will be evacuated to a safe location if a public health threat is posed;
- Isolate and contain hazardous spill areas;
- Deny entry to unauthorized personnel;
- Do not allow contact with spilled material;
- Stay upwind;
- Use water spray to reduce dust;
- Take samples for analysis to determine adequate cleanup; and
- Spill removal and clean-up actions, as needed.

Any uncovered capacitors will be handled as contaminated material.

8. 3 Notification of Spills and Discharges

ECC will orally notify USADEH, USEPA, and DEQ within 24 hours of discovery of the incident. ECC will submit a report to USADEH, USEPA, and DEQ no later than ten days after a release, to include the following items:

- Description of material spilled, including identity, quantity, and a copy of the waste disposal manifest;
- Exact time and location of the spill, and the description of the area involved;
- Containment procedures utilized;
- Description of the cleanup procedures employed at the site, including disposal of spill residue;
- Summary of the communications between ECC and other agencies; and
- The date upon which the report to the appropriate agency was made, as well as the name of the agency representative who accepted the report.

8. 4 Reporting Requirements

ECC will have a representative available on Saipan, who will be on call 24 hours a day during scheduled field activities, to handle potential emergency situations at the site. A contact telephone number will be set up once ECC personnel are mobilized to the site. This number will be provided to the USADEH, DEQ and USEPA as soon as it is acquired.

9.0 DECONTAMINATION PROCEDURES

9. 1 Exit from Sites

Decontamination will be required for any personnel or equipment prior to exit from the exclusion zone established for each PCB excavation site. The decontamination facilities will be located in the contamination reduction zone. Exit from any of the sites requires the following procedures as described below:

- Exit from exclusion zone (EZ) through the contamination reduction zone (CRZ);
- All gloves, protective suits, and booties will be removed at the end of the day's work or prior to leaving the site;
- Dispose of Tyvek™ suit, booties and latex gloves; store other protective clothing in a manner to avoid potential contamination of inner surfaces;
- Thorough washing of the entire body is required as soon as possible after doffing of protective outer garments and leaving the site.

9. 2 Decontamination

All equipment and materials leaving the contaminated area of the site will be decontaminated to remove all potentially harmful chemicals. The procedure will be an organized process, with a series of stations to provide the maximum level of decontamination with clearly defined areas and all necessary equipment. The procedure will vary from site to site but will always include the following steps:

1. Equipment drop;
2. Boots wash/rinse (step off);
3. Boots and gloves removal;
4. Suit removal;
5. Face-piece removal, wash/rinse;
6. Field wash (face, hands).

Personnel assigned to the decontamination process will assist workers, and decontaminate equipment and reusable protective gear.

All field equipment such as probes, tools, etc. will be decontaminated with a solution of Alconox™ and water, and rinsed with water before the equipment is stored for future use. Rinsate will be placed in 55-gallon drums. The drum contents will be dispersed on the contaminated-soil stockpiles.

To decontaminate heavy equipment, a decontamination station contained by a berm will be established at the edge of the contaminated area, accessible to the contaminated area. The berm will separate the exclusion zone from the support zone. Four heavy-duty grates will be placed within the decontamination station so that all four wheels of the trucks will be off that ground at once. All vehicles will be decontaminated on these grates. All decontamination water will stay in the EZ. Grates will be washed between vehicles.

At Cemetery 2, the size of the site will dictate that a front-end loader is used to move soil from the excavation area to the soil holding cell(s). Therefore, a corridor will be established between the site and the adjacent soil holding cell(s), which will allow the trucks to travel back and forth without decontamination. The corridor will be considered part of the exclusion zone. Once soil transfer is complete at Cemetery 2, the trucks and heavy equipment will be properly decontaminated.

At the other sites, the excavating equipment and dump trucks will be staged outside of the exclusion zone where possible, so that only the excavator (or backhoe) bucket is reaching in to excavate contaminated soil. This will minimize the equipment decontamination requirements. Dust suppression will be employed to minimize airborne particulates during soil excavation and loading.

In case of an emergency, in which personnel need to be transported off-site for medical attention, the employee will be decontaminated before leaving the site. If life-saving care must be given immediately, decontamination will not be considered.

9. 3 Disposal of Decontamination Materials

Materials such as liquid rinsate and PPE, resulting from decontamination activities, will be placed in separate, Department of Transportation-approved, 55-gallon containers for temporary storage. The drums will be stored adjacent to the soil cells, in a controlled area surrounded by fencing. Drums will be covered by durable, UV-resistant plastic, to provide a certain level of protection from sun and rain during the duration of waste storage. The covering will be secured by rope or by other methods necessary to resist damage by high winds.

It is estimated that 5 to 10 drums of decontaminated materials will be generated. The waste will be placed in the last active cell for final disposition.

10.0 SITE OPERATIONS

The tasks described in the following sections present the site operations that will be followed for this project after all equipment, materials and personnel have been mobilized to the site. These sections outline the tasks that will be completed in order to close each of the remaining active sites.

Some of the tasks described above will progress concurrently. The proposed project schedule is presented in Appendix B. ECC will maintain coordination among the tasks to ensure strict adherence to the project schedule.

10. 1 Cemetery 2

Cemetery 2 will be the first site characterized, as the removal action for the active cemetery must be completed by 15 October 2000. Sampling data from Phase II was used to determine that the Footprint Area is contaminated at >1-ppm PCBs (Figure 2-2). After vegetation clearing, soil samples will be collected to characterize the vertical extent of contamination in the Footprint Area. Surface samples will be collected to characterize the remaining areas of Cemetery 2. Once the perimeter of the site is established, the entire area will be cordoned off with wire mesh construction fencing, and the different work zones established. Next, the soil storage cell area will be established along the northwest perimeter of the site (Figure 7-1). Construction fencing will extend around the soil storage area.

The contaminated areas of the site will be excavated starting on one end and working across the site to the opposite end. Excavation will be designed to ensure that the probability of cross-contamination is minimized. Once excavation is complete in an area, a sample grid will be established, and soil verification samples collected to ensure that contaminated soil has been removed. Further excavation will be necessary if analytical results indicate residual PCB contamination equals or exceeds 1-ppm PCBs.

10. 2 Village Sites

Over the course of the project, other sites in Tanapag village identified as PCB-contaminated will be characterized by sampling and excavated until verified to have less than 1-ppm PCBs. . ECC will assess site conditions and commence site investigation and removal activities following the procedures defined in Section 11.

10. 3 Site SS-TT

Site SS/TT is located at the Tanapag Beach Park. The PCB-contaminated sand and sediment will be removed from site SS/TT. Sampling and excavation will proceed as at other sites, until groundwater is reached. Sections 10.3.1 and 10.3.2 address excavation procedures below groundwater. The three areas within site SS/TT, where PCB concentrations are greater than 1-ppm below groundwater, have been called ST-1, ST-2, and ST-3. These areas are shown in Figure 10-1: Site SS / TT Excavation Diagram.

10.3.1 Site Characteristics

Special operations are required at Site SS-TT because it is located near the beach and the contamination extends below the groundwater table. The proposed approach will minimize the potential for contamination of the lower strata through engineered controls.

Three localized areas were identified as contaminated with PCBs at above 1-ppm concentrations below the round water table within the larger site SS/TT excavation. The three contaminated are currently 1.1-m bgs to approximately 0.2 m below the brackish water table. Standing water is always present in these areas due to a shallow water table. The subject areas are located in a coastal zone between 50 foot and 80 foot from the high tide mark (vegetation line). Brackish water within the excavation is tidally influenced. The observed average variation in water level within the areas of concern is between 5 to 10 centimeters (cm) daily. The substrate is sand from grade to approximately 4-m bgs, underlain by soft coral shelf.

10.3.2 Excavation Approach Below Ground Water

The removal effort is divided into two tasks:

(1) Inserting sheet piling around the peripheral of the three areas of contamination; and
(2) Excavating and removing isolated contaminated sand and sediments.

The proposed method to remove the PCB-contaminated sand with minimum cross contamination would be to enclose (box in vertically) Sites ST-1, ST-2 and ST-3 with sheet piling. The sheet piling will be driven vertically to 12 bgs and into the soft coral shelf. Sand and sediment within each contained area will be excavated in increments of a minimum of 0.3 m. Water will be drained from the excavator bucket before the soil is loaded into trucks for transport to the soil containment cells. The truck beds will be lined with 30-mil PVC liners to prevent soil or water spills from the truck during transport.

At completion of excavation, verification sampling will take place immediately. If sample concentrations remain > 1-ppm, an additional 0.3m will be excavated as described above and verification samples will be collected again. Excavation and sampling will continue until all verification samples are less than 1-ppm. It is assumed that the EPA will collect their verification samples during ECC’s field effort.

11.0 FIELD SAMPLING PLAN

This Field Sampling Plan describes the approaches which will be used to gain chemical data during site characterization and cleanup verification, including sampling and documentation methods, decontamination procedures, and sample handling procedures in the field.

During the earlier stages of Phase III characterization, a buried group of crushed drums with oily sheen was uncovered at C2 in the area of Soil Holding Cell # 10. Approximately, 15 rusted drums were removed and cleaned on site and disposed as metal scrap. The soil at the buried drum location was sampled and tested for RCRA metals, TCLP metals and PCBs. Further work dealing with the drums is not authorized by the Formerly Used Defense Sites (FUDS) program. The landowner is responsible for the drums.

11. 1 Sample Grids

A grid sampling approach will be employed. As required by the EPA, a grid sampling strategy will be implemented, which has been proven to be successful in previous phases of PCB cleanup at Tanapag, and. In 1998, EPA updated their grid sampling policy for self-implementing on-site cleanup and disposal of PCB remediation waste. The updates are outlined in 40 CFR 761, Subparts N and O; and in 40 CFR 761.289. Briefly, the new policies are centered on a square grid system with a 3-m interval.

This approach will be used at all the sites except Cemetery 2. ECC proposes an alternative approach for Cemetery 2, which is designed to allow for construction to proceed in the most-efficient and least-disruptive manner, is based on the site conditions, and is followed up with a rigorous, statistically-based excavation verification sampling. The rationale for the proposed site characterization at Cemetery 2 is provided in Section 6.4. This approach is described in detail in Section 11.1.1, while the EPA approach for the Tanapag Village sites is described in Section 11.1.2.

Note that a certain amount of flexibility will be necessary with the application of the grid sampling approach at certain sites. For example, at Cemetery 2, certain sample locations may fall directly over an obstacle, such as a headstone. In these cases, the sample locations will be shifted off the nearest edge of the obstacle and a soil sample obtained. As another example, PCB-contamination soil at Site UU is located in planter boxes, which are not amenable to a grid sampling strategy. The sampling strategy will need to be revised at this site, using best judgement, to obtain necessary chemical data.

11.1.1 Cemetery 2 Sampling Approach

A systematic random-start sampling approach will be utilized at Cemetery 2, adopted from Chapter 9 of SW-846 (EPA, 1997a). Other documents consulted during the development of this approach include Statistical Methods for Environmental Pollution Monitoring (Gilbert, 1987) and PCB Risk Assessment Review Guidance Document (EPA, 2000).

Site Characterization Sampling:
The purpose of site characterization sampling is:

- To estimate the quantity of PCB-contaminated material to be excavated;
- To determine a logical progression of excavation in order to minimize cross contamination; and
- To ensure that contaminated soil is identified for excavation. .

Initially, a clear delineation on-site will be made between the areas which will be automatically excavated (Footprint), and areas which will require site characterization to assess their lateral limits (perimeter). The footprint is based on historical data (Figure 2-2). Two established benchmarks in the road north of Cemetery 2 (TC-1 and TC-2) will be used to create a network of temporary survey control points around Cemetery 2. A total station survey instrument will then be used to layout the footprint/perimeter boundary.

Footprint:
Based on site characterization efforts conducted in Phase II, the Footprint Area is contaminated above the action level. Therefore, additional characterization of the surface of the Footprint Area is not needed and the Area is designated for excavation. However, in order to provide planning information so that the most-efficient and least-disruptive excavation can be executed, depth sampling at selected locations will be performed in the Footprint Area. Additional justification for this pre-excavation sampling strategy in Cemetery 2 is presented in Section 6.4.

In order to establish vertical extent of contamination, an 18-m x 18-m grid will be established over the entire Footprint. Each 18-m x 18 m grid will be divided into nine sub-grids of equal area. A random number generator will be used to select one of the nine sub-grids as a depth sample location. A list of random numbers between 1 and 9 will be generated using Excel, and then printed out for use in the field. The numbers will be used in the order they appear on the page and crossed out after use, ensuring a new random number is used for each grid. Within the sub-grid selected for sampling, a small excavator or backhoe will be used to pothole approximately 0.6 m bgs. From the test pit wall, one sample will be collected at 0.3-m bgs and another at 0.6-m bgs.

Perimeter:
Both surface and depth characterization samples will be collected in the perimeter area. For the perimeter, a 10-m x 10-m grid will be used. This grid spacing is based on previous characterization data from Phase II, historical information about the nature of the contamination spread and site traffic/re-grading, and a statistically-based, post-excavation follow-up sampling. Additional justification for the Cemetery 2 sampling strategy is presented in Section 6.4.

Each 10-m x 10 m grid will be divided into nine square sub-grids of equal area. For sampling in the Footprint area, a random number generator system, described above, will be used to locate three sample points. The three random numbers will correspond to three of the nine sub-grids, which will be selected as locations for surface samples. Surface samples will be collected from the center of the sub-grids, as shown in Figure 11-1. A new set of three random numbers will be used for each grid.

One depth sample location will be chosen for every three adjacent grids, equivalent to one depth sample location per $300m^2$ (or 3-10m x 10m grids). A small excavator or backhoe will be utilized to dig approximately 1m bgs at the chosen location. From the test pit wall, one sample will be collected at 0.3m bgs and another at 0.6m bgs.

The PM may increase the number or samples collected and the depth of the characterization based upon site conditions and knowledge of contamination concentrations within the grid. However, the number of samples will not be less than three per 10m x 10m grid, with at least one depth sample location per three grids. In certain cases within the Cemetery proper, where sample points fall directly over a gravesite, samples shall be collected no deeper that 30-cm bgs.

In grids for which any sample result was reported at greater than 1-ppm PCB, adjacent grids must be established and sampled to determine the lateral extent of contamination. Additional grid layout and sampling will continue until PCB concentrations are less than 1-ppm for all samples bounding the contaminated area.

All areas of the Footprint and perimeter with soil concentrations greater than 1-ppm will be excavated to 0.3m bgs unless depth samples indicate PCB contamination deeper than 0.3-m bgs. Where depth samples at 0.3m bgs are greater than 1-ppm, the area will be excavated to 0.6-m bgs.

<u>Excavation Verification Sampling</u>:
The post-excavation survey process consists of calculating a standard deviation value sigma (δ) from the site characterization data, and using that value to calculate the number of samples required for post excavation surveys.

Generating Standard Deviation:
The site characterization data set of concentrations greater than Below Reporting Limit (BRL) and less than 1-ppm will be entered into a spreadsheet in order to calculate the standard deviation.

The Sign Test:
Since the contaminant is assumed not present in background, contamination levels are compared directly to the clean-up criteria. The Sign Test is used to determine the minimum number of data points necessary to meet the specified clean-up goals.

The combination of sampling design error and measurement error is termed as the Total Study Error. Since it is impossible to eliminate error in measurement data, two types of decision errors can occur: Type I / Type II.

A Type I error is commonly referred to as a false positive. The probability of a Type I error is denoted by alpha (α). α is sometimes referred to as the size of the test. A Type II error is commonly referred to as the false negative. The probability of a false negative is denoted by beta (β).

The probability of a Type I decision error that is tolerable falls under the 95% confidence level. Therefore, the error rate is set at 0.05 ($\alpha = 0.05$). The probability of a Type II error falls under a 90% confidence level, which equates to an error rate of 0.10 ($\beta = 0.10$).

The initial step in determining the number of data points is to calculate the Relative Shift, delta (Δ/δ). Δ is one-half of the clean-up criteria and δ is the estimation of the standard deviation from the survey unit. The survey unit is defined as the relevant data set from the site characterization data. Table 5.5 in NUREG 1575 (EPA, 1997b) lists values for the number of samples (N) for a given relative shift (Appendix C). Note that this table accounts for an additional 20% more samples to account for missing and/or unusable data.

For post-excavation survey planning, Δ is set at one-half the clean-up criteria (0.5-ppm).

The following example will be calculated using a δ set at 0.19.

Relative Shift (Δ/δ) = 0.5/0.19 = 2.63

Referring to the table in Appendix C, a relative shift of 2.63 would dictate the collection of 15 samples from each survey unit.

After the samples have been collected for each survey unit, the statistical test will be run again using analytical results from the cleanup verification samples. A new δ will be calculated, resulting in an updated relative shift. This number will be used to calculate whether enough samples were collected during cleanup verification sampling. If it is determined that an insufficient number of samples have been collected, additional samples will be collected from the survey unit that has failed. The locations of the additional samples within each of the survey units would be determined using a grid and a random number generator.

Grid Lengths:
Since the population is in random order, random-start systematic sampling, utilizing triangular grids, has been chosen for the cleanup verification sampling. Triangular grids provide more uniform coverage of the target population and yield a more accurate estimate of the mean concentration.

The surface area for the grids eligible for verification sampling, and the following equation, will be used to determine the spacing of the systematic pattern:

L = SQRT(A/.866N)

Where,

N = Number of samples
A = Surface area of grids eligible for post excavation surveys (2000 m2)
L = Spacing of the systematic pattern

Continuing with our example, if N = 15 samples (assuming a relative shift of 2.63), then L would be calculated as follows:

L = SQRT[2000/.866(15)] = 12.41 m

After L is determined, a row of sampling points is established parallel to Magnetic North, at intervals of L. A second row of points will then be developed parallel to the initial row at 0.866 x L from the first row. Sampling locations along the second row are midway between the points on the first row. Additional parallel rows of sample points will be laid out until an excavation is covered. Figure 11-2 depicts the setup of a verification sample grid.

Due to the size and shape of some of the excavations in Cemetery 2, the sample points may not be parallel to Magnetic North, and the spacing between samples may be less than the calculated value. This will resulting in a denser verification sampling grid and a greater number of samples collected than is necessary to reach a 95 % confidence level for the cleanup, but will ensure all excavations are sufficiently sampled.

Verification samples with concentrations greater than 1-ppm will be removed. Excavation lines will be drawn midway between samples greater than 1-ppm and less than 1-ppm. All soil within these excavation lines will be excavated an additional 0.3 m bgs. The verification sample grid will be reestablished as described above and an additional round of verification samples will be collected. This process will continue until all sample concentrations are less than 1-ppm.

11.1.2 Tanapag Village Sampling Approach

This sampling approach is in accordance with 40 CFR 761, Subparts N and O. It should be noted that ECC will consider the depth of the floor of the excavation, after removal of all soil contaminated above 1-ppm PCBs, to represent the vertical extent of contamination.

During site characterization, a 3-m x 3-m grid will be used as the basis for sample locations. Samples will be collected at the corners or intersections of the grids. One 3-meter grid will be centered on singular points of contamination, as identified from Phase II or EPA sampling. If there are adjacent original data points, then one 3m grid will be established to completely encompass the original data points (Figure 11-3). With this approach, each of the original data points will be surrounded by at least four characterization samples. All characterization samples will be discrete samples.

Where characterization analytical results are greater than 1-ppm, the grid will be expanded on the same 3-meter interval, and additional samples collected. This process will continue until all areas of PCB contamination are surrounded by characterization samples below 1-ppm.

After a site is fully characterized, it will be excavated to remove approximately 0.5 m of soil vertically. The excavation will extend laterally to the grids with PCBs reported less than 1-ppm.

Excavation verification sampling will be conducted in accordance with 40 CFR 761, Subpart O.

The regulations require the collection of samples at a 1.5-m interval. Due to this dense sampling interval, ECC will employ composite sampling, as allowed under 40 CFR 761.289. The regulations allow for combining up to nine samples into one composite sample over a 3-m x 3-m grid area. 3 m x 3-m grids will be laid out on the excavation floor, covering the entire excavation. In cases where a square grid will not fit at the edge of an excavation, a rectangular or triangular grid may be used, but the area of the grid shall not exceed $9m^2$. One composite sample will be collected from within each grid. Each composite sample will consist of nine aliquots evenly spaced within the grid. An example of the verification sample layout for Tanapag Village sites is shown in Figure 11-4.

In accordance with Subpart O, if verification sampling indicates that further excavation is required, and more soil is removed, a new verification sample grid must be established following the re-excavation. Soil will be removed in 0.3-m vertical intervals, with verification sampling in between, until all analytical results are less than or equal 1-ppm.

11.1.3 Sampling Protocol Around Roadways

Two categories of roads will be encountered during remedial activities, paved and unpaved. Paved roads are roads topped with concrete or asphalt cover, unpaved are roadways that are topped with either coral or gravel. At the Tanapag Village sites where contamination reaches the roadway edge, areas across the street will be sampled (except Cemetery 2 site) as described in Section 11.1.1.

Unpaved Roads

If characterization sampling of a site shows PCB contamination greater than 1-ppm at the edge of an unpaved roadway, then sampling will continue across the roadway. Subsurface samples will be collected beneath the coral or gravel road at 3-meter intervals as described for characterization sampling in Section 11.1.2. Subsurface sample locations will be potholed to the depth of visible soil beneath the coral or gravel, usually 20 to 30 cm bgs. A sample of the soil will be collected and the pothole back-filled.

Paved Roads

If characterization sampling of a site shows PCB concentrations greater than 1-ppm at the edge of a paved roadway, a row of surface samples, 3 meters apart, will be collected directly across the road. If any of the samples across the road are greater than 1-ppm, characterization will proceed as described in Section 11.1.2. No sampling of the paved road cover is anticipated.

11.1.4 Sampling Protocols for Foundations and Structures

If characterization sampling of a site shows PCB concentrations greater than 1-ppm at the edge of a house foundation, then sampling of the structure may be directed. The concrete surface will be brushed clean of any loose soil prior to sampling. The concrete foundation will be chip sampled at a point nearest the contaminated soil. A minimum of one sample will be collected from each concrete foundation.

Wood chip samples of floorboards or walls may also be collected if the structure is made predominantly of wood. The surface will be cleaned of any loose dirt and wood chips or splinters will be collected using a knife or pliers which have been decontaminated.

Based on site conditions and direction by the government, high traffic areas within the building may be sampled. Sample point(s) shall be areas with the highest traffic potential such as exterior entryways.

11.1.5 Protocols for Sampling Concrete Pads Other Than Foundations

If characterization sampling of a site shows PCB concentrations greater than 1-ppm at the edge of concrete pads, then concrete chip samples will be collected. A minimum of one sample will be collected from each concrete pad, with more samples collected from larger pads. Sample locations will be selected randomly and chip samples will be collected from the surface of the pad. The surface will be brushed clean of any loose soil, and the top 2 to 3 cm will be chipped out using a hammer and chisel.

11.1.6 Protocols for Sampling Soil Stockpiles

Soil stockpiles in each loaded containment cell will be sampled at random at two locations as discrete samples collected in 4-inch brass sleeves. These samples will be analyzed for the EPA priority pollutants, and the results will be considered in planning the treatment options. The sampling rationale and analytical methods will be presented in the Indirect Thermal Desorption Plan, to be submitted under separate cover.

11. 2 Sampling Procedures

11.2.1 Equipment Decontamination Sampling

During sampling activities, appropriate decontamination measures shall be taken to minimize sample contamination from external sources such as sampling equipment or sample containers. Decontamination procedures consist of cleaning the sampling equipment using a non-phosphate surfactant, a distilled water rinse, and isopropyl alcohol rinse, followed by another distilled water rinse.

11.2.2 Sample Collection

The following is the procedures that ECC will follow for the collection of soil samples.

- For samples that require excavation into the subsurface, a backhoe will be used to pothole. The wall of the test pit will be sampled at the correct depth (at 0.3 meter and 0.6 meter bgs). Soil on the surface of the test pit wall will be scraped away using a hand trowel, to mitigate any potential cross-contamination that may have occurred from the backhoe bucket. Additionally, the backhoe bucket will be swept of any loose material to mitigate cross-contamination between samples.
- Soil samples will be collected with a hand trowel and placed in a glass jar. Each jar will be labeled with the unique sample identification (ID) number, location, and date.
- Composite or duplicate samples requiring homogenization will be mixed in stainless steel

bowls or clean plastic bags prior to being placed in a glass jar.

- For hard to reach locations, the backhoe bucket may be used. The bucket will be decontaminated before use in sampling and between each unique sample. The sample will be taken from the center of the soil in the bucket.
- Sampling equipment will be decontaminated after each sample. Containers will be new and certified clean by the vendor.
- All samples collected shall be preserved according to EPA and/or USACE protocols established for the parameters of interest, as described in the Table 11-1.
- All relevant sampling information will be recorded in the field notebooks and chain of custody forms (Appendix D).
- Samples for off-site analysis will be shipped in an ice chest. Plastic bags containing ice or blue ice will be placed inside the ice chest in order to maintain its contents at the required 4 degrees Celsius (^{o} C) temperature. Custody seals will be used on the ice chest. In addition, a chain of custody form and analytical request form will accompany each ice chest.

11.2.3 On-site Sampling Equipment

ECC uses the following equipment to collect samples on-site:

- Disposable gloves
- Stainless steel spoon
- Stainless steel trowels
- Stainless steel auger
- Coring sleeves
- Distilled water for decontamination
- Non-phosphate surfactant for decontamination
- Isopropyl alcohol for decontamination
- 4 oz glass jars and 1 L amber glass bottles with Teflon sealed caps
- Disposable wiping clothes
- Survey flags
- Sample bags and seals
- 100-foot tape measure
- Compass and site maps
- Cooler maintained at 4°C to preserve samples onsite
- Ice for sample preservation
- Plastic bags
- Labels for sample containers of good quality
- Bubble wrap for packaging samples being shipped for off-site analytical

11.2.4 Excavation Sampling

Entry into excavations over four feet in depth will only be allowed under the following conditions: shoring is in place, the excavation has been benched in increments not to exceed four foot in vertical height, or the sides of the excavation have been sloped at an angle less than 45%. If appropriate, the backhoe bucket will be used to bring a soil sample from deeper excavations for sampling at the surface. In addition, a hand-held sampler with an extension may be used for avoiding entry of personnel into an unstable excavation.

11. 3 Survey of Sampling Locations

A total station land survey instrument will be used throughout the project to accurately locate sample points, excavation boundaries, buildings, and monuments relevant to the work. A network of temporary control points will be established throughout Cemetery 2 and Tanapag Village. Using these control points, all sample locations will be surveyed immediately after samples are collected, so that they can be relocated later and accurately placed on the final project drawings.

All survey data collected will be recorded in field logbooks.

11. 4 Field Log Books

All procedures used in sampling will be documented along with any site-specific information concerning sampling in field logbooks. Each day's sampling activities will be recorded in a bound, page-numbered book. The person overseeing the sampling activities will be responsible for maintaining the field log with daily entries, signed at the end of each day.

11. 5 Sample Handling

11.5.1 Labeling

Sampling locations will be sequentially numbered and their location will be displayed on a schematic of each site. Each sample container will be clearly identified with the sample ID number, date of sampling, and location. Field information will be written in indelible ink, and a label will be permanently affixed the respective container. The sampling numbering system will be coordinated to ensure that the proposed ID numbers are unique in the project data set. All sampling information will be recorded in the field logbooks.

ECC will utilize an alphanumeric system to assign sample ID numbers, consisting of six alphanumeric strings. The format is:

TNPG3-hh-nnn-ddd-date-xaaa

The "hh" designation represents the site from which the sample was pulled. For example, Cemetery 1 and Cemetery 2 will be represented as C1 and C2, respectively. The third string, "nnn", will indicate the phase of sampling – "CHR" for site characterization sampling and "VER" for excavation verification sampling. The fourth string, "ddd", indicates the depth of the sample (in m) in the case of characterization samples, or the round of excavation being sampled in the case of verification samples. Rounds of excavation will be abbreviated as R1, R2, etc. The fifth string, "date", indicates the date the sample was collected, in the format DDMMYY. For example, November 5, 2000 would be represented as 051100. The sixth string, "xaaa", indicates the unique sample number for the site. "x" describes the sample medium, where:

1 = groundwater,
2 = soil or concrete,
3 = tank contents,
4 = rinsate/decontamination fluid, and
5 = surface water.

For example, the numbering scheme will result in the first soil sample taken from Site AA/CC being labeled as follows:

TNPG3-AACC-CHR-0.1-140900-2001

Waterproof labels will be used to protect the integrity of the sample. Clear plastic tape may be used to augment the integrity of the label in moist conditions. Sample tags may also be used in addition to the labels.

11.5.2 Packaging and Shipping

ECC will follow the procedures listed below for packaging and shipping the samples:

- The samples will be stored in insulated plastic coolers;
- The samples will be kept in glass jars with Teflon lids;
- Each sample will be wrapped in bubble wrap to protect the container during transport.
- The jars will be enclosed in clear plastic bags, through which sample tags and labels will be visible. The jars will be kept upright in the cooler;
- Bags of ice will be placed on top, around, on and among the samples;
- Remaining space of the container will be filled with bubble wrap;
- The chain of custody (COC) record will be placed in a water proof plastic bag and taped to the inside portion of the lid of the cooler, using masking tape;
- The drain of the cooler will be shut and the cooler will be secured by duct tape;
- A current United States Department of Agriculture Soil Importation Permit from the receiving laboratory will be affixed to the top of each cooler;
- A signed custody seals will be affixed to the front of the cooler;
- Coolers will be shipped via Continental QuikPak™ to ensure the fastest delivery to the QA laboratory;
- ECC will insure minimum weight of each cooler, as per specifications.

The above-described procedure will be followed for all samples. The shipper hazardous certification form will be completed by ECC before shipping.

11.5.3 Chain of Custody Records

A COC will be completed for all samples collected throughout the project, showing the date and time each sample was collected and when the samples were released to the laboratory for analysis. A COC will accompany all samples delivered to the ECC field lab and all samples shipped off island. The original forms will be retained by ECC's field chemist to be filed at

ECC's Corporate Headquarters at the end of the project.

11.5.4 Sample Handling and Preservation

All samples collected shall be preserved according to EPA protocols established for the parameters of interest. Appropriate measures should be taken to ensure that temperature requirements are maintained during transport to the laboratory, and prior to log-in and storage at the laboratory. ECC will follow the procedures recommended by USACE in "Chemical Data Quality Management for Hazardous Waste Remedial Activities, ER1110-1-293", for sample handling and preservation. The following table provides the summary of the sample handling procedures.

Table 11-1
Sample Containers, Preservation, and Holding Times

Location	Parameter / Matrix	Container	EPA Method	Preservation[1]	Holding Times (days)
On Site	PCB / Soil	One 4 oz wide mouth glass jar, full with Teflon lined lid	8082	Ice to 2-6^{o}C	14
Off Site	PCB / Water	2-one liter amber glass jars	8082	Ice to 2-6^{o}C	7
Off Site	PCB / Soil	One 4 oz wide mouth glass jar, full with Teflon lined lid	8082	Ice to 2-6^{o}C	14

Notes
1. Sample preservation will be done in the field immediately upon sample collection. The sample will be capped, sealed, labeled, and immediately placed in a cooler to bring the temperature to 4^{o}C or lower.

12.0 QUALITY ASSURANCE PLAN

12. 1 Elements of Quality Control

12.1.1 Precision

Precision measures the agreement among individual measurements of the same property, usually under prescribed similar conditions. Precision describes the effects random errors have on analytical measurements. Precision is a measure of the degree of reproducibility, and is usually expressed in terms of relative percent difference or standard deviation. Acceptance ranges for precision are discussed in Section 12.2.7. Corrective actions to be taken when precision ranges are not met are discussed in Section 12.2.8.

12.1.2 Accuracy

Accuracy is the degree of agreement of a measurement with an accepted reference or true value. The accuracy of an analytical procedure is determined by the addition of a known amount of material (matrix spike) to a field sample matrix or a standard matrix. Accuracy is used to estimate the impact of systematic errors or biases on analytical measurements required for programmatic decision-making. Acceptance ranges for accuracy are discussed in Section 12.2.7. Corrective actions to be taken when accuracy ranges are not met are discussed in Section 12.2.8.

12.1.3 Representativeness

Representativeness expresses the degree to which sample data accurately and precisely represents actual site conditions. Representativeness involves the selection of analytical methods and sampling protocols and locations such that results are representative of the media being sampled (i.e., water, soil, etc.) and of the conditions being measured. It is the qualitative parameter concerning the proper design of the sampling program.

12.1.4 Completeness

Completeness is a measure of the amount of valid data obtained from a measurement system compared to the amount that was expected and needed to meet the project data goals. Field data completeness is assessed by comparing the number of samples collected to the number of samples planned. The completeness goal for this project is 95 percent. Analytical completeness is assessed by comparing the total number of samples with valid analytical results to the number of samples collected.

Completeness will be evaluated both qualitatively and quantitatively. The qualitative evaluation of completeness will be determined as a function of all events contributing to the sampling event including items such as correct handling of chain of custody forms, etc. The quantitative description of completeness shall be defined as the percentage of controlled laboratory quality control (QC) parameters that are acceptable. ECC's laboratory quantitative assessment for completeness will include surrogate percent recovery of organic analyses, analysis of field and laboratory for RPD, analysis of MS/MSD analyses for percent recovery and RPD, and analysis of laboratory control samples (LCSs) for percent recovery. As per the requirement, ECC's QC

Officer will supervise ECC's laboratory performance and achieve at least 90% quantitative assessment of completeness.

12.1.5 Comparability

Comparability is a qualitative measure of the confidence with which one data set can be compared to another data set. Comparability is achieved by using standard methods to collect and analyze representative samples and the reporting of the resulting data in standard units.

12. 2 Field Laboratory

The majority of the samples that will be taken to characterize contamination at the various sites will be analyzed at the field laboratory, to be setup within the DEQ laboratory. This will eliminate sample shipment time and provide rapid analytical results so the project can proceed without the threat of down time.

12.2.1 Scope and Applications

ECC will utilize a gas chromatographic (GC) procedure with electron capture detector (ECD) and capillary column applicable to the determination of Aroclor 1254. During Phase II sampling, Arochlor 1254 was determined to be the only Arochlor of concern at the Tanapag sites. The ECC field laboratory will only analyze samples for Arochlor 1254.

This procedure is applicable to soils and sediments. The following policies will be adhered to for all analytical work.

- Soil samples are extracted within 14 days holding time from sampling date.
- Any sample with extract concentration over the calibration curve (1,000-ppb) is diluted to bring sample value into the curve range.
- If a positive identification is made for more than one PCB in a sample, then peaks that are not common to the two PCB must be used for quantitation.

12.2.2 Definitions

The following is a list of definitions that will aid in the understanding of the procedures to be used for the on-site analytical:

- Extraction Batch - A group of 20 or fewer samples of similar matrix which are extracted together by the same person within the same time period using the same reagents. Each extraction batch will be uniquely identified and include appropriate QC as specified in this Standard Operating Procedure (SOP).
- Analytical Batch - A group of samples that are analyzed together within the same run sequence in the same or continuous time periods. Each analytical batch will contain the appropriate standards and will be uniquely identified.
- Continuing Calibration - Analytical standard run every 10 injections to verify the calibration of the GC/ECD system.
- Duplicate - Two aliquots of the same sample analyzed using identical procedures. Analysis

of duplicates monitors precision associated with laboratory procedures.

- Instrument Blank - An injection of the pure solvent (in this SOP it will be hexane) used in preparation of final standards and sample extracts. This is done to determine solvent purity and instrument system cleanliness.
- Initial Calibration - Analysis of analytical standards for a series of different specified concentrations; used to define the linearity and dynamic range of the response of the electron capture detector to the target compounds.
- Matrix - The predominant material of which the sample to be analyzed is composed. For the purpose of this SOP, a sample matrix is either water or soil/sediment. Matrix is not synonymous with phase (liquid or solid).
- Matrix Spike - Aliquot of a matrix (water or soil) fortified (spiked) with known quantities of specific compounds and subjected to the entire analytical procedure in order to indicate the appropriateness of the method for the matrix by measuring recovery.
- Matrix Spike Duplicate - A second aliquot of the same matrix as the MS (above) that is spiked in order to determine the precision of the method.
- Method Blank - An analytical control consisting of all reagents, internal standards and surrogate standards that is carried through the entire analytical procedure. The method blank is used to define the level of laboratory background and reagent contamination. At least one method blank per extraction batch will be analyzed.
- Reagent Water - Water in which a contaminant is not observed at or above the minimum quantitation limit of the parameters of interest.
- Surrogates (Surrogate Standard) - Compound added to every blank, sample, MS/MSD, and standard; used to evaluate analytical efficiency by measuring recovery. Surrogates are brominated, fluorinated, or isotopically labeled compounds not expected to be detected in environmental media.
- Target Compound List - A list of compounds designated by the client for analysis.

12.2.3 Equipment and Materials

The following is a list of the materials and equipment needed on-site to perform sample analysis, including the reagents and calibration standards:

- 1 GCs - Hewlett Packard 6890 equipped with auto-sampler and an ECD.
- Column: Column 2, DB-1701, 30m X 0.32 mm; film thickness 0.25u.
- Analytical Balance - Mettler AE 160 capable of accurately weighing 0.0001 grams.
- Glassware.
- Vials - Glass 10 to 15 mL capacity, with Teflon-lined screw cap.
- Funnels.
- Volumetric Flask - 10 and 25 mL cap with Teflon cap.
- Autosampler vials and crimp caps.
- Beakers - 250 mL.
- 50 mL glass columns.
- Microsyringe - 10 micro-liter (μL), 25 μL, 50 μL, 100 μL, and 1000 μL gas-tight. Purchased to be + 1% of total volume.
- Pasteur pipettes - disposable.

- Water - demonstrated to be free of contaminants. De-ionized and/or distilled water created using an Elga™ water purification system.
- Hexane and acetone-pesticide or High Performance Liquid Chromatography grade.
- Sodium sulfate - granular, anhydrous, sodium sulfate.
- Sulfuric Acid.
- Stock Standard Solutions - Stock standard solutions are purchased as certified solutions from Supelco™, Ultrascientific™, and/or Accu Standard™.
- Surrogate Standards are purchased as certified solutions from Ultrascientific™, Supelco™, and/or Accu Standard™. Surrogate mix contains 2, 4, 5, 6-Tetrachloro-m-xylene and Decachlorbiphenyl.
- Calibration curve for Aroclor 1254 will be prepared at a minimum of 5 concentration levels by adding volumes of one or more stock standards to a volumetric flask and diluting to volume with hexane.

Level 1 - 100 µg/L
Level 2 - 200 µg/L
Level 3 - 500 µg/L
Level 4 - 800 µg/L
Level 5 - 1000 µg/L

12.2.4 Gas Chromatograph Conditions

The following lists the conditions under which analysis will be run using Column DB1701 on a Hewlett Packard 6890 GC with dual injection ports, auto-samplers, an integrator and two ECDs.

<u>Column DB1701</u>
Flow Rate - 3 mL/min
Injection Temp. - 250 ^{o}C
Detector Temp. - 350 ^{o}C

<u>Hewlett Packard 6890 GC</u>
Initial Temperature - 150^{o}C
Initial Time - 0.5 min.
Rate - 8^{o}/min.
Final Temperature - 280 ^{o}C
Final Time - 10 min.

12.2.5 Analytical Procedures

The sequence in which the analysis will be performed is listed below:

Hexane blank
(1) Aroclor 1254-1
(2) Aroclor 1254-2
(3) Aroclor 1254-3
(4) Aroclor 1254-4

(5) Aroclor 1254-5
(6) Calibration check containing Aroclor 1254 [500 micrograms per liter (µg/L) mid point curve]
(7) Samples up to 10
(8) Hexane blank
(9) Calibration check containing Aroclor 1254

<u>Sample Extraction for Solid Samples</u>
The following steps are performed in order to extract the PCB from a solid matrix:

1. Weigh 10 grams of solid sample into a beaker.
2. Mix sodium sulfate with sample until free flowing.
3. Place a plug of glass wool in a 50-mL glass column.
4. Pour sample into the column and place beaker under the column.
5. Spike samples with surrogate and LCS, MS, MSD with spike solution.
6. Pass 50-mL of a 1:1 hexane/acetone solution through the column collecting it in the beaker used to weigh out the sample.
7. After sample has drained, pour approximately 100-mL of DI water in beaker.
8. Pipette off the top hexane layer into a 40-mL screw cap vial.
9. Acid-clean all samples. Place a small amount of sample in a 4-mL screw cap vial. Then add 1 pipette (disposable) of H_2SO_4 to vial cap and shake. Then pipette off top hexane layer into an auto-sampler vial for analysis.

12.2.6 Sulfuric Acid Cleanup

This procedure is used to remove contaminants from solution. It does not appreciably effect the PCB concentration.

1. Using a disposable pipette, transfer 1 or 2 mL of the hexane extract to a 5-mL vial. Carefully add 1 or 2 mL of sulfuric acid to the vial (sulfuric acid volume should be the same as the amount of hexane used). This should be done in a fume hood.
2. After the acid is added, mark where the top of the hexane layer is on the vial with a marker.
3. Cap the vial and shake vigorously for one minute.
4. Allow the phases to separate for at least 1 minute. Examine the top (hexane) layer; it should not be highly colored nor should it have a visible emulsion or cloudiness. In addition, notice where the hexane layer is in regards to the original mark made on the vial. If the layer is less than 1/2, the original hexane layer thickness, this should be noted in the extraction book and noted in the analytical results.
5. If a clean phase separation is achieved, pipette the top hexane layer into an auto-sampler vial for analysis.
6. If the hexane layer is colored or emulsion persists for several minutes, remove the sulfuric acid layer from the vial and dispose of it properly. Then add another 1 or 2 mL of sulfuric acid. Shake and allow to separate.
7. If a clean phase separation is achieved, pipette the top hexane layer into an auto-sampler vial for analysis.
8. All extracts for PCB analysis are “cleaned-up” using this procedure, including all QC samples associated with a batch.

12.2.7 Quality Control Procedures

These procedures will be utilized to ensure quality control of the analysis.

- The calibration curve must consist of 5 standards for all analytes and surrogates. Curve must have a Relative Standard Deviation (RSD) of 20% or less.
- The calibration curve is checked by a calibration check at the beginning, every 10 samples, and at the end of the analytical run, and must be within ±15% of the true value. Calibration check standards are also ran after the initial calibration.
- A reagent blank sample must be run on the instrument at the beginning of every experiment to demonstrate the reagents are free from contamination and before each calibration check.
- A method blank must be carried through the whole extraction and analysis procedure with every batch.
- An MS/MSD, LCS and a duplicate must be run with every batch to demonstrate the continuous reproducibility of the method.
- Extracts must be stored in a refrigerator in the dark and analyzed within forty days of extraction.

12.2.8 Corrective Action and Responsibilities

- The calibration curve should have an RSD of less than or equal to 20% on each compound. If the calibration curve does not pass, redo the calibration curve.
- The calibration check standards must pass by ± 15% of the true value. If they do not, try injecting a new calibration check. If it still does not pass, run a new calibration curve. Samples may need to be re-run in the event that a calibration check standard failed.
- The GC operator is responsible for the above corrective action.

12.2.9 Documentation

The Lab notebook will contain the following information:

- GC conditions
- Sample numbers
- Weight
- Final Volume
- Dilution factor
- Sample results
- Notebook and page number for standards
- What if any clean up was done on a sample
- date of analysis and person performing analysis

Standard Preparation will include the following information:

- Identification (ID) number
- Date opened
- Compound name
- Source, manufacturer and lot number or ECC ID number
- Certificate of analysis number

- Manufacturer expiration date
- Initial concentration
- Weight/volume used
- Final volume
- Final concentration
- Solvent and ID number
- Expiration date
- Prepared by, date
- Check by, date

The Extraction Log-in Book will contain the following information:

- sample identification
- Client/work order number
- Volume/weight of sample
- pH
- Color
- Final volume
- Comment about extraction (any problems that may occur)
- Batch number
- Technician (who prepped the samples)
- Date of extraction
- Date concentrated
- Amount of surrogate and matrix spike solution used, the ID number for each solution, and notebook and page number for the prep of each solution
- A reviewed by signature
- Date analyzed
- A relinquished to signature and date and time sample extract were relinquished

12.2.10 Calculations

Surrogates are compounds that are added to every blank, sample, MS/MSD duplicate and standard. They are used to evaluate analytical efficiency by measuring percent recovery. The calculations are based on response factor (RF) values of the calibration curve.

<u>Solid Sample</u>:

SC (μg/L) x FV (L) x DF = Surrogate Concentration [micrograms per kilogram (μ/kg)]
weight of sample [kilogram (kg)]

Where:
SC = Sample Concentrations from the computer
FV = Final Volume
DF = Dilution Factor

Response Factor Calculation:

$$\frac{\text{Standard Concentration}}{\text{Area of curve}} = \text{RF}$$

Relative Standard Deviation Calculation:

$$\frac{\text{Standard deviation x 100}}{\text{Average RF}} = \text{\% RSD}$$

Calculation for Multi-Peak Compounds:

- Identify the compound by comparing the sample pattern with the standards pattern.
- Pick several peaks that are the same in the standard and sample. The same peaks must be used for all standards and samples.
- Add up the area of all peaks to be used for that standard and samples.
- Calculate the RF value for each standard as previously shown.
- Calculate % RSD as previously shown. % RPD must be < 20%.

Multi-Peak Compound Soil Sample Calculation:

Area of sample x Average RF = Sample Concentration from curve (µg/L)

$$\frac{\text{SC } (\mu\text{g/L}) \text{ x FV (mL) x DF}}{\text{Weight of sample (kg)}} = \text{Surrogate Concentration } (\mu\text{g/kg})$$

Where:

SC = Sample Concentrations from the computer
FV = Final Volume
DF = Dilution Factor

12.2.11 Miscellaneous Notes and Precautions

Method interference may be caused by contaminants in solvents, reagents, glassware, and other sample processing hardware that lead to discrete artifacts and/or elevated baselines in GCs (phthalate is an example).

12.2.12 Confirmation Techniques for Single-column Gas Chromatograph

Confirmation technique for single column is as follows per EPA Method 8082 section 7.7.3.

"When samples are analyzed from a source known to contain specific Aroclors, the results from a single-column analysis may be confirmed on the basis of a clearly recognizable Aroclor pattern. This approach should not be attempted for samples from unknown or unfamiliar sources or for samples that appear to contain a mixture of Aroclors. In order to employ this approach, the analyst must document:

* The peaks that were evaluated when comparing the sample chromatogram and the Aroclor standard.
* The absence of major peaks representing any other Aroclor.
* The source-specific information indicating that Aroclors are anticipated in the sample (e.g., historical data, generator knowledge, etc.)."

Since the site is known to contain Aroclors we don't need to confirm the Aroclor 1254 on a second column. Pattern recognition is a form of confirmation when the site is known to contain Aroclors.

12.2.13 References

- SW-846, EPA Method 8000A
- SW-846, EPA Method 8082

12.2.14 Modifications to SW-846, EPA Method 8082

There are two modifications to the EPA method used by the ECC field laboratory.

- The extraction method described in Section 12.2.5 is not an EPA method.
- The ECC field laboratory did not perform a Method Detection Limit (MDL) study.

12.2.15 Safety Precautions

The following safety precautions will be adhered to during all analytical activities in the field laboratory.

<u>Work and Hygienic Practices</u>:

- Wear gloves, lab coat, and eye protection.
- Handle material in an approved fume hood and work in a properly ventilated area.
- DO NOT take solvents internally.
- Eye wash and safety equipment should be readily available.
- Wash thoroughly after handling samples and chemicals.

<u>First Aid Measures</u>:

- Get medical assistance for all cases of overexposure.
- If Hexane or CH_2Cl_2 touches skin, wash thoroughly with soap and water.
- If eyes come in contact with solvent immediately flush with water for at least 15 minutes.
- If solvent has been ingested do NOT induce vomiting. Get immediate medical attention.
- If solvent has been inhaled, remove to fresh air. If breathing has stopped give artificial respiration.

<u>Exposure Limits</u>:

- During an 8-hour day the exposure of Methylene Chloride should not exceed 500-ppm. During 15 minutes, the exposure of CH_2Cl_2 should not exceed 1000-ppm. At NO time should the exposure exceed 2000-ppm.
- During an 8-hour day, the average exposure to hexane cannot exceed 500-ppm. During an 8-hour day, the average exposure to acetone cannot exceed 1000-ppm.

12. 3 QC and QA Samples

These samples will be analyzed for the purpose of assessing the quality of the sampling effort and of the analytical data. QA and QC samples will be splits of field soil samples.

10% of soil samples collected will be sent off site for analysis. A designated QA/QC sample will be split into three samples. The QC and the primary sample will be sent to the field laboratory, while the QA sample will be shipped to the designated USACE-certified laboratory.

QC samples will be collected and the results will be reviewed as soon as feasible so that any potential problems can be identified and corrected in the early stages of work. Samples will be selected for off site analysis by maintaining a log of primary and QC samples and obtaining QC samples approximately every 10 primary samples obtained based on the number of samples, rather than on other considerations such as location.

12.3.1 QC Samples

The sampling team will collect QC samples for analysis by ECC's field laboratory. The identity of these samples is held blind to the analysts and laboratory personnel until data are in deliverable form. The purpose of the samples is to provide site-specific, field-originated checks that the data generated by the laboratory are of suitable quality.

12.3.2 QA Samples

The QA samples collected during the excavation phase will be sent to the designated USACE-certified laboratory, and analyzed to evaluate ECC’s field laboratory performance. One QA sample shall be collected per 10 primary samples for off-site QA laboratory analysis by Sequoia Laboratories Inc.

FIGURES

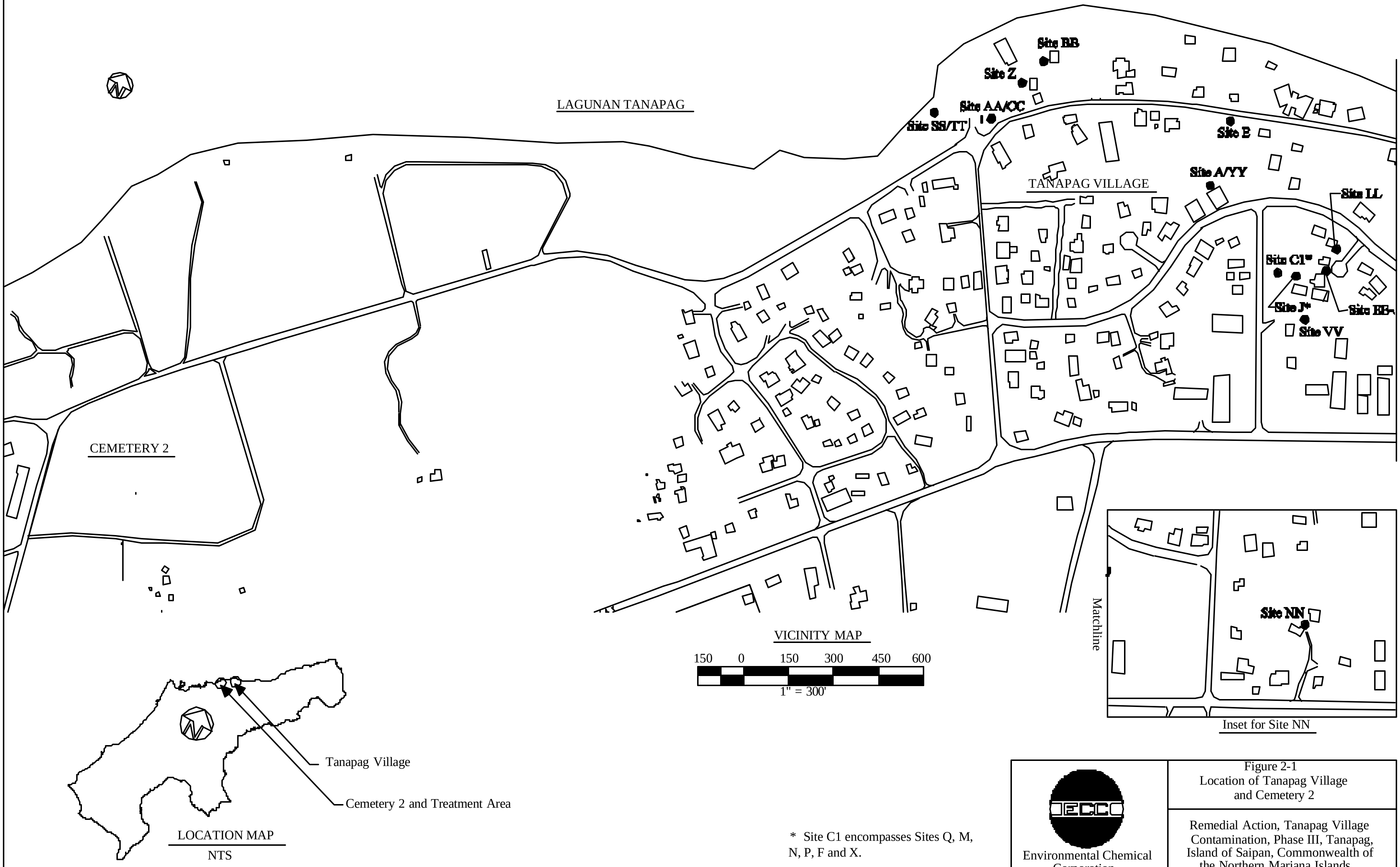

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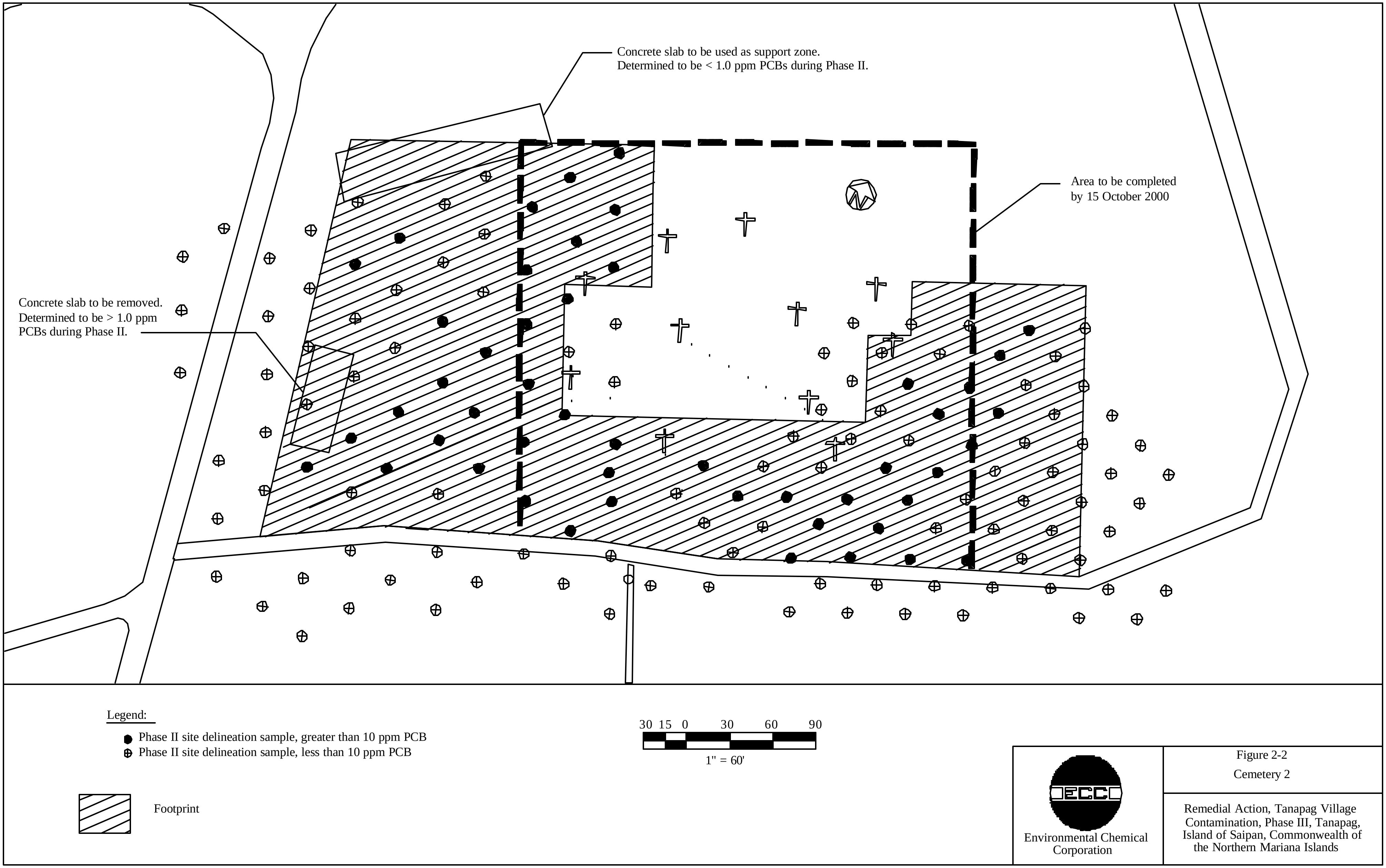
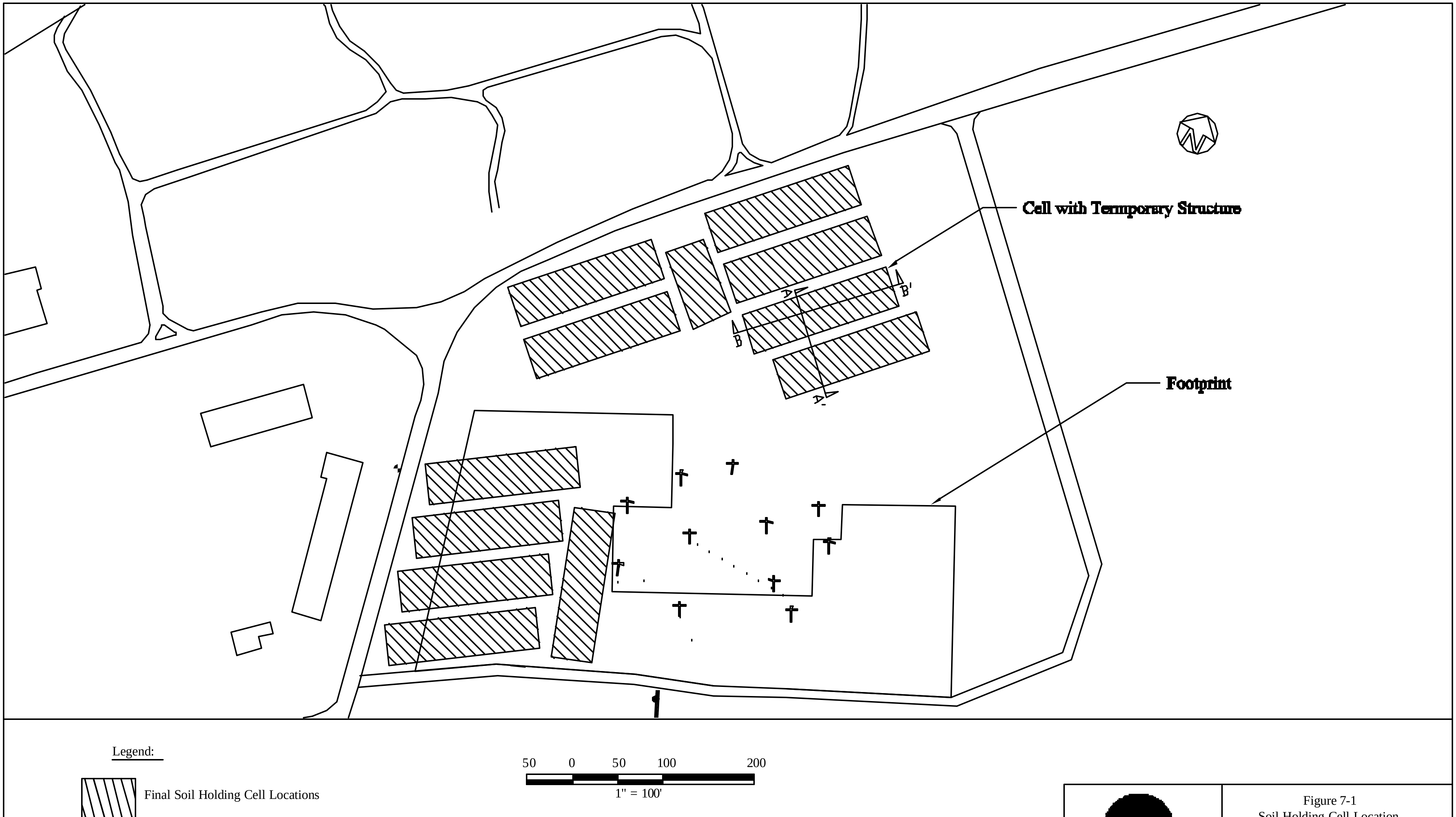
Figure 2-1
Location of Tanapag Village and Cemetery 2

Remedial Action, Tanapag Village Contamination, Phase III, Tanapag, Island of Saipan, Commonwealth of the Northern Mariana Islands



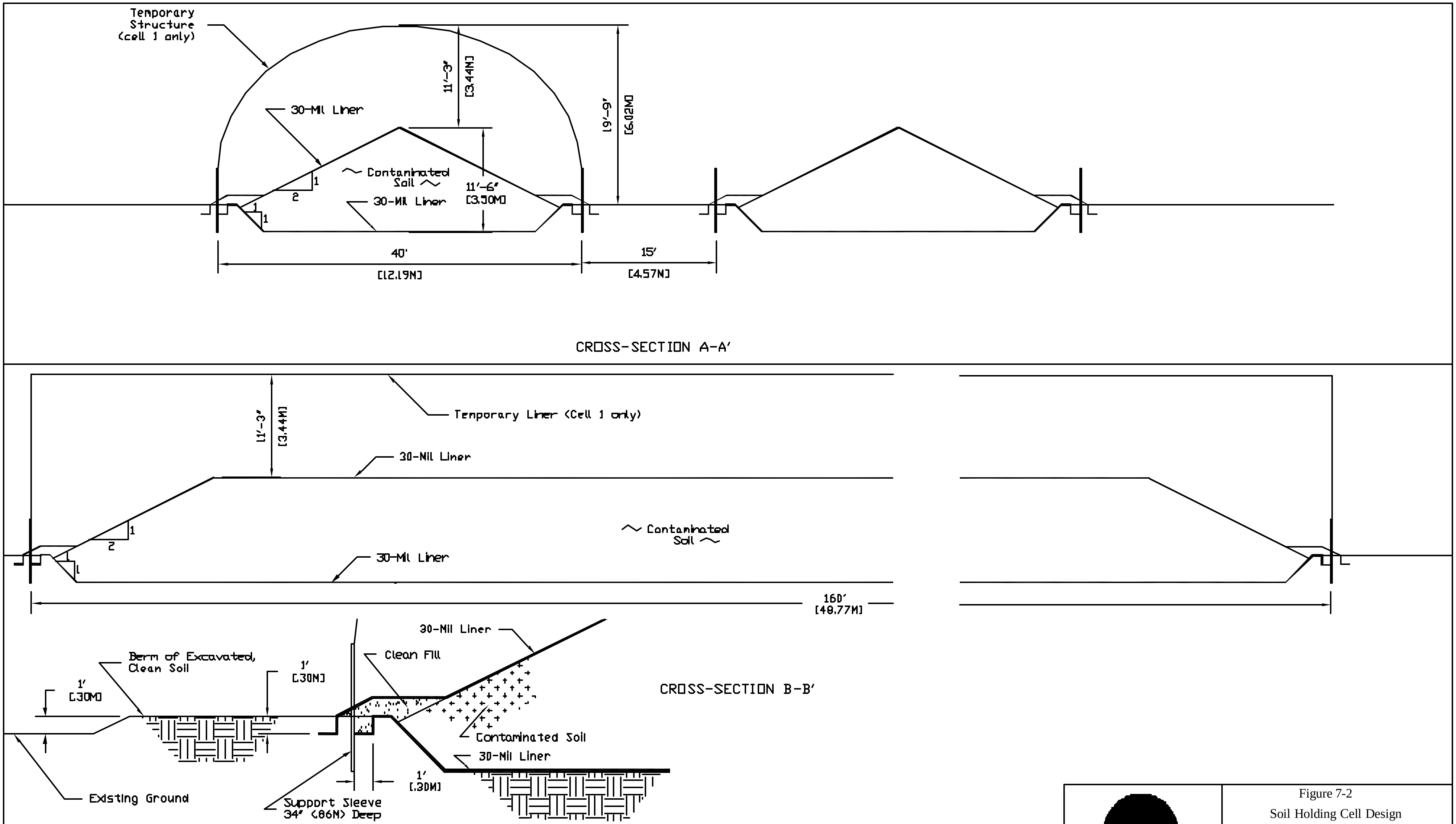
Concrete slab to be used as support zone.
Determined to be < 1.0 ppm PCBs during Phase II.
Area to be completed
by 15 October 2000
Concrete slab to be removed.
Determined to be > 1.0 ppm
PCBs during Phase II.
Legend:
Phase II site delineation sample, greater than 10 ppm PCB
Phase II site delineation sample, less than 10 ppm PCB
Footprint
30 15 0 30 60 90
1" = 60'
Environmental Chemical Corporation
Figure 2-2
Cemetery 2
Remedial Action, Tanapag Village Contamination, Phase III, Tanapag, Island of Saipan, Commonwealth of the Northern Mariana Islands



Environmental Chemical Corporation

Figure 7-1
Soil Holding Cell Location

Remedial Action, Tanapag Village Contamination, Phase III, Tanapag, Island of Saipan, Commonwealth of the Northern Mariana Islands



Environmental Chemical Corporation

Figure 7-2

Soil Holding Cell Design

Remedial Action, Tanapag Village Contamination, Phase III, Tanapag, Island of Saipan, Commonwealth of the Northern Mariana Islands

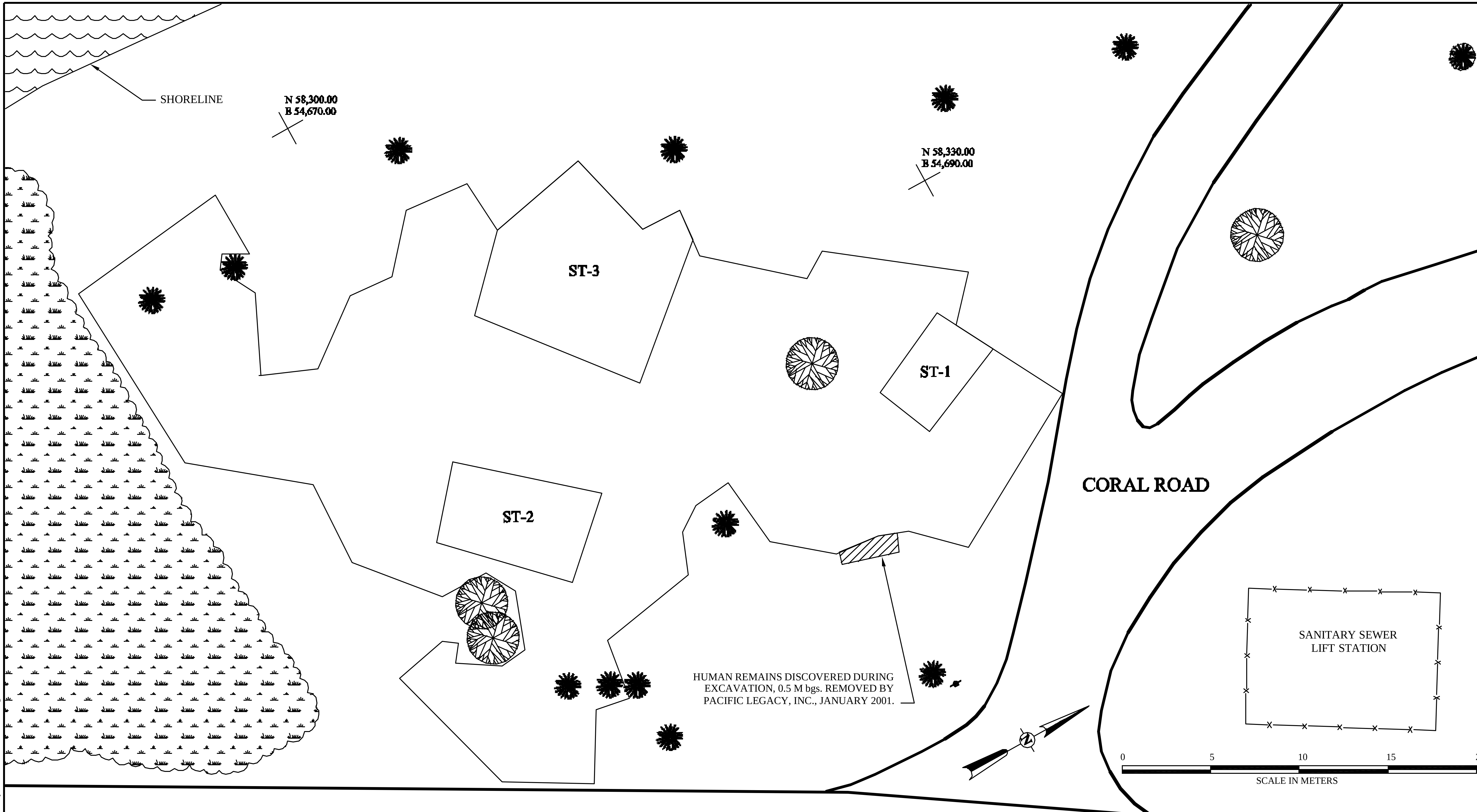


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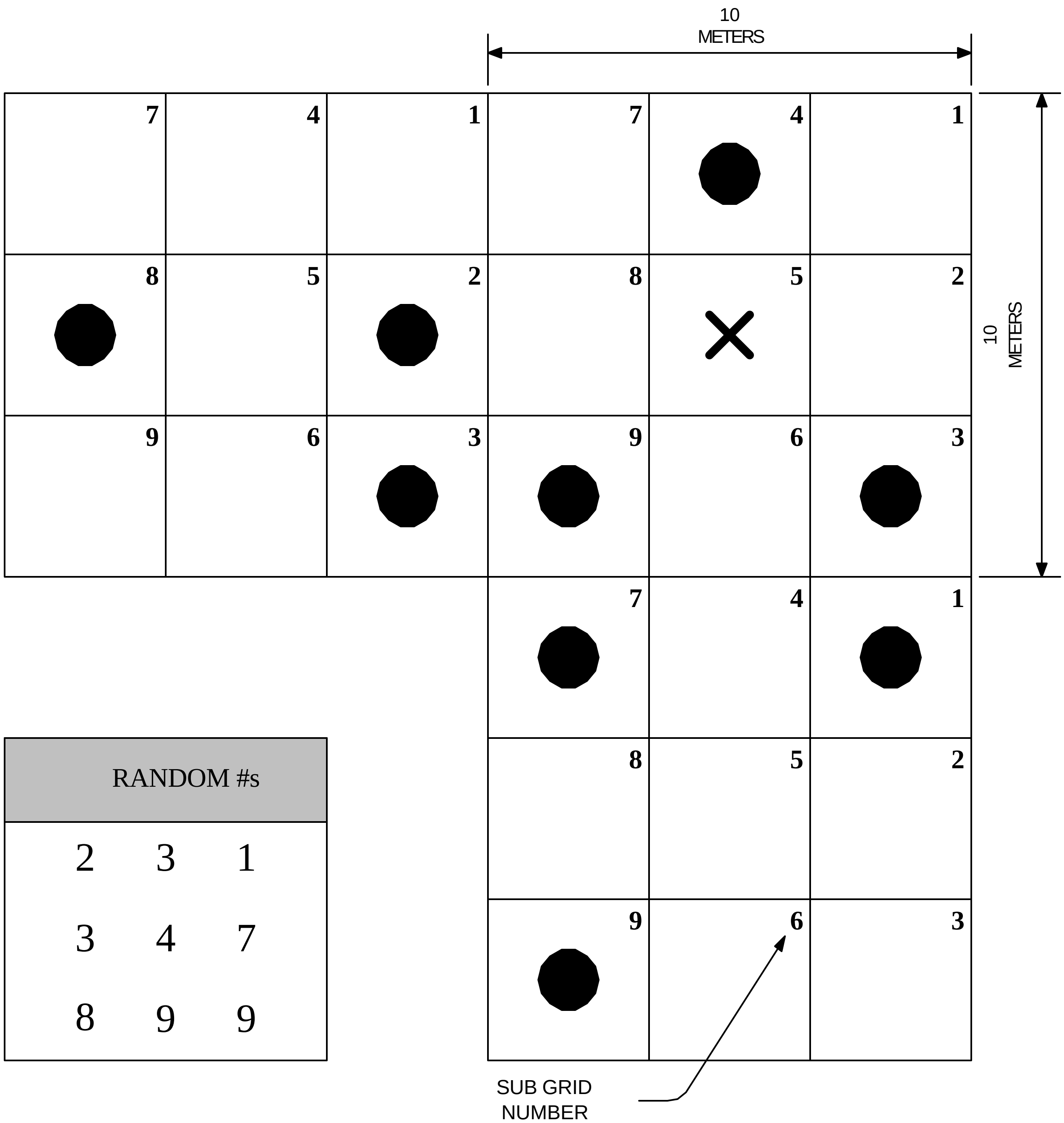
FIGURE 10-1
SITE SS/TT EXCAVATION DIAGRAM

Remedial Action, Tanapag Village Contamination, Phase III, Tanapag, Island of Saipan, Commonwealth of the Northern Mariana Islands



RANDOM #s		
2	3	1
3	4	7
8	9	9

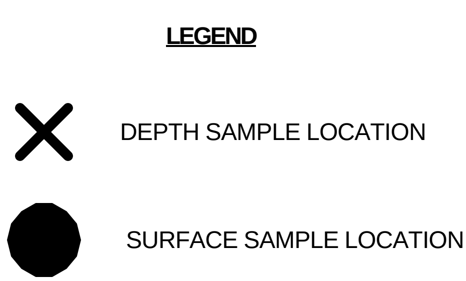


Figure 11-1
Cemetary 2 Perimeter
Chracterization Sample Gids

Remedial Action, Tanapag Village Contamination, Phase III, Island of Saipan, Commonwealth of the Northern Mariana Islands

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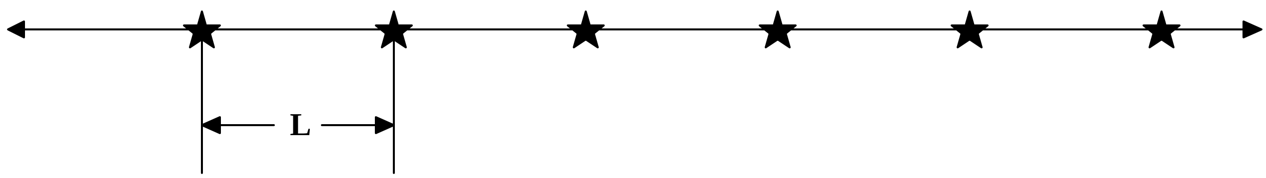
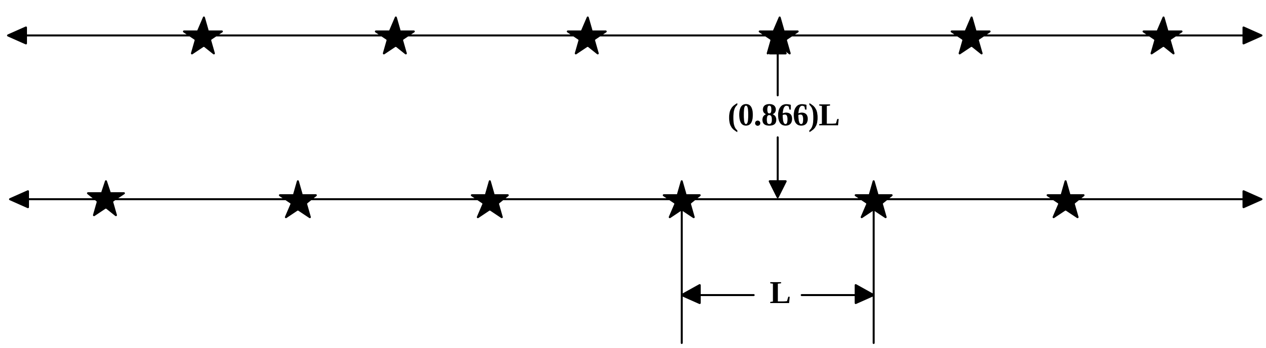
Step 1:

Establish first row of samples. Samples are **L** distance apart.



Step 2:

Set next row **0.866*L** from first row. Sample points from second row should be offset, so that they are equidistant from samples in first row.



Step 3:

Continue establishing rows until entire excavation area is covered.

Figure 11-2
Cleanup Verification Sample Grid
Cemetery 2

Remedial Action, Tanapag Village Contamination, Phase III, Island of Saipan, Commonwealth of the Northern Mariana Islands

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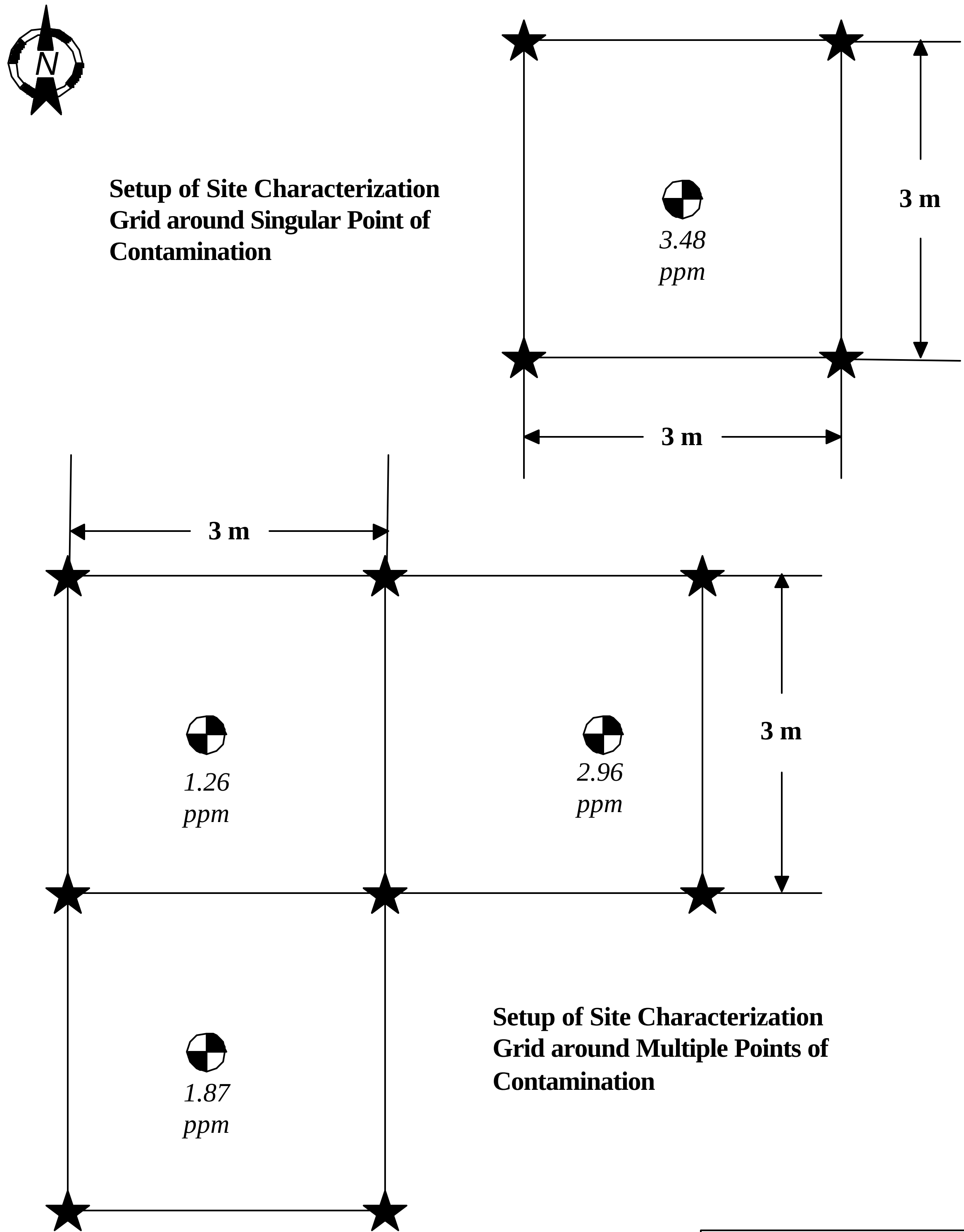

LEGEND

★ Site Characterization Sample Point

Original "Dirty" Data Point

Figure 11-3
Site Characterization Grid Preparation
Tanapag Village Sites

Remedial Action, Tanapag Village Contamination, Phase III, Island of Saipan, Commonwealth of the Northern Mariana Islands

Environmental Chemical Corporation

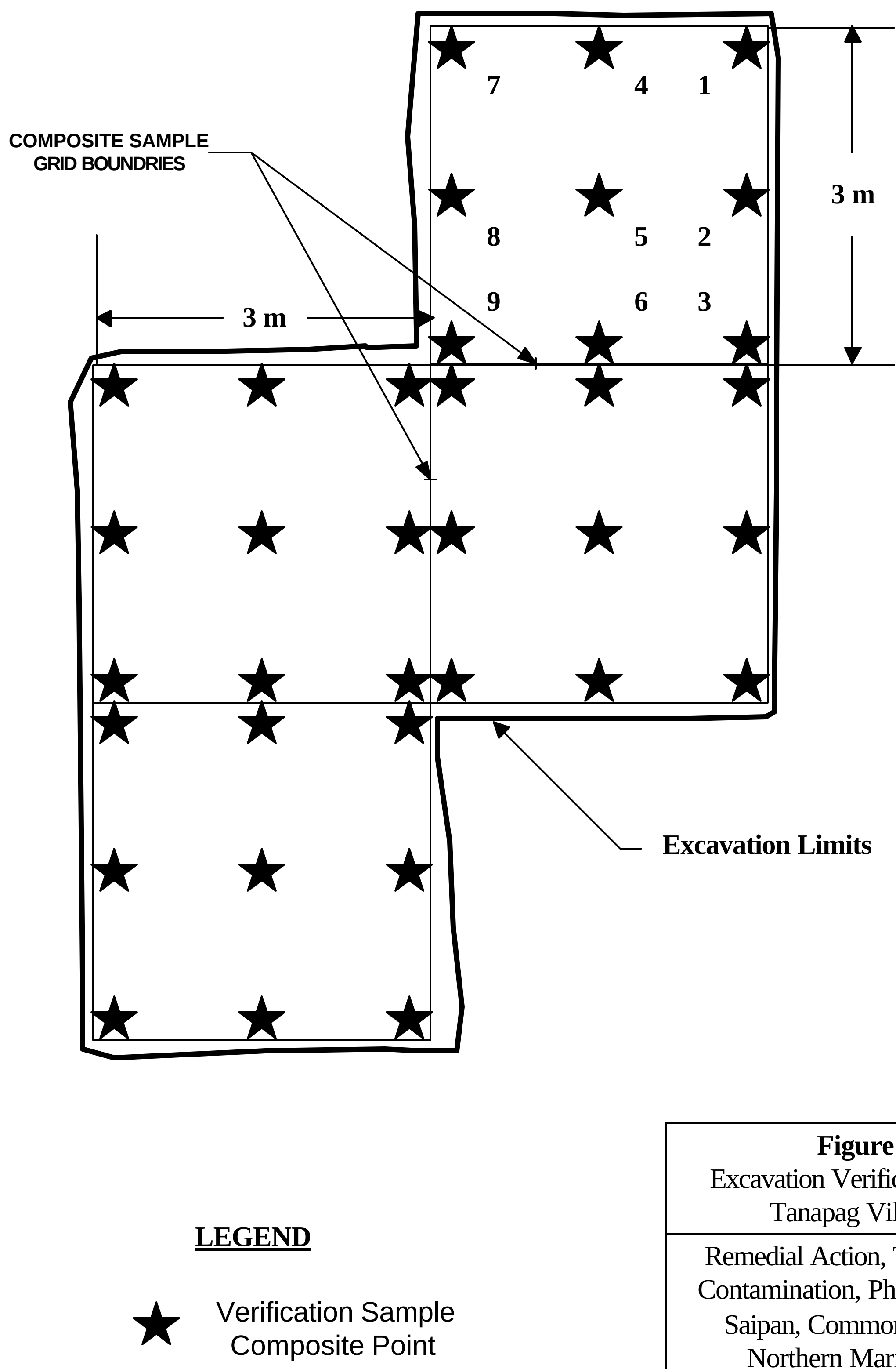

Figure 11-4
Excavation Verification Sampling
Tanapag Village Sites

Remedial Action, Tanapag Village Contamination, Phase III, Island of Saipan, Commonwealth of the Northern Mariana Islands

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APPENDIX A
LIST OF ARAR'S FOR THE
PHASE III REMOVAL ACTION

APPENDIX A

Selected Federal Chemical-, Location-, and Action-Specific ARARs For Phase III Tanapag Village Removal Action

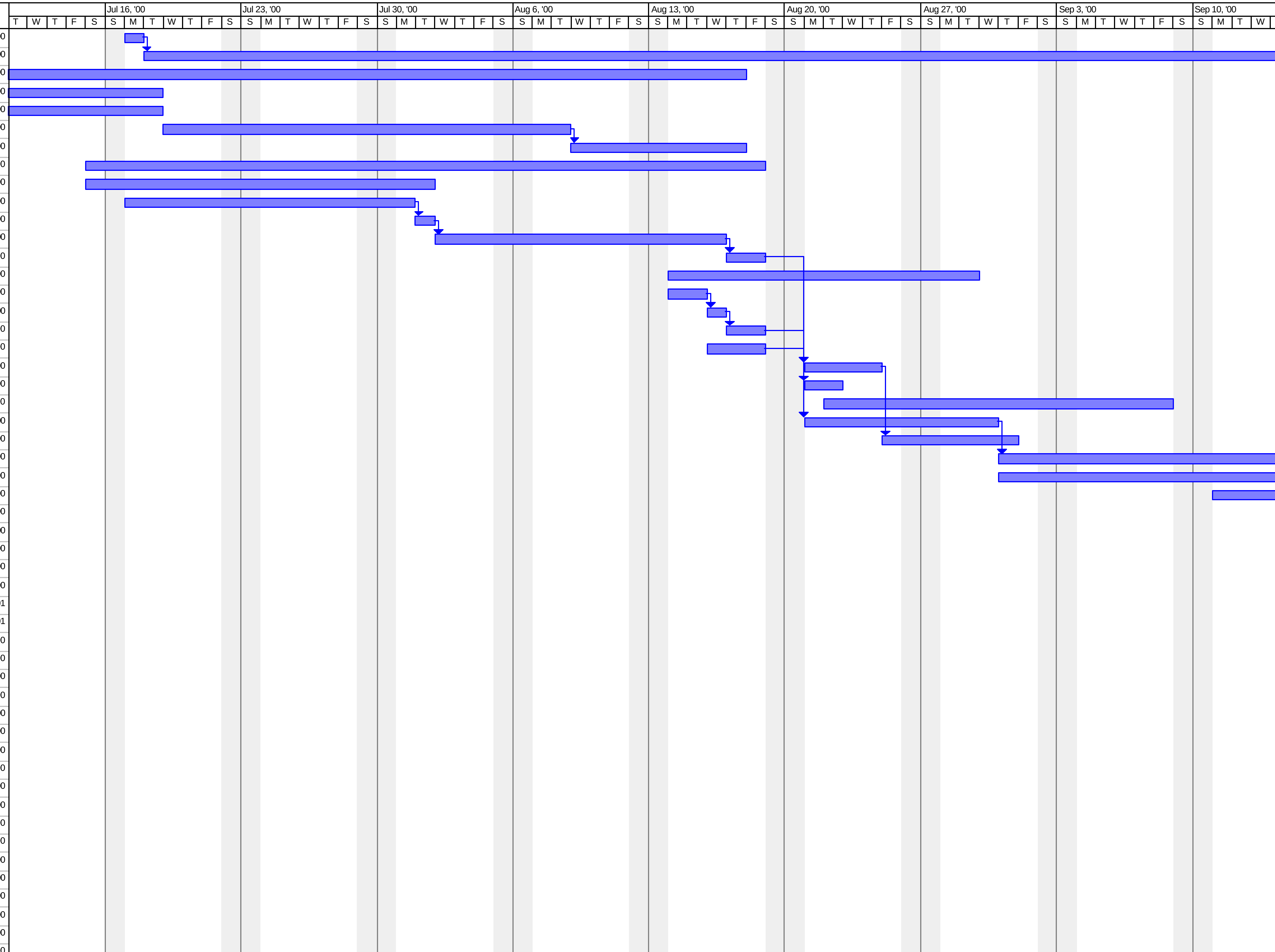
MEDIUM/AUTHORITY	CITATION	STATUS	SYNOPSIS
Waste, Soil, Sediment / Toxic Substances Control Act (TSCA), (15 USC § 2605)	40 CFR § 761.61	ARAR	Non-liquid PCB remediation waste containing < 50 ppm may be sent off-site for disposal in either a TSCA incinerator, traditional TSCA chemical waste landfill, traditional RCRA Subtitle C landfill, or a state approved landfill. PCB remediation waste with concentrations at or above 50 ppm may be sent off-site for disposal to a TSCA incinerator, TSCA chemical waste landfill, or RCRA Subtitle C landfill. If using Subtitle C or state approved landfills, there are waste characterization and notification requirements in 40CFR 761.61 that must be met. Soil with <1 ppm PCBs is considered unregulated waste for disposal under TSCA, whether on-site or off-site. Bulk PCB remediation waste > 25 ppm, but < 50 ppm may be retained at a low occupancy area, if secured with a fence and marked. Bulk PCB remediation waste with > 25 ppm but < or equal to 100 ppm may remain, if the site is capped.
Clean Water Act (CWA)	40 CFR § 131.36	ARAR	The Clean Water Act regulates and establishes standards for the discharge of pollutants into water of the United States. Clean Water Act discharge standards may be applicable if treatment water from the Site is discharged into receiving water. The CWA will be applicable to stormwater collected at the stockpile/treatment location.
Solid Waste Disposal Act (SWDA)		ARAR	The Solid Waste Disposal Act regulates the disposal of contaminated wastes. SWDA standards may be applicable if Off-Site disposal options are implemented.

Explanation:
ARAR – Applicable, Relevant, and Appropriate Requirement
CFR – Code of Federal Regulations
PCBs – Polychlorinated biphenyls
USC – United States Code

APPENDIX B
PROJECT SCHEDULE

Tanapag Phase III
Saipan, CNMI

ID		Task Name	Duration	Start	Finish
1		Notice To Proceed	1 day	Mon 7/17/00	Mon 7/17/00
2		Coordinate w/Environmental Branch	104 days	Tue 7/18/00	Wed 12/6/00
3		Preparation of Project Plans	29 days	Tue 7/11/00	Thu 8/17/00
4		Draft work Plan/SAP	7 days	Tue 7/11/00	Tue 7/18/00
5		Draft HS Plan	7 days	Tue 7/11/00	Tue 7/18/00
6		Government Review	15 days	Wed 7/19/00	Tue 8/8/00
7		Finalization of WKP and HSP	7 days	Wed 8/9/00	Thu 8/17/00
8		**Mobilization Equipment and Supplies**	26 days	Sat 7/15/00	Fri 8/18/00
9		Purchase supplies and materials	13 days	Sat 7/15/00	Tue 8/1/00
10		Load container	11 days	Mon 7/17/00	Mon 7/31/00
11		Deliver container to port of Oakland	1 day	Tue 8/1/00	Tue 8/1/00
12		Transit to Saipan	11 days	Wed 8/2/00	Wed 8/16/00
13		Customs clearance and delivery to site	2 days	Thu 8/17/00	Fri 8/18/00
14		**Site Set Up and Preparation**	12 days	Mon 8/14/00	Tue 8/29/00
15		Meetings with DEQ and support agencies	2 days	Mon 8/14/00	Tue 8/15/00
16		Site set up	1 day	Wed 8/16/00	Wed 8/16/00
17		Brush clearing of cemetery II	2 days	Thu 8/17/00	Fri 8/18/00
18		Green wasate removal	3 days	Wed 8/16/00	Fri 8/18/00
19		Set up field laboratory	4 days	Mon 8/21/00	Thu 8/24/00
20		Establish sampling grids-cemetery II	2 days	Mon 8/21/00	Tue 8/22/00
21		Characterization Sampling Cemetery II	14 days	Tue 8/22/00	Fri 9/8/00
22		Prepare soil holding cells	8 days	Mon 8/21/00	Wed 8/30/00
23		Assemble structure	5 days	Fri 8/25/00	Thu 8/31/00
24		**Removal Action-Cemetery II**	46 days	Thu 8/31/00	Thu 11/2/00
25		First round excavation cemetery II	23 days	Thu 8/31/00	Mon 10/2/00
26		First round verification sampling cemetery II	17 days	Mon 9/11/00	Tue 10/3/00
27		Second round excavation cemetery II	16 days	Tue 10/3/00	Tue 10/24/00
28		Second round verification sampling cemetery II	8 days	Mon 10/16/00	Wed 10/25/00
29		Additional excavation cemetery II	7 days	Wed 10/25/00	Thu 11/2/00
30		Additional verification sampling cemetery II	4 days	Wed 11/1/00	Mon 11/6/00
31		Site restoration cemetery II	5 days	Wed 11/8/00	Mon 11/13/00
32		**Characterization Sampling village Sites**	80 days	Mon 11/6/00	Thu 2/15/01
33		**Removal Action -Village Sites**	119 days	Sat 11/11/00	Tue 4/17/01
34		First round excavation site NN	2 days	Thu 11/2/00	Fri 11/3/00
35		Verification sampling site NN	0.5 days	Fri 11/3/00	Fri 11/3/00
36		Additional excavation site NN	4 days	Mon 11/6/00	Thu 11/9/00
37		Verification sampling site NN	5 days	Mon 11/6/00	Fri 11/10/00
38		Restoration site NN	1 day	Sat 11/11/00	Sat 11/11/00
39		Verification sampling site E	1 day	Tue 11/7/00	Tue 11/7/00
40		Second round excavation site E	2 days	Wed 11/8/00	Thu 11/9/00
41		Verification sampling site E	1 day	Fri 11/10/00	Fri 11/10/00
42		Additional excavation site E	5 days	Sat 11/11/00	Thu 11/16/00
43		Verification sampling site E	4 days	Mon 11/13/00	Thu 11/16/00
44		Restoration site E	1 day	Fri 11/17/00	Fri 11/17/00
45		Istallation of coral road site UU	2 days	Thu 11/9/00	Fri 11/10/00
46		Thanksgiving Break	7 days	Tue 11/21/00	Tue 11/28/00
47		Verification sampling site LL	1 day	Sat 11/11/00	Sat 11/11/00
48		Additional excavation and sampling	6 days	Mon 11/13/00	Mon 11/20/00
49		Retoration site LL	1 day	Tue 11/28/00	Tue 11/28/00
50		Verification sampling Kim's enterprises	3 days	Tue 11/28/00	Thu 11/30/00
51		Restoration Kim's site	1 day	Fri 12/1/00	Fri 12/1/00



Project: TANAPAG_Sch_Final
Date: Wed 5/30/01

Task | Progress | Milestone | Summary | Rolled Up Task | Rolled Up Milestone | Rolled Up Progress | Split | External Tasks | Project Summary

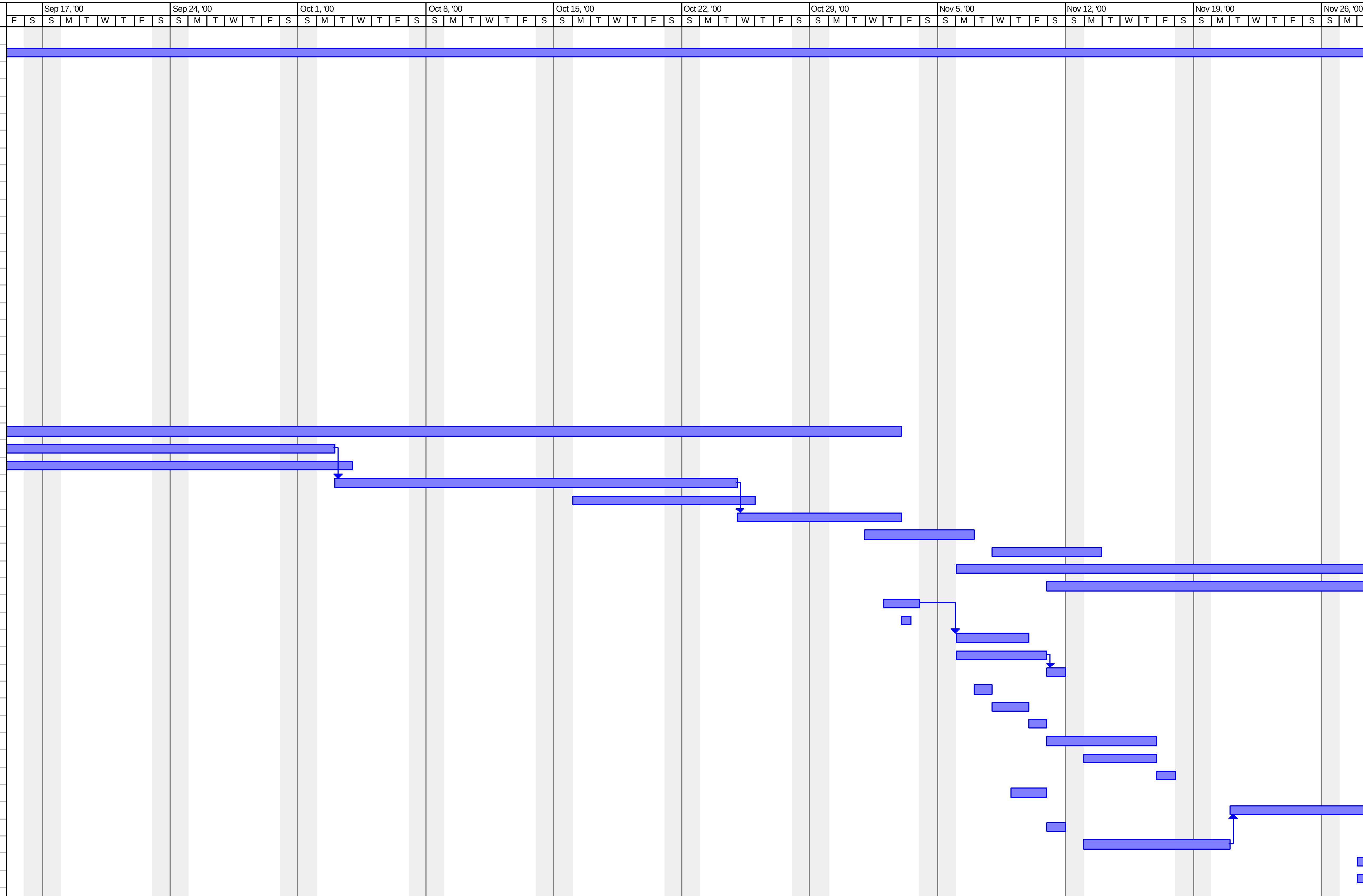
ID	Task Name	Duration	Start	Finish
52	First round verification sampling site EEJJ	1 day	Mon 12/4/00	Mon 12/4/00
53	Second round excavation site EEJJ	3 days	Tue 12/5/00	Thu 12/7/00
54	Second round verification sampling site EEJJ	1 day	Thu 12/7/00	Thu 12/7/00
55	Third round excavation site EEJJ	3 days	Mon 12/11/00	Wed 12/13/00
56	Verification sampling site EEJJ	1 day	Wed 12/13/00	Wed 12/13/00
57	Restoration site EEJJ	2 days	Fri 12/15/00	Sat 12/16/00
58	Verification sampling site A	1 day	Tue 11/14/00	Tue 11/14/00
59	Restoration site A	1 day	Wed 11/15/00	Wed 11/15/00
60	First round verification sampling site SSTT	2 days	Fri 12/8/00	Sat 12/9/00
61	Second excavation site SSTT	5 days	Mon 12/11/00	Fri 12/15/00
62	Verification sampling site SSTT	1 day	Sat 12/16/00	Sat 12/16/00
63	Restoration site SSTT	2 days	Mon 12/18/00	Tue 12/19/00
64	Christmas Beak	11 days	Thu 12/21/00	Thu 1/4/01
65	Excavation Kim's (2)	4 days	Sat 1/6/01	Wed 1/10/01
66	Verification sampling Kim's (2)	3 days	Mon 1/8/01	Wed 1/10/01
67	Restoration Kim's (2) site	2 days	Mon 1/22/01	Tue 1/23/01
68	Demolish Headstart Center	1 day	Sat 1/6/01	Sat 1/6/01
69	First round excavation site BB	1 day	Wed 1/10/01	Wed 1/10/01
70	First round verification sampling site BB	1 day	Wed 1/10/01	Wed 1/10/01
71	Restoration site BB	1 day	Tue 1/23/01	Tue 1/23/01
72	Second round excavation site SSTT	1 day	Thu 1/11/01	Thu 1/11/01
73	Verification sampling second round site SSTT	2 days	Fri 1/12/01	Sat 1/13/01
74	Additional excavation and sampling site SSTT	40 days	Thu 1/18/01	Wed 3/14/01
75	Retsoration site SSTT	3 days	Thu 3/15/01	Sat 3/17/01
76	Landscaping site SSTT	7 days	Fri 4/6/01	Mon 4/16/01
77	First round excavation site AACC	4 days	Tue 1/9/01	Fri 1/12/01
78	First round verification sampling site AACC	1 day	Sat 1/13/01	Sat 1/13/01
79	Second round excavation site AACC	2 days	Mon 1/15/01	Tue 1/16/01
80	Second round verification sampling site AACC	1 day	Wed 1/17/01	Wed 1/17/01
81	Additional excavation site AACC	4 days	Fri 1/19/01	Wed 1/24/01
82	Additional verification sampling site AACC	1 day	Mon 7/17/00	Mon 7/17/00
83	Restoration site AACC	3 days	Thu 2/8/01	Mon 2/12/01
84	Additional excavation (multiple rounds) site A	21 days	Mon 1/15/01	Mon 2/12/01
85	Verification sampling site A	23 days	Mon 1/15/01	Wed 2/14/01
86	Restoration site A	3 days	Thu 2/15/01	Mon 2/19/01
87	Structure demolition site EEJJ	1 day	Mon 2/19/01	Mon 2/19/01
88	Additional excavation rounds site EEJJ	34 days	Wed 2/21/01	Fri 4/6/01
89	Additional sampling (multiple rounds) site EEJJ	32 days	Fri 2/23/01	Fri 4/6/01
90	Restoration site EEJJ	2 days	Mon 4/16/01	Tue 4/17/01
91	C1 Excavation (incorporates sites C1,Q,J,M anc	51 days	Wed 1/24/01	Tue 4/3/01
92	C1 verification sampling	48 days	Tue 1/30/01	Wed 4/4/01
93	Restoration site C1	21 days	Tue 3/20/01	Tue 4/17/01
94	Additional excavation (3) site A	3 days	Tue 4/3/01	Thu 4/5/01
95	Additional verification sampling (3) site A	1 day	Thu 4/5/01	Thu 4/5/01
96	Restoration site A	2 days	Wed 4/18/01	Thu 4/19/01
97	Demobilization	5 days	Thu 4/19/01	Wed 4/25/01

Timescale: Jul 16, '00 – Sep 10, '00

Project: TANAPAG_Sch_Final
Date: Wed 5/30/01

Task | Milestone | Rolled Up Task | Rolled Up Progress | External Tasks
Progress | Summary | Rolled Up Milestone | Split | Project Summary

ID	Task Name
1	Notice To Proceed
2	Coordinate w/Environmental Branch
3	Preparation of Project Plans
4	Draft work Plan/SAP
5	Draft HS Plan
6	Government Review
7	Finalization of WKP and HSP
8	**Mobilization Equipment and Supplies**
9	Purchase supplies and materials
10	Load container
11	Deliver container to port of Oakland
12	Transit to Saipan
13	Customs clearance and delivery to site
14	**Site Set Up and Preparation**
15	Meetings with DEQ and support agencies
16	Site set up
17	Brush clearing of cemetery II
18	Green wasate removal
19	Set up field laboratory
20	Establish sampling grids-cemetery II
21	Characterization Sampling Cemetery II
22	Prepare soil holding cells
23	Assemble structure
24	**Removal Action-Cemetery II**
25	First round excavation cemetery II
26	First round verification sampling cemetery II
27	Second round excavation cemetery II
28	Second round verification sampling cemetery II
29	Additional excavation cemetery II
30	Additional verification sampling cemetery II
31	Site restoration cemetery II
32	**Characterization Sampling village Sites**
33	**Removal Action -Village Sites**
34	First round excavation site NN
35	Verification sampling site NN
36	Additional excavation site NN
37	Verification sampling site NN
38	Restoration site NN
39	Verification sampling site E
40	Second round excavation site E
41	Verification sampling site E
42	Additional excavation site E
43	Verification sampling site E
44	Restoration site E
45	Istallation of coral road site UU
46	Thanksgiving Break
47	Verification sampling site LL
48	Additional excavation and sampling
49	Retoration site LL
50	Verification sampling Kim's enterprises
51	Restoration Kim's site



Project: TANAPAG_Sch_Final
Date: Wed 5/30/01

Task		Milestone	◆	Rolled Up Task		Rolled Up Progress		External Tasks	
Progress		Summary		Rolled Up Milestone	◆	Split		Project Summary	

Tanapag Phase III
Saipan, CNMI

ID	Task Name
52	First round verification sampling site EEJJ
53	Second round excavation site EEJJ
54	Second round verification sampling site EEJJ
55	Third round excavation site EEJJ
56	Verification sampling site EEJJ
57	Restoration site EEJJ
58	Verification sampling site A
59	Restoration site A
60	First round verification sampling site SSTT
61	Second excavation site SSTT
62	Verification sampling site SSTT
63	Restoration site SSTT
64	Christmas Beak
65	Excavation Kim's (2)
66	Verification sampling Kim's (2)
67	Restoration Kim's (2) site
68	Demolish Headstart Center
69	First round excavation site BB
70	First round verification sampling site BB
71	Restoration site BB
72	Second round excavation site SSTT
73	Verification sampling second round site SSTT
74	Additional excavation and sampling site SSTT
75	Retsoration site SSTT
76	Landscaping site SSTT
77	First round excavation site AACC
78	First round verification sampling site AACC
79	Second round excavation site AACC
80	Second round verification sampling site AACC
81	Additional excavation site AACC
82	Additional verification sampling site AACC
83	Restoration site AACC
84	Additional excavation (multiple rounds) site A
85	Verification sampling site A
86	Restoration site A
87	Structure demolition site EEJJ
88	Additional excavation rounds site EEJJ
89	Additional sampling (multiple rounds) site EEJJ
90	Restoration site EEJJ
91	C1 Excavation (incorporates sites C1,Q,J,M an
92	C1 verification sampling
93	Restoration site C1
94	Additional excavation (3) site A
95	Additional verification sampling (3) site A
96	Restoration site A
97	Demobilization

Timeline: Sep 17, '00 – Nov 26, '00

Project: TANAPAG_Sch_Final
Date: Wed 5/30/01

Legend: Task; Progress; Milestone; Summary; Rolled Up Task; Rolled Up Milestone; Rolled Up Progress; Split; External Tasks; Project Summary

ID	Task Name
1	Notice To Proceed
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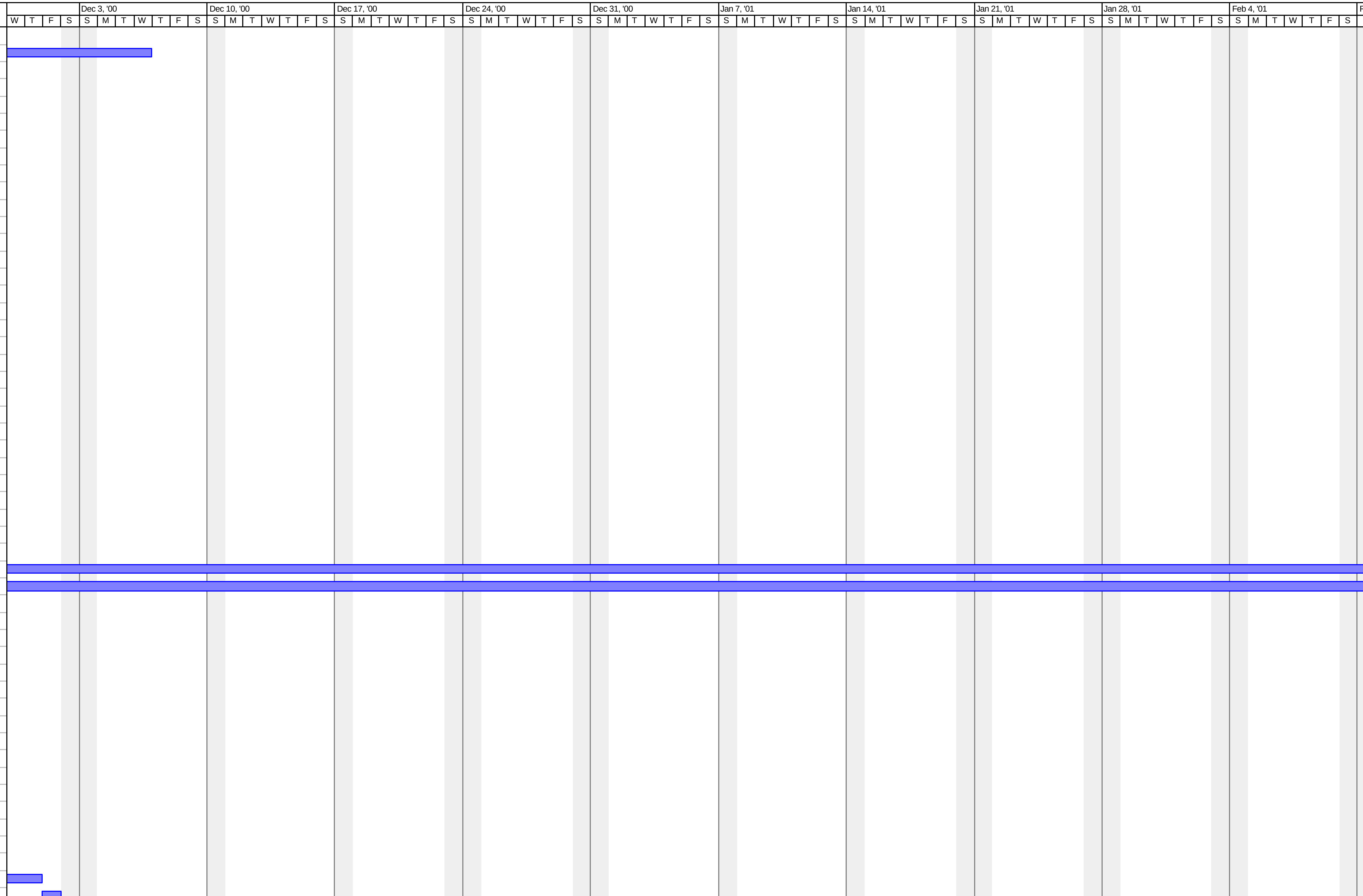
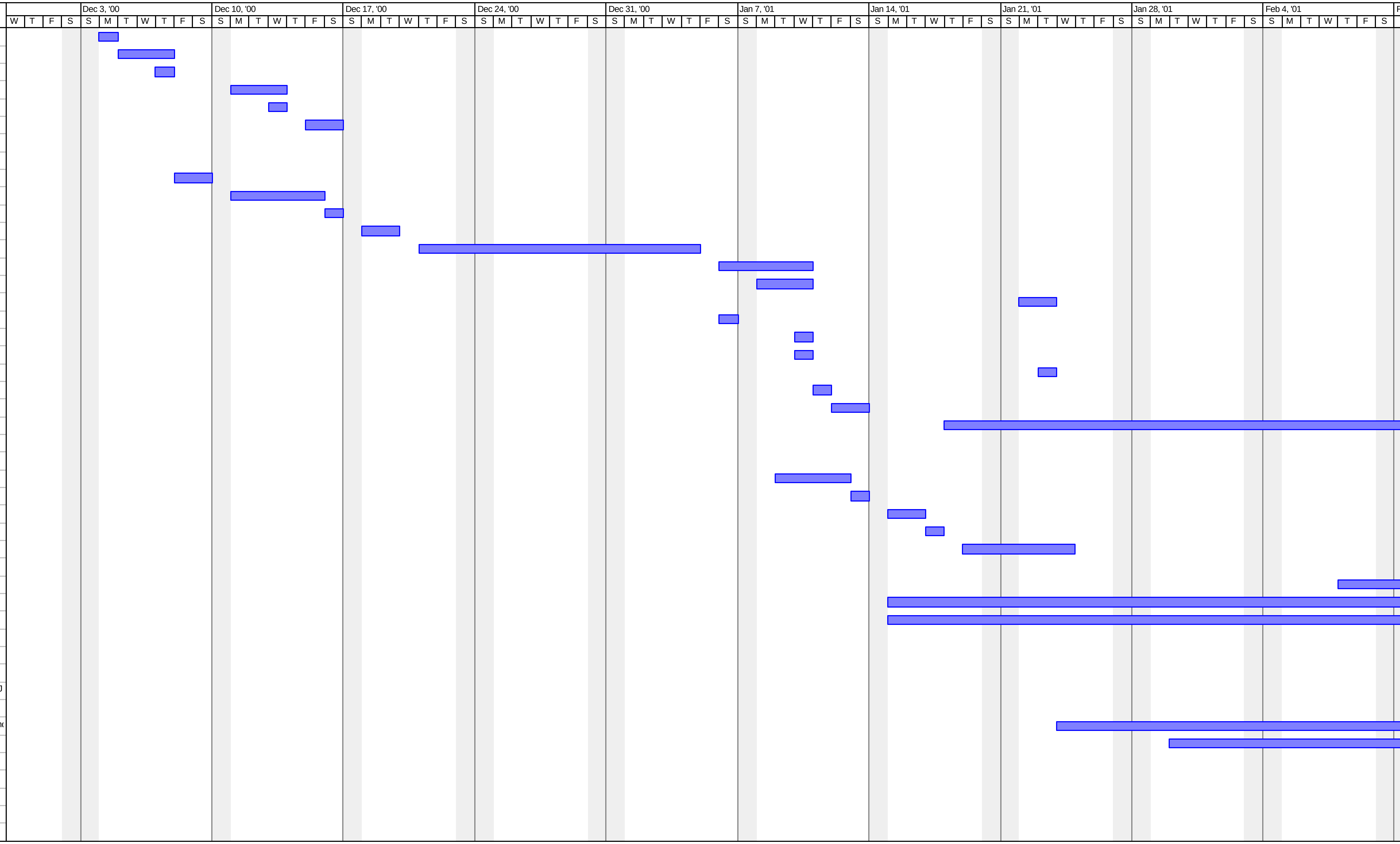
26	First round verification sampling cemetery II
27	Second round excavation cemetery II
28	Second round verification sampling cemetery II
29	Additional excavation cemetery II
30	Additional verification sampling cemetery II
31	Site restoration cemetery II
32	**Characterization Sampling village Sites**
33	**Removal Action -Village Sites**
34	First round excavation site NN
35	Verification sampling site NN
36	Additional excavation site NN
37	Verification sampling site NN
38	Restoration site NN
39	Verification sampling site E
40	Second round excavation site E
41	Verification sampling site E
42	Additional excavation site E
43	Verification sampling site E
44	Restoration site E
45	Istallation of coral road site UU
46	Thanksgiving Break
47	Verification sampling site LL
48	Additional excavation and sampling
49	Retoration site LL
50	Verification sampling Kim's enterprises
51	Restoration Kim's site



Project: TANAPAG_Sch_Final
Date: Wed 5/30/01

Task		Milestone		Rolled Up Task		Rolled Up Progress		External Tasks	
Progress		Summary		Rolled Up Milestone		Split		Project Summary	

ID	Task Name
52	First round verification sampling site EEJJ
53	Second round excavation site EEJJ
54	Second round verification sampling site EEJJ
55	Third round excavation site EEJJ
56	Verification sampling site EEJJ
57	Restoration site EEJJ
58	Verification sampling site A
59	Restoration site A
60	First round verification sampling site SSTT
61	Second excavation site SSTT
62	Verification sampling site SSTT
63	Restoration site SSTT
64	Christmas Beak
65	Excavation Kim's (2)
66	Verification sampling Kim's (2)
67	Restoration Kim's (2) site
68	Demolish Headstart Center
69	First round excavation site BB
70	First round verification sampling site BB
71	Restoration site BB
72	Second round excavation site SSTT
73	Verification sampling second round site SSTT
74	Additional excavation and sampling site SSTT
75	Retsoration site SSTT
76	Landscaping site SSTT
77	First round excavation site AACC
78	First round verification sampling site AACC
79	Second round excavation site AACC
80	Second round verification sampling site AACC
81	Additional excavation site AACC
82	Additional verification sampling site AACC
83	Restoration site AACC
84	Additional excavation (multiple rounds) site A
85	Verification sampling site A
86	Restoration site A
87	Structure demolition site EEJJ
88	Additional excavation rounds site EEJJ
89	Additional sampling (multiple rounds) site EEJJ
90	Restoration site EEJJ
91	C1 Excavation (incorporates sites C1,Q,J,M an
92	C1 verification sampling
93	Restoration site C1
94	Additional excavation (3) site A
95	Additional verification sampling (3) site A
96	Restoration site A
97	Demobilization

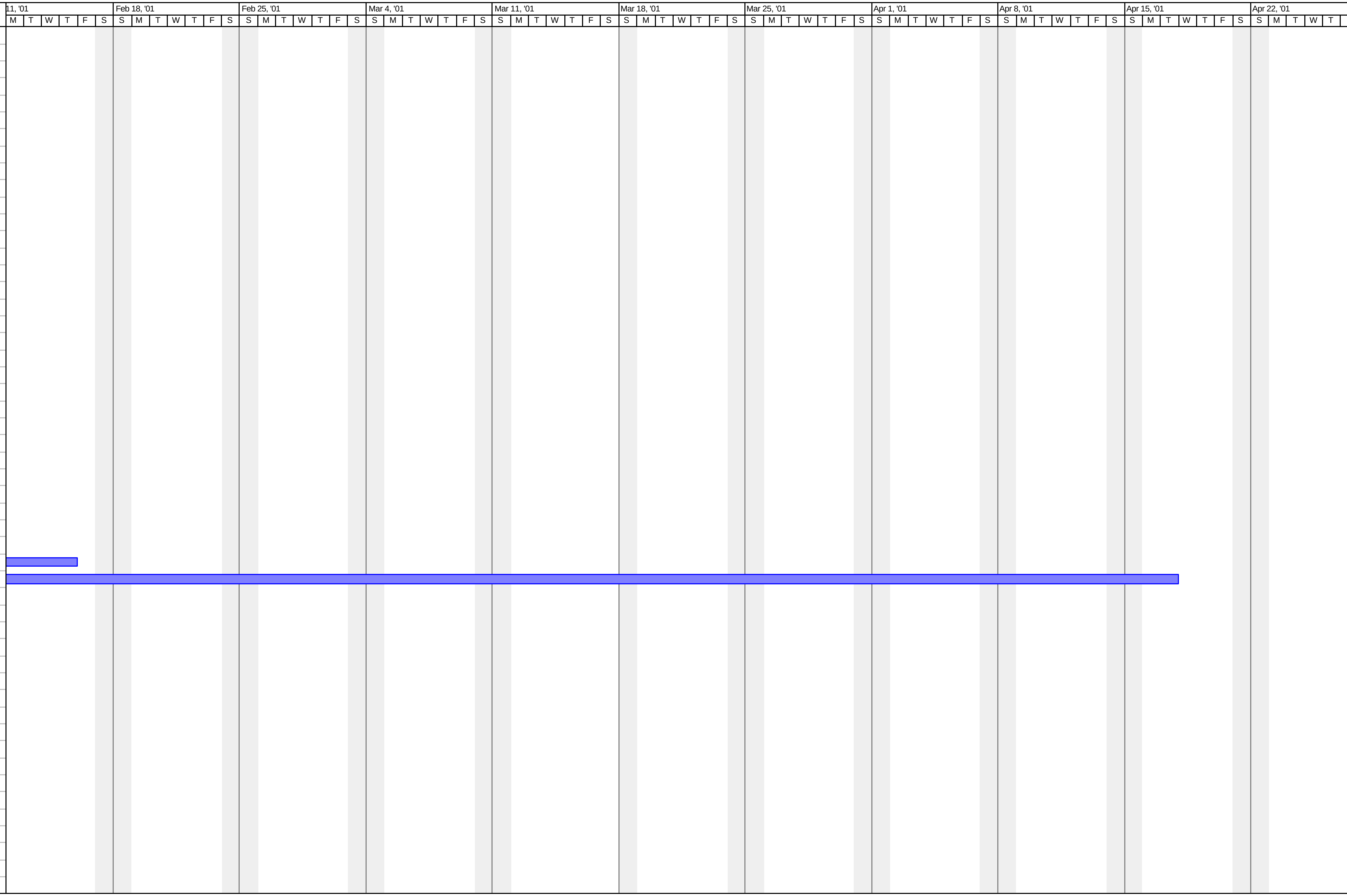


Project: TANAPAG_Sch_Final
Date: Wed 5/30/01

Task | Milestone | Rolled Up Task | Rolled Up Progress | External Tasks
Progress | Summary | Rolled Up Milestone | Split | Project Summary

Tanapag Phase III
Saipan, CNMI

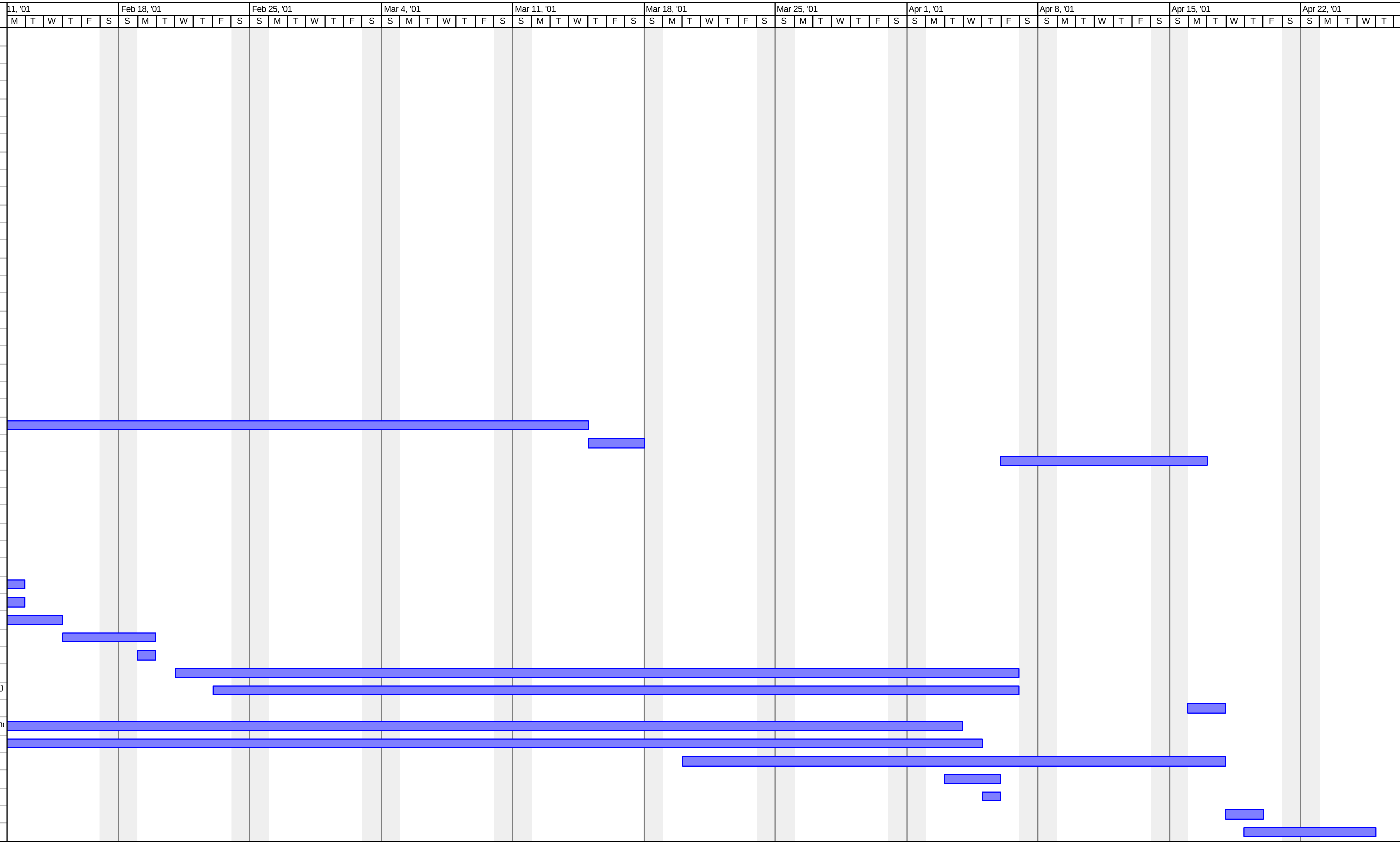
ID	Task Name
1	Notice To Proceed
2	Coordinate w/Environmental Branch
3	Preparation of Project Plans
4	Draft work Plan/SAP
5	Draft HS Plan
6	Government Review
7	Finalization of WKP and HSP
8	**Mobilization Equipment and Supplies**
9	Purchase supplies and materials
10	Load container
11	Deliver container to port of Oakland
12	Transit to Saipan
13	Customs clearance and delivery to site
14	**Site Set Up and Preparation**
15	Meetings with DEQ and support agencies
16	Site set up
17	Brush clearing of cemetery II
18	Green wasate removal
19	Set up field laboratory
20	Establish sampling grids-cemetery II
21	Characterization Sampling Cemetery II
22	Prepare soil holding cells
23	Assemble structure
24	**Removal Action-Cemetery II**
25	First round excavation cemetery II
26	First round verification sampling cemetery II
27	Second round excavation cemetery II
28	Second round verification sampling cemetery II
29	Additional excavation cemetery II
30	Additional verification sampling cemetery II
31	Site restoration cemetery II
32	**Characterization Sampling village Sites**
33	**Removal Action -Village Sites**
34	First round excavation site NN
35	Verification sampling site NN
36	Additional excavation site NN
37	Verification sampling site NN
38	Restoration site NN
39	Verification sampling site E
40	Second round excavation site E
41	Verification sampling site E
42	Additional excavation site E
43	Verification sampling site E
44	Restoration site E
45	Istallation of coral road site UU
46	Thanksgiving Break
47	Verification sampling site LL
48	Additional excavation and sampling
49	Retoration site LL
50	Verification sampling Kim's enterprises
51	Restoration Kim's site



Project: TANAPAG_Sch_Final
Date: Wed 5/30/01

Task | Progress | Milestone | Summary | Rolled Up Task | Rolled Up Milestone | Rolled Up Progress | Split | External Tasks | Project Summary

ID	Task Name
52	First round verification sampling site EEJJ
53	Second round excavation site EEJJ
54	Second round verification sampling site EEJJ
55	Third round excavation site EEJJ
56	Verification sampling site EEJJ
57	Restoration site EEJJ
58	Verification sampling site A
59	Restoration site A
60	First round verification sampling site SSTT
61	Second excavation site SSTT
62	Verification sampling site SSTT
63	Restoration site SSTT
64	Christmas Beak
65	Excavation Kim's (2)
66	Verification sampling Kim's (2)
67	Restoration Kim's (2) site
68	Demolish Headstart Center
69	First round excavation site BB
70	First round verification sampling site BB
71	Restoration site BB
72	Second round excavation site SSTT
73	Verification sampling second round site SSTT
74	Additional excavation and sampling site SSTT
75	Retsoration site SSTT
76	Landscaping site SSTT
77	First round excavation site AACC
78	First round verification sampling site AACC
79	Second round excavation site AACC
80	Second round verification sampling site AACC
81	Additional excavation site AACC
82	Additional verification sampling site AACC
83	Restoration site AACC
84	Additional excavation (multiple rounds) site A
85	Verification sampling site A
86	Restoration site A
87	Structure demolition site EEJJ
88	Additional excavation rounds site EEJJ
89	Additional sampling (multiple rounds) site EEJJ
90	Restoration site EEJJ
91	C1 Excavation (incorporates sites C1,Q,J,M an
92	C1 verification sampling
93	Restoration site C1
94	Additional excavation (3) site A
95	Additional verification sampling (3) site A
96	Restoration site A
97	Demobilization



Project: TANAPAG_Sch_Final
Date: Wed 5/30/01

Task		Milestone	◆	Rolled Up Task		Rolled Up Progress		External Tasks	
Progress		Summary		Rolled Up Milestone ◆		Split		Project Summary	

APPENDIX C
STATISTICAL REFERENCE TABLE

Table 5.5 Values of N for a Given Relative Shift (Δ/σ), α, and β when the Contaminant is Not Present in Background

	α=0.01					α=0.025					α=0.05					α=0.10					α=0.25				
	β					β					β					β					β				
Δ/σ	0.01	0.025	0.05	0.10	0.25	0.01	0.025	0.05	0.10	0.25	0.01	0.025	0.05	0.10	0.25	0.01	0.025	0.05	0.10	0.25	0.01	0.025	0.05	0.10	0.25
0.1	4095	3476	2984	2463	1704	3476	2907	2459	1989	1313	2984	2459	2048	1620	1018	2463	1989	1620	1244	725	1704	1313	1018	725	345
0.2	1035	879	754	623	431	878	735	622	503	333	754	622	518	410	258	623	503	410	315	184	431	333	258	184	88
0.3	468	398	341	282	195	398	333	281	227	150	341	281	234	185	117	282	227	185	143	83	195	150	117	83	40
0.4	270	230	197	162	113	230	1921	162	131	87	197	162	136	107	68	162	131	107	82	48	113	87	68	48	23
0.5	178	152	130	107	75	152	126	107	87	58	130	107	89	71	45	107	87	71	54	33	75	58	45	33	16
0.6	129	110	94	77	54	110	92	77	63	42	94	77	65	52	33	77	63	52	40	23	54	42	33	23	11
0.7	99	83	72	59	41	83	70	59	48	33	72	59	50	40	26	59	48	40	30	18	41	33	26	18	9
0.8	80	68	58	48	34	68	57	48	39	26	58	48	40	32	21	48	39	32	24	15	34	26	21	15	8
0.9	66	57	48	40	28	57	47	40	33	22	48	40	34	27	17	40	33	27	21	12	28	22	17	12	6
1.0	57	48	41	34	24	48	40	34	28	19	41	34	29	23	15	34	28	23	18	11	24	19	15	11	5
1.1	50	42	36	30	21	42	35	30	24	17	36	30	26	21	14	30	24	21	16	10	21	17	14	10	5
1.2	45	38	33	27	20	38	32	27	22	15	33	27	23	18	12	27	22	18	15	9	20	15	12	9	5
1.3	41	35	30	26	17	35	29	24	21	14	30	24	21	17	11	26	21	17	14	8	17	14	11	8	4
1.4	38	33	28	23	16	33	27	23	18	12	28	23	20	16	10	23	18	16	12	8	16	12	10	8	4
1.5	35	30	27	22	15	30	26	22	17	12	27	22	18	15	10	22	17	15	11	8	15	12	10	8	4
1.6	34	29	24	21	15	29	24	21	17	11	24	21	17	14	9	21	17	14	11	6	15	11	9	6	4
1.7	33	28	24	20	14	28	23	20	18	11	24	20	17	14	9	20	16	14	10	6	14	11	9	6	4
1.8	32	27	23	20	14	27	22	20	16	11	23	20	16	12	9	20	16	12	10	6	14	11	9	6	4
1.9	30	26	22	18	14	26	22	18	15	10	22	18	16	12	9	18	15	12	10	6	14	10	9	6	4
2.0	29	26	22	18	12	26	21	18	15	10	22	18	15	12	8	18	15	12	10	6	12	10	8	6	3
2.5	28	23	21	17	12	23	20	17	14	10	21	17	15	11	8	17	14	11	9	5	12	10	8	5	3
3.0	27	23	20	17	12	23	20	17	14	9	20	17	14	11	8	17	14	11	9	5	12	9	8	5	3

APPENDIX D
SAMPLING FORMS

CHAIN-OF-CUSTODY RECORD

Environmental Chemical Corporation
99-1151 Iwaena Street
Aiea, Hawaii 96701
Phone No.: (808) 486-3707
Fax No.: (808) 486-3316

Customer Name: ____________
Address: ____________
____
Phone No.: ____________
Fax No.: ____________

Contact/Report To: ____________
Project Name: ____________
Project Number: ____________
Purchase Order No.: ____________

Turn Around Time: (Working Days) Report Date: ______
Std. - 10 day ☐ 72 hours ☐
48 hours ☐ 24 hours ☐

*Sample Types:
1. Soil 5. Air
2. Water 6. Wipe
3. Sludge 7. Other
4. Filter

SAMPLE IDENTITY:	SAMPLE LOCATION:	Date Sampled	Time Sampled	Sample Description Type* (1. S, 2. W, 3. SL, 4. F, 5. A, 6. WP, 7. O)	Preservative (1. HNO_3, 2. H_2SO_4, 3. HCl, 4. NaOH, 5. $Na_2S_2O_3$, 6. None, 7. Other)	Container Type	Sample Volume	No. of Containers	Analyses									

Comments: ____________

Possible Hazard Identification:
Non-Hazard ☐ Flammable ☐ Skin Irritant ☐ Poison ☐
Radiochemical ☐ Unknown ☐

Sample Disposition: Disposal ☐ Return ☐ Archive ☐

Container Receipt Information: ____________

Problems & Corrective Action (If Required):

1. Container Temperature (Range 4°±2°C) Temperature: ___ Yes ☐ No ☐
2. Were tamper evident custody seals present? Yes ☐ No ☐
3. Were sample(s) received with COC? Yes ☐ No ☐
4. Were sample(s) received intact and in good condition? Yes ☐ No ☐

Relinquished By: (Signature)	Date	Time	Received by: (Signature)	Date	Time
Relinquished By: (Signature)	Date	Time	Received by: (Signature)	Date	Time

Representative Sampling Document

Phase III, Tanapag Cemetery, Tanapag, Island of Saipan, CNMI

Environmental Chemical Corporation

Project No: **Date:** **Time:**

Weather: **Temperature:**

Sample Source:

G	UST Excavation	G	Stockpile	G	Surface
G	Excavation	G	Biocell	G	In-Situ area

Sampling Methodology:

Sample Container: Sample Amount:

Chain of Custody: Custody Seals: Yes No

Sample Location: Sample Number:

Diagram:

Sample Analysis: G BTEX (EPA 8020) G PNA (EPA 8270)

G PCB (EPA 8082) G Lead/Chrome G Asbestos

G Other____

Matrix: G Soil G Sludge G Water G Other______________________

Sampler Name (print):____

Sampler Signature:______________________________________Date____________________

I CERTIFY THAT THE ABOVE SAMPLE(S) WAS (WERE) TAKEN BY MY DIRECTION AND IN MY PRESENCE.

Name (print):__________________________________Title:____________________________

Signature:_____________________________________Date:____________________________

Witness Name (print):___________________________Title:____________________________

Signature:_____________________________________Date:____________________________