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Interim Measures Report for Potential Release Sites

49-001(b)
49-001(c)
49-001(d)
49-001(g)

Environmental Restoration Project
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Produced by the Material Disposal Areas Focus Area

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1.0 INTRODUCTION

This interim measures report addresses activities at Potential Release Sites (PRSs) 49-001(b,c,d, and g) in Technical Area (TA) 49 of Los Alamos National Laboratory (the Laboratory) (Figure 1-1). These PRSs are also known as Material Disposal Area (MDA) AB, Areas 2, 2A, and 2B. For purposes of this report, Areas 2, 2A, and 2B will be collectively referred to as Area 2. Stabilization activities at this site were implemented as both interim measures and best management practices (BMPs); this report provides as-built descriptions of those activities that were considered by the New Mexico Environment Department (NMED) to be interim measures. The principal objective of this stabilization effort was to reduce the moisture content of near-surface soils at Area 2.

The principal activities implemented as interim measures included

- plugging and abandonment of Corehole 2 (CH-2);
- removing asphalt pavement from Area 2;
- regrading the site with clean, crushed tuff to eliminate surface water ponding;
- spreading topsoil over the regraded site;
- reseeding the topsoil with shallow-rooting grasses;
- placing gravel on the topsoil for erosion protection; and
- covering part of the site and the vicinity with a biointrusion barrier.

The work was completed by reinstalling the chainlink security fence. These activities were implemented to temporarily stabilize the site pending identification of a permanent remedy within the next 5 to 10 yr. The design of these interim measure activities is described in "Stabilization Plan for Implementing Interim Measures and Best Management Practices at Potential Release Sites 49-001 (b,c,d, and g)" (LANL 1998, 59641). Deviations identified in this report from planned activities are based on the scope of the stabilization effort as described in the stabilization plan. Deviations include (1) additional boreholes drilled on the north slope of Area 2 and (2) a larger amount of crushed tuff.

The construction activities were performed by KEERS Environmental of Albuquerque, New Mexico, under the direction of the Morrison Knudsen/Program Management Company (MK/PMC) Los Alamos Project Team.

The principal activities implemented as BMPs included construction of a surface water diversion channel upgradient of Area 2 and construction of erosion control structures in both upgradient and downgradient surface water drainage channels. These activities were described in the BMP report (Environmental Restoration Project 1998, 63041). BMPs implemented at Area 2 include a silt fence, the stabilization of the upgradient and downgradient channels, and a surface water diversion channel. The detailed results of screening and sampling activities conducted in support of the stabilization activities will be described in a data summary report being prepared for MDA AB, Area 2.

Acronyms defined in this report are listed in Appendix A.

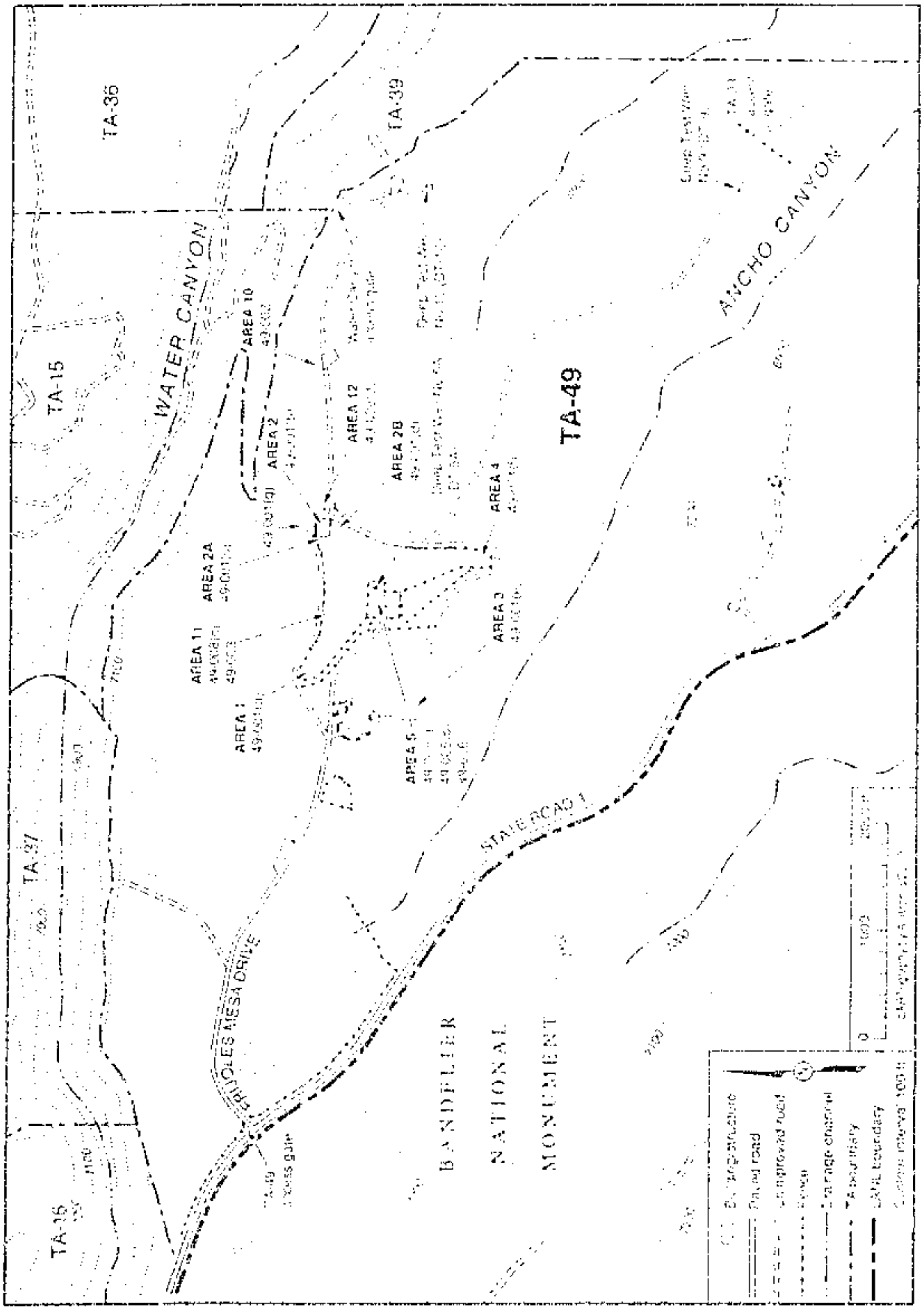

Figure 1-1. Map of MDA AB TA-49

2.0 INTERIM MEASURES AND RELATED ACTIVITIES

All work was performed in accordance with the site-specific health and safety plans for these activities (Environmental Restoration Project 1998, 63112; Environmental Restoration Project, 1998, 63114).

2.1 Air Quality Monitoring

Air quality monitoring was conducted at locations to the northeast and northwest of the stabilized area (Figure 2-1). The monitoring was part of ESH-17's site-wide air quality program. Three air quality monitoring stations were operated continuously during the stabilization activities; two are shown in Figure 2-1, and the other is located in Area 5 (southwest of Area 2). No elevated levels of airborne contaminants were detected. Air-monitoring data will be presented in the summary data report, which will be completed in September 1999.

2.2 Borings to Competent Tuff

Up to 20 shallow borings to competent tuff with a hand auger were planned around the western and southern perimeter of MDA AB, Area 2. The purpose of these holes was to provide information on subsurface stratigraphy. Of particular interest was the possible presence of deep erosion features in the competent tuff that could affect the movement of interflow. Because indication of deep erosion features was found, only 13 of the original 20 planned borings were installed. The boreholes were drilled on April 30, 1998, and May 1, 1998. The cuttings were logged, and the general moisture conditions were noted. The boring locations are shown in Figure 2-1. All borings were drilled to the depth of refusal. After completing the borings, the cuttings were used to backfill the holes.

The depth to competent tuff varied from 25 in. near the northern end of the perimeter to 42 in. near the eastern end. The thickness of overlying soil was generally less than the expected 36 to 48 in. The surface strata were characterized as a brown silty to clayey soil overlying weathered tuff. The weathered tuff was a soft, reddish brown material that transitioned to a light gray to white competent tuff with increasing depth. An approximately 1-in.-thick clay-rich layer was occasionally noted between the soil and weathered tuff. The upper soil layer of El Cajete pumice common to TA-49 appeared to be missing in most holes, suggesting that much of the area had previously been reworked. The site may have been graded in 1959 before nuclear safety tests were conducted at Area 2. In addition, local surface soils may have been the source of the clayey, silty fill material placed over Area 2 in 1960 to cover contaminated soils.

The moisture content in the boreholes was visually characterized as ranging from dry to moist with no particular pattern identified because no laboratory tests were conducted. The highest moisture levels were found in Holes t11 and t14. No saturated conditions were found in any hole.

Figure 2-2 is a vertical section along the line of borings. The elevation of competent tuff generally conformed with the surface topography. An apparent low point in the competent tuff that could channel subsurface interflow drainage toward Area 2 was identified north of Hole T-6. This is also the location of the principal channel feeding surface water run-on to Area 2.

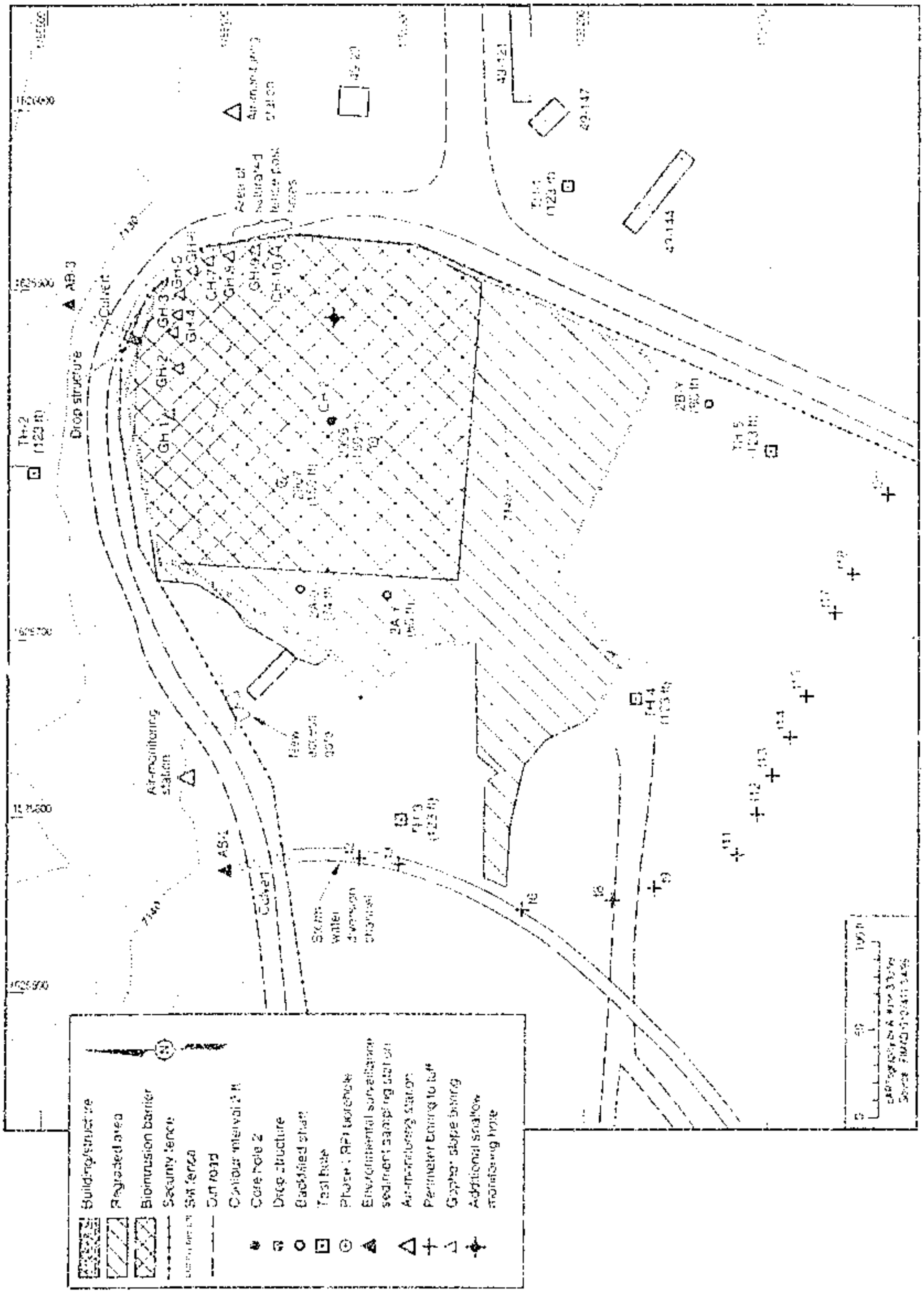

Figure 2-1. Locations of structures, samples, and areas at TA-49

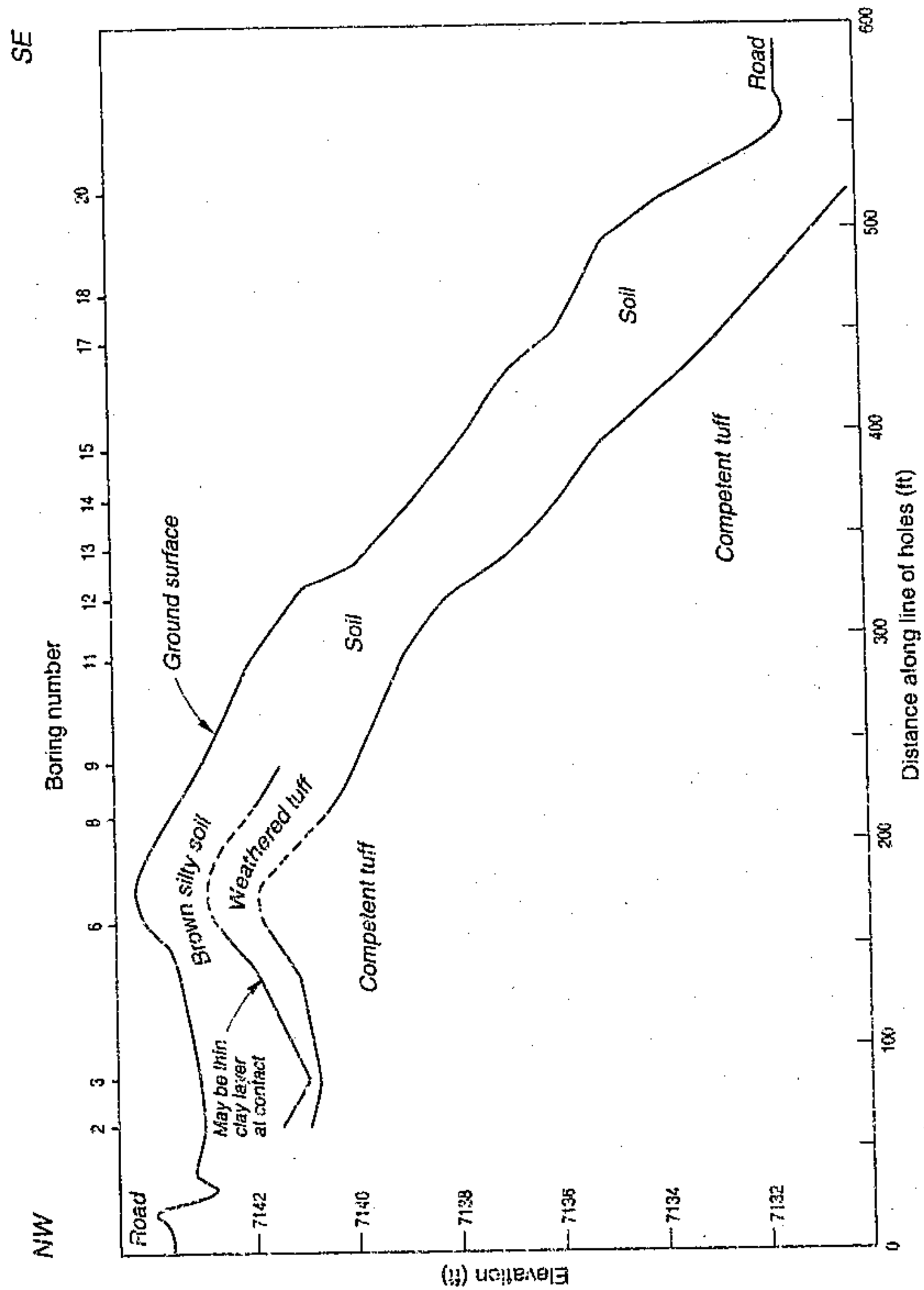

Figure 2-2. Vertical section along line of borings to tuff

2.3 Plugging and Abandonment of CH-2

In 1959, CH-2 was drilled to a depth of about 500 ft to provide geologic and hydrologic information on MDA AB, Area 2, before selecting the site for nuclear safety tests. The hole is located near the center of the array of shafts used in the safety tests and is within the area that was subsequently filled and paved with asphalt. The location of the hole is shown in Figure 2-1. Before the asphalt was removed, the old casing was removed, and the hole was plugged and abandoned in August 1998 because of concern that it could elevate moisture content of the near-surface soils and tuff at the site. The hole was plugged and abandoned in accordance with NMED Ground Water Bureau's guidelines (NMED 1992, 53805.16), the Laboratory Environmental Restoration (ER) Project Standard Operating Procedure 5.03, R0, "Monitor Well and RFI Borehole Abandonment," and the "Monitoring Well and Borehole Abandonment Plan" included as Attachment 3 to the stabilization plan (LANL 1998, 59641). The work was performed by Stewart Brothers Drilling Company of Grants, New Mexico, under direct contract to the Laboratory. Field direction for drilling operations, site safety and health, waste management, and radiological monitoring were provided by the MDA AB team of Laboratory and MK/PMC team personnel. A detailed description of the plugging and abandonment of CH-2 is presented in Appendix B.

2.4 Asphalt Removal

The asphalt was removed during September and October of 1998. Fill was first placed around the southern and western edges of the pad before removing the asphalt to provide a clean working perimeter. Sequential squares with dimensions of about 20 ft by 20 ft were excavated, as originally planned; the asphalt was broken into pieces smaller than 3 ft but was not crushed. A Caterpillar EL300B excavator lifted and turned the asphalt. The asphalt and underlying soil were screened for elevated radioactivity as the asphalt was removed. In accordance with the site's radiation work permit, respiratory protection was worn when removing the asphalt overlying Shafts 2-M and 2-N because of the potential for encountering elevated radioactivity at these locations. Shaft 2-M was the location of an accidental release that contaminated the original ground surface at Area 2, and high levels (129,223 disintegrations per minute [dpm] alpha activity, 20,083 dpm beta activity, and 8,207,127 dpm gamma activity) of radioactivity were found above the adjacent Shaft 2-N during prestabilization sampling. Additional discussion of this release and other releases is presented in Section 2.2 of the stabilization plan (LANL 1998, 59641). However, no elevated radioactivity was found at any location when removing the asphalt. As discussed in Section 5.1, samples of moisture taken beneath the asphalt in April 1998 contained above-background levels of tritium. Because of this, all of the removed asphalt was managed as low-level radioactive waste. After screening was completed, the excavated asphalt was temporarily staged on an unexcavated portion of the pavement, as needed, pending disposal at the Laboratory's low-level radioactive disposal facility, MDA G, at TA-54. A Komatsu WA250 front-end loader stockpiled and loaded the asphalt into trucks. The asphalt was delivered to TA-54 during September and October 1998, in accordance with Department of Transportation and other applicable regulations.

The area where asphalt had been removed was covered with a 20-mil high-density polyethylene (HDPE) liner, and excavated asphalt was covered with polyethylene sheeting during potential rain events. To promote drying, the surface of the underlying fill material was scarified by the backhoe to a depth of about 6 in. during excavation. However, because of the potential for exposing buried radiological contamination, no other reworking or excavation of the underlying fill material was performed. The casings of the two 150-ft-deep Resource Conservation and Recovery Act (RCRA) facility investigation (RFI) boreholes (49-2906 and 49-2907) were marked with orange paint for improved visibility and were not damaged during the excavation. A site map showing the extent of the asphalt that was removed is presented in Figure 2-3. Photographs of the asphalt removal process are presented in Figures 2-4 through 2-7.

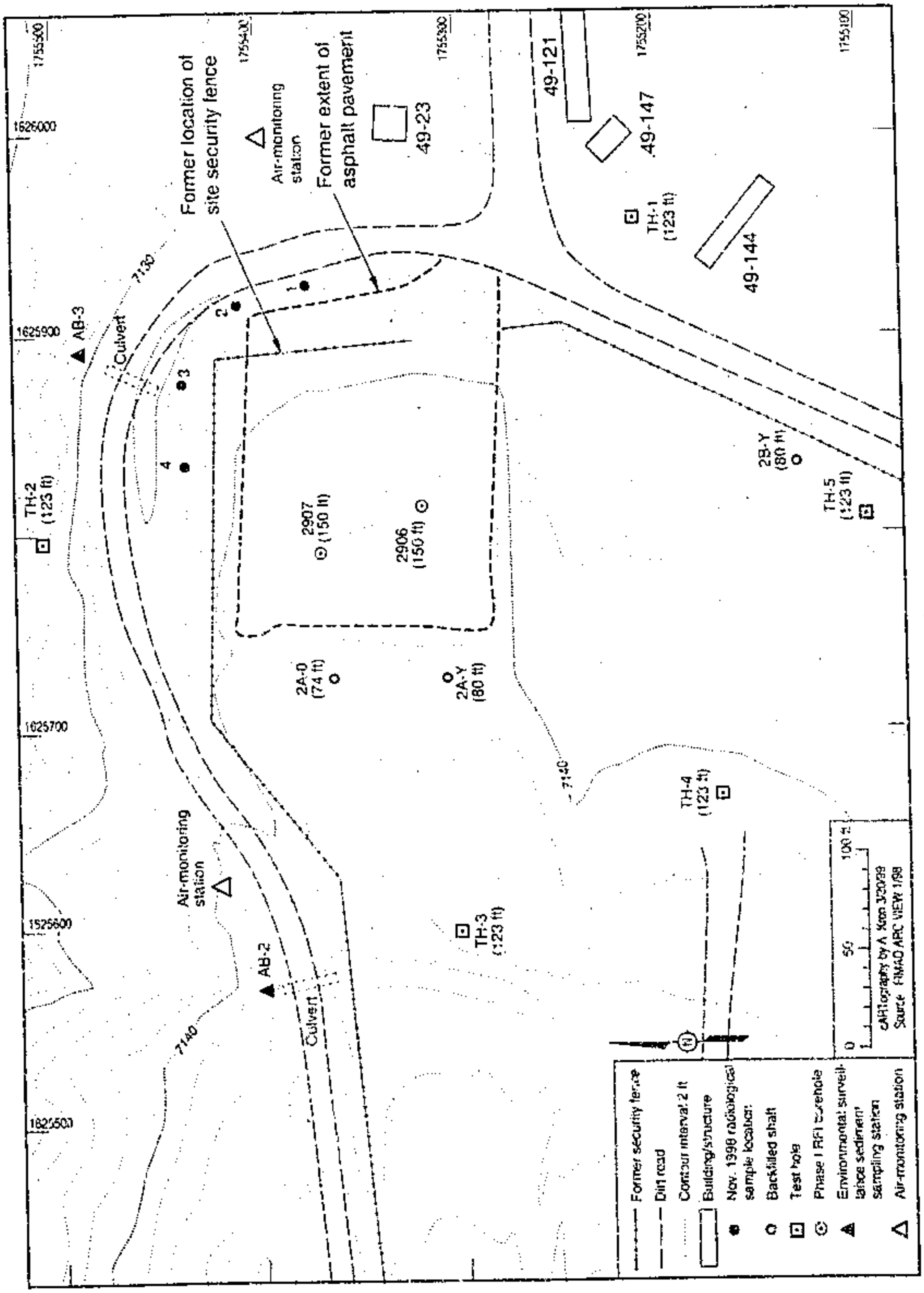

Figure 2-3. Area of asphalt removal and locations of four surface samples

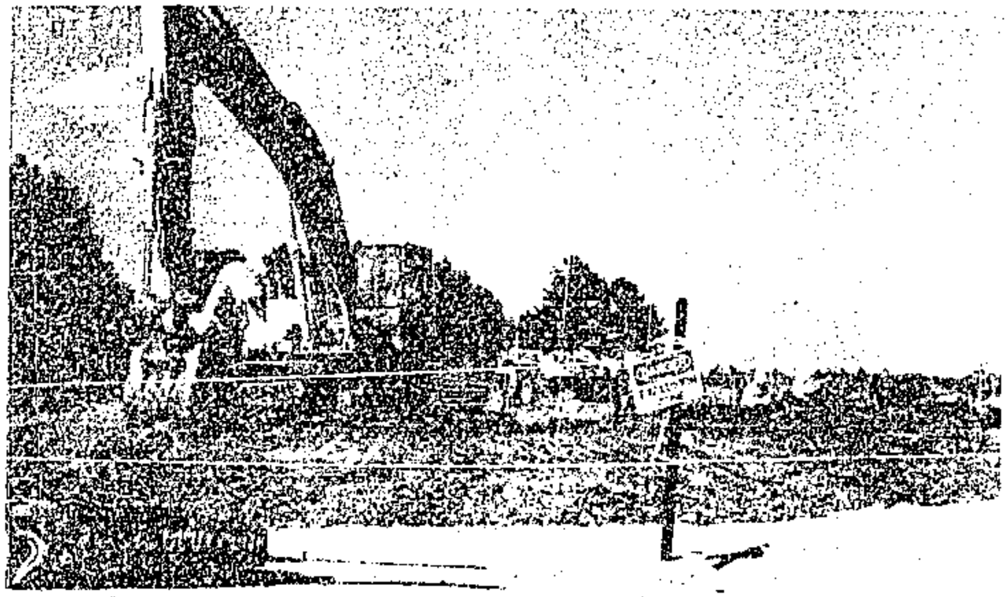

Figure 2-4. Removing the asphalt

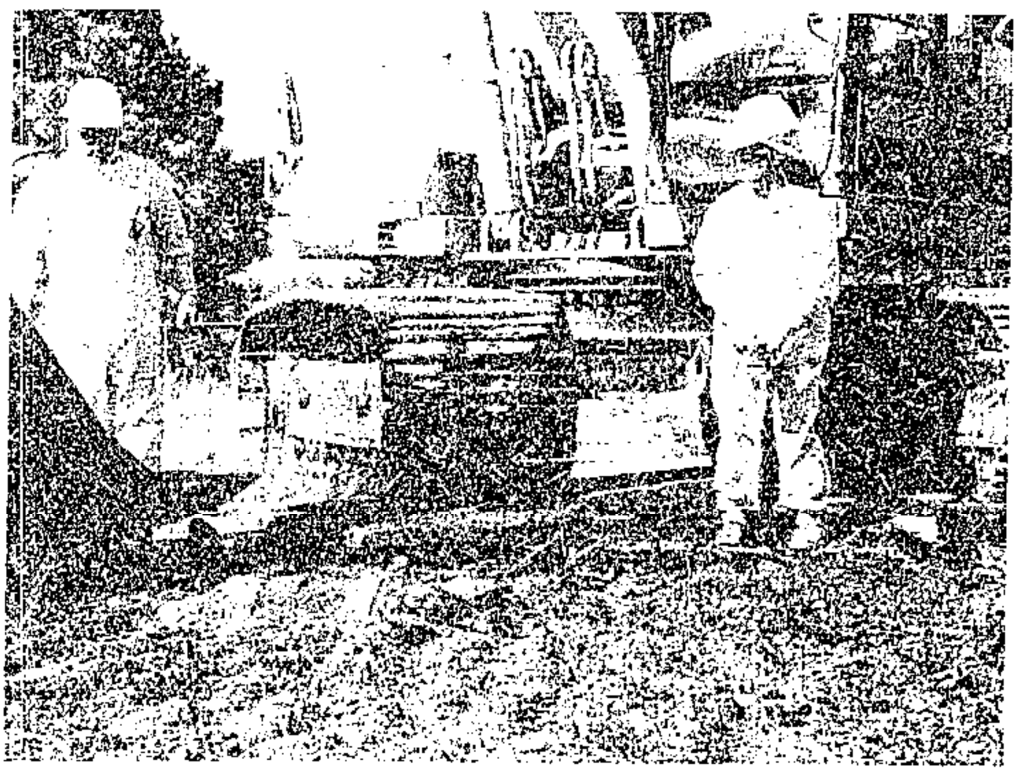

Figure 2-5. Screening for radionuclides as the asphalt is being removed

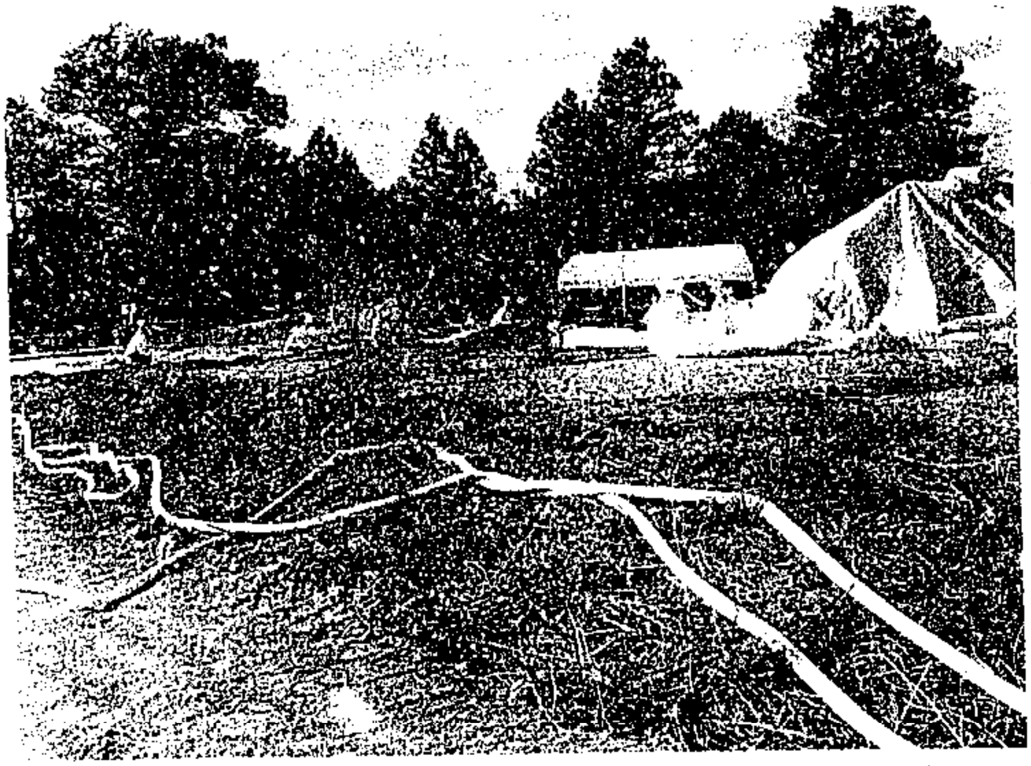

Figure 2-6. Prestabilization site conditions at MDA AB Area 2

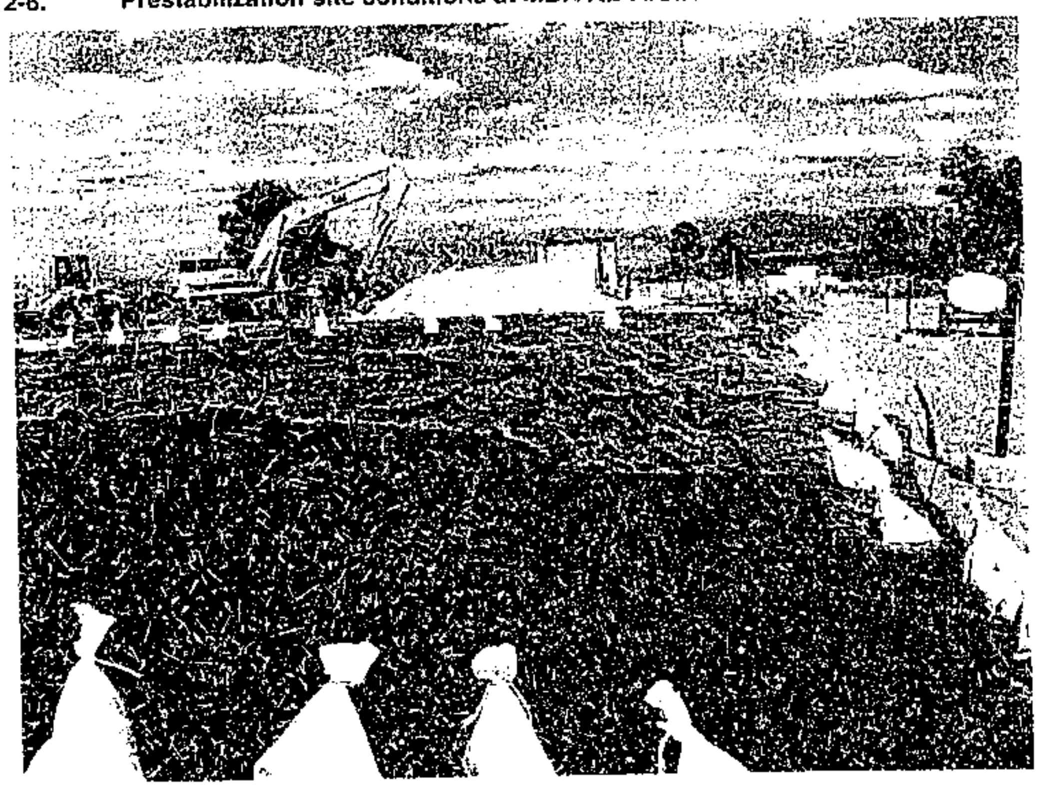

Figure 2-7. Covering the area after the asphalt has been removed

The asphalt varied from 1 to 8 in. in thickness but was generally thinner than the approximately 6 in. that was originally expected. The fill material beneath the asphalt was drier than originally expected, probably because of the lack of significant precipitation during the months preceding excavation and because a surface water diversion channel had previously been installed upstream from the asphalt pad. During the work, the fill material was visually characterized as dry to damp, and none of the wet to saturated conditions observed during the April 1998 RFI coring in the pad area were noted. The fill directly beneath the asphalt was a gravelly sand that was probably used as a base course before paving. The more clayey fill material beneath the base course was not exposed during excavation.

Screening of the asphalt and the exposed fill material beneath the asphalt was performed with an Eberline ESP-1 PG-2 instrument rather than a field instrument for detection of low-energy radiation (FIDLER) instrument, as originally planned, because a FIDLER instrument was not available. Because both instruments measure low-level gamma radiation using a sodium-iodide crystal, the results would be comparable, and this modification to the original plan was considered acceptable. Because no elevated radiation levels were found, a comprehensive, documented survey of the exposed surface beneath the asphalt was not considered necessary. After the completion of the asphalt removal with the excavator, the remaining larger chunks of asphalt (about 2 in.) were hand raked and removed for disposal. A total volume of approximately 490 yd^3 of asphalt was removed from the site. The final excavated surface was marked with survey hubs and plastic whiskers to identify the original grade of the fill materials.

2.5 Borings in Northeast Corner of Site

During a field-screening survey in November 1998, locations of above-background radiation were found on the slope at the northeast corner of Area 2. Although samples taken for analysis at the TA-21 count laboratory did not show radiological levels that were of concern for worker health and safety, control of the extensive gopher activity on the slope was necessary to avoid further unearthing of buried contaminants. Reduction of the slope angle would make it easier to install a gopher barrier and would also reduce erosion potential.

The slope was to be reduced by lowering the crest and raising the toe by 1 to 2 ft. Because lowering the crest involved excavating into soil that was potentially contaminated, 10 shallow boreholes were installed along the crest of the slope before excavation. The approximate locations of these borings are shown in Figure 2-1. The holes were numbered Gopher Hole (GH) 1 through 10. The boreholes were advanced with a hand auger on November 17, 1998, on approximately 10-ft spacings. Cuttings were collected in a core barrel from the ground surface to a depth of 3 ft in 6-in. lifts.

All cuttings were immediately field screened for low-level gamma radiation: an Eberline ESP-1 PG-2 instrument was rested on the cuttings, and 1-min. counts were taken. Ground surface background levels were determined from five background locations in the vicinity of the slope; they ranged between approximately 2000 counts per minute (cpm) and 3000 cpm and averaged about 2500 cpm. These readings were comparable to background levels in the vicinity of the Bottle House in Area 12 across the road. Two field measurements exceeded 3000 cpm, and the rest were within the background range. The first measurement (3170 cpm) was taken from a depth of 0 to 6 in. in Hole GH-7. This is sufficiently low that it was considered to be within the background range. The second measurement (4460 cpm) was taken from a depth of 0 to 6 in. in Hole GH-6. Although this is sufficiently elevated that it may be considered outside the background range, it was not high enough to be of concern for worker health and safety.

Based on the results of the surface screening and borings, a radiological work permit was prepared, and contouring of the slope proceeded. Soil was excavated from the crest of the slope with a front-end loader and moved across and down the slope to fill in low spots. The crest of the slope was reduced back to the approximate location of the original site fence. The excavated surface was screened for radiation as it was exposed, and no elevated levels were found.

2.6 Site Regrading

The site was regraded during October and November 1998 with clean, crushed tuff obtained from the Los Alamos County Landfill. The crushed tuff was placed on and in the vicinity of the pad area to create the final graded surface. The deep drainage channel beside the MDA AB perimeter road was also partially filled to reduce the potential for ponding. A Komatsu WA250 front-end loader was used to spread, shape, and compact the fill material. Although the fill material was originally planned to be specially compacted with a self-propelled vibratory compactor, the compaction provided by on-site equipment was found to be sufficient. Photographs of the regrading activities are shown in Figures 2-8 and 2-9.

The thickness of the new fill material ranged between a minimum of about 6 in. and a maximum of about 4 ft. The greatest thicknesses of fill were in the low area between MDA AB Areas 2 and 2B, where ponding formerly occurred, and on an east-west divide running roughly down the middle of the former pad; a greater thickness here encourages precipitation to run off to the north and south. Four-foot extensions were welded to the outer casings to raise the wellheads of the two 150-ft boreholes (49-2906 and 49-2907). A total fill volume of about 2750 yd^3 was required to attain the final fill grade and drain direct precipitation from the site. Because the area to be stabilized and the thickness of the fill were greater than originally planned, the volume of fill was greater. The limits of the regraded area are shown in Figure 2-1. The regrading included filling a low area to the west of the former pad and filling a former drainage swale on the southwest side of the site.

The steep slopes on the northern and northeastern sides of the site were the last portion of the site to be regraded; the regrading took place after cuttings from the borings had been screened. The slopes were reduced to lower erosion potential. These slopes had been a habitat for gophers, and elevated radioactivity levels had historically been found in the gopher diggings (LANL 1998, 59641, Section 3.2.1). A photograph of the slope reduction is shown in Figure 2-10. Before the slopes were reduced, the surface area was surveyed for radiation using an Eberline ESP-1 PG-2 low-level gamma meter; surface soil samples were taken at four above-background locations and submitted to the TA-21 count laboratory for fixed laboratory analysis. The locations of the four surface samples are shown in Figure 2-3. The samples were analyzed for gross alpha, beta, and gamma radiation. The results of those analyses are shown in Table 2-1.

Only one measurement (a gross alpha value of 16.2 pCi/g in sample 3) was above the count laboratory's minimum detectable concentration, and none of the results were considered to be of concern to worker health and safety. Radiological screening of subsurface samples from the 10 borings also yielded results that were not of concern to worker health and safety by the ESH-1 staff on site during the work. Based on the results of these surveys, excavation and grading of the slopes was allowed to proceed.

Although no bedrock was encountered when reducing the slopes, an approximately 20-ft-long, 1-ft-wide zone of damp soil was encountered adjacent to the northeast corner of the site about halfway up the slope. This damp area was thought to have resulted from lateral movement of moisture that had accumulated beneath the former asphalt pad, probably within the old fill material. A 4-ft by 4-ft concrete drop structure was placed at the upstream end of the existing culvert at the northeast corner of the site to accommodate the change in grade and reduce erosion potential. The location of the drop structure is shown in Figure 2-1. No changes were made to the existing culvert or to the perimeter road.

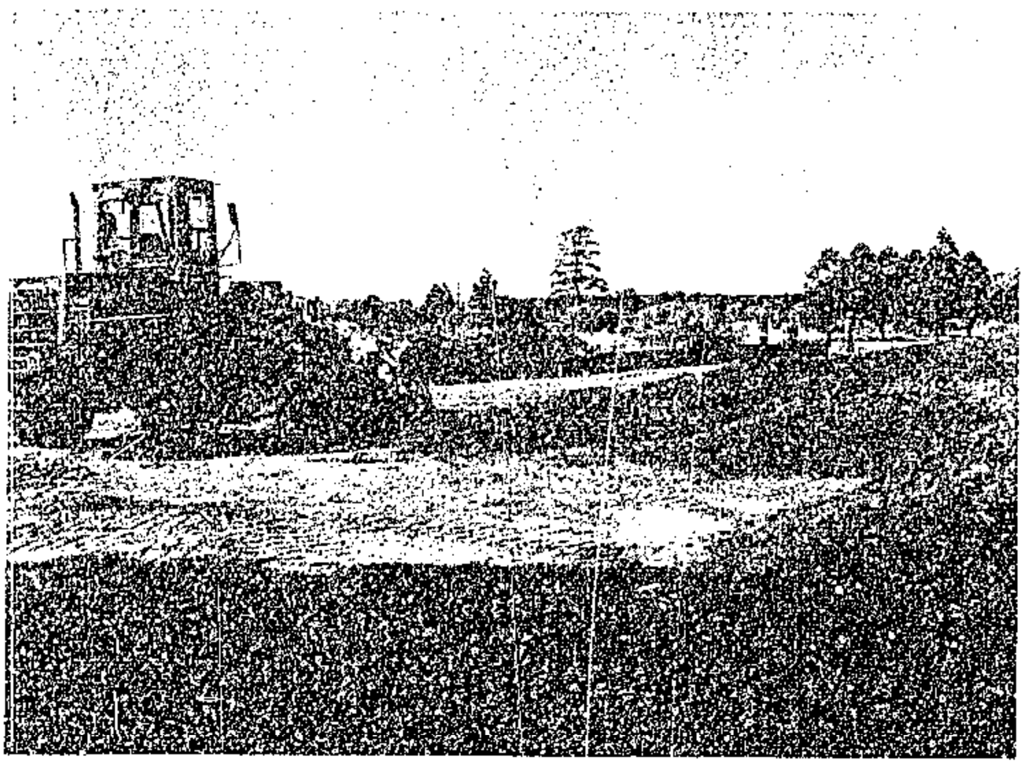

Figure 2-8. Regrading the area after asphalt removal

Figure 2-9. Regrading the area after the asphalt was removed

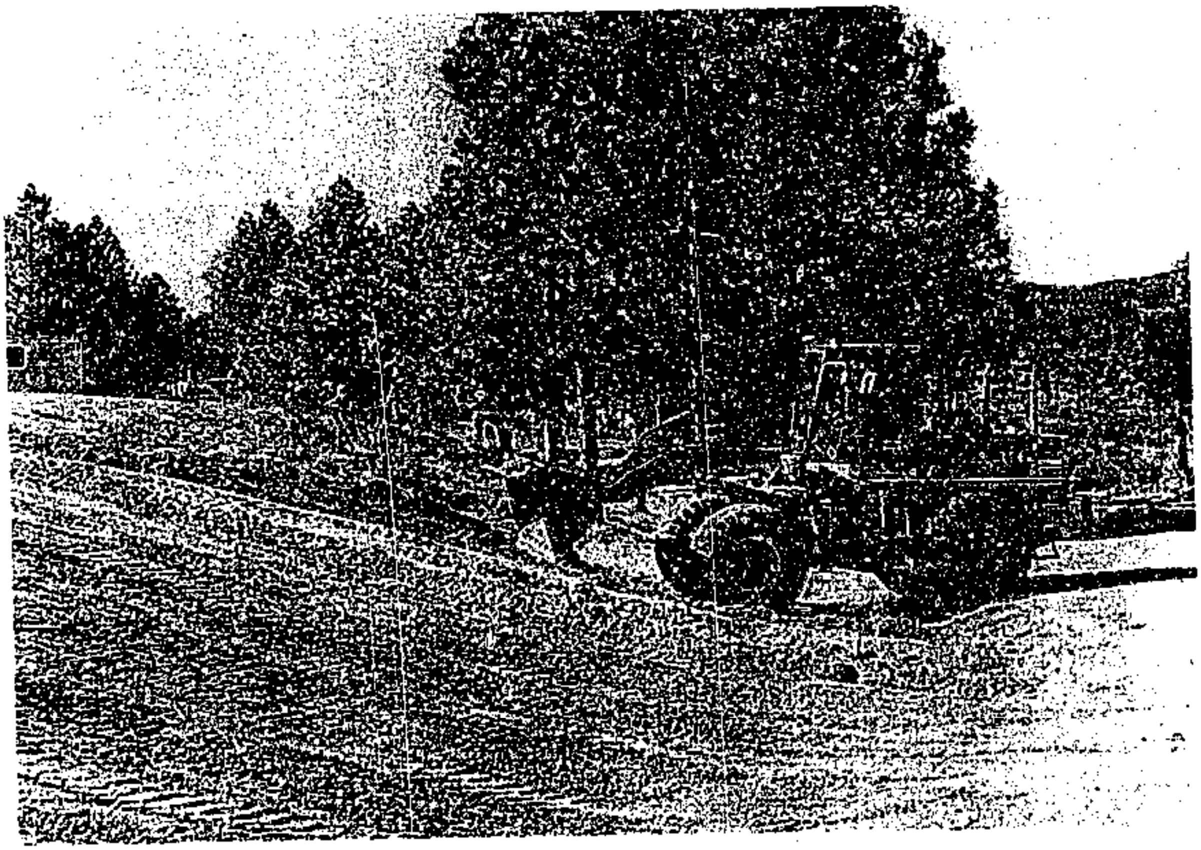

Figure 2-10. **Reducing the slope on the northeast corner**

Table 2-1
Results of November 1998 Soil Samples taken from Northeast Corner of Site

Sample Number	Gross Alpha (pCi/g)	Gross Beta (pCi/g)	Gross Gamma (pCi/g)
1	<1.41E+00*	<1.43E+00*	<4.74E+01*
2	<1.12E+00*	<1.25E+00*	<5.36E+01*
3	1.62E+01	<1.25E+00*	<5.61E+01*
4	<6.64E-01*	<1.15E+00*	<5.78E+01*

* Minimum detectable concentration is shown; analytical result was less than this amount.

2.7 Placing Topsoil

A 6-in. layer of topsoil was placed over the regraded surface of the site in November and December 1998. Approximately 1260 yd^3 of topsoil was used. This volume was greater than originally planned because of the greater extent of the stabilized area. Because of the scarcity and cost of topsoil from sources near Los Alamos, it was most cost-effective to bring in soil from the Albuquerque area. The soil was obtained from several sources; some loads were mixed with organic soil builder to obtain a more uniform quality. Photographs of the soil placement activity are shown in Figures 2-11 and 2-12.

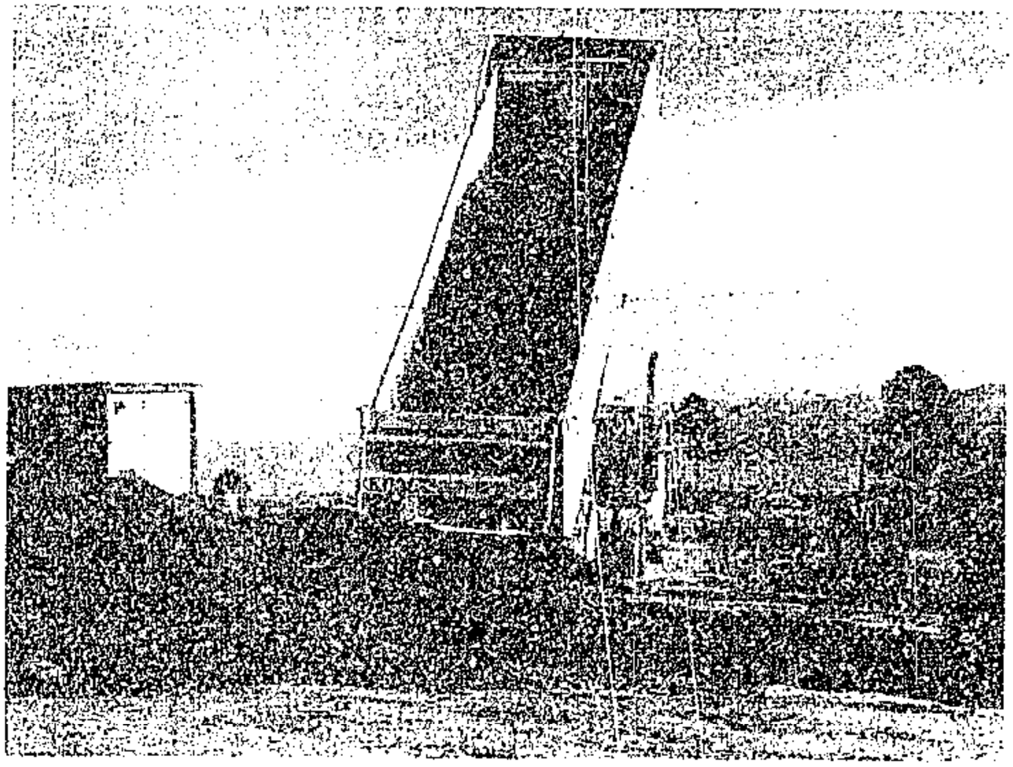

Figure 2-11. Placing soil on the regraded area

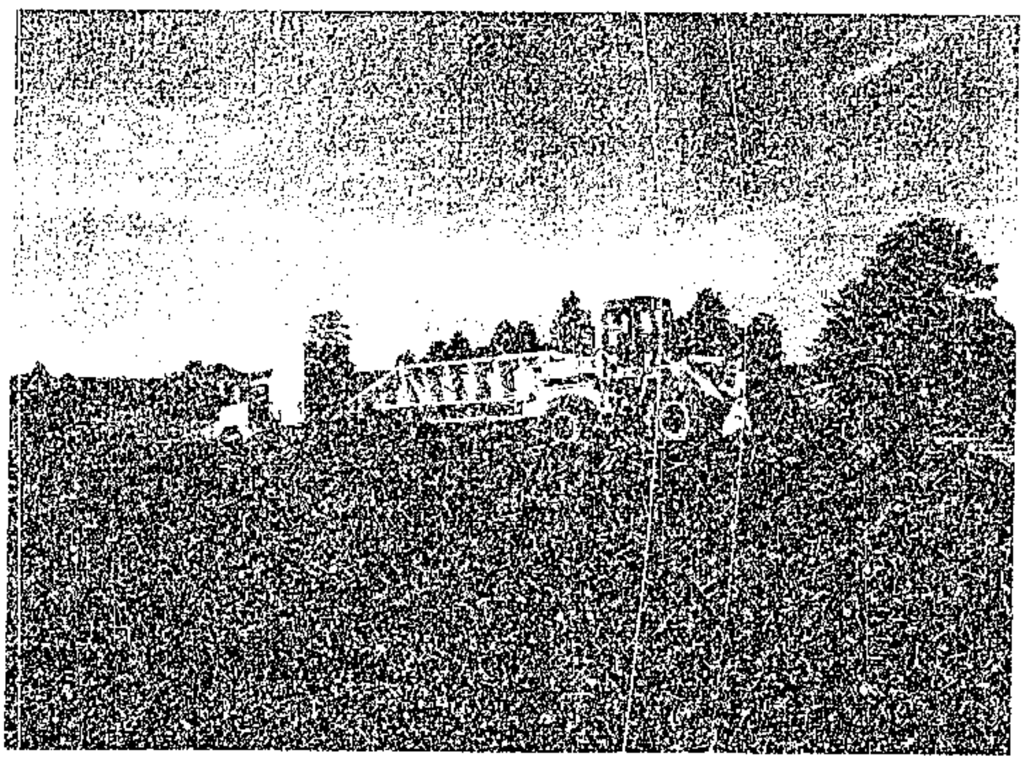

Figure 2-12. Placing soil on the regraded area

The minimum thickness of tuff, along with a minimum 6-in. thickness of topsoil (Section 2.3) was intended to provide a minimum 1 ft of additional cover over the prestabilization surface at the site for erosion protection.

2.8 Site Seeding

The topsoil was hand-seeded with a 48-lb. mixture of 40% blue grama (Bouteloua gracilis), 40% western wheatgrass (Agropyron smithii), and 20% annual ryegrass. The seed was purchased from Plants of the Southwest in Santa Fe, New Mexico. This seed mixture was recommended by ESH-20 personnel and was a modification of the originally planned mixture of 50% blue grama and 50% western wheatgrass. Under environmental conditions at Los Alamos, blue grama and western wheatgrass are shallow-rooted perennial grasses; they are intended to enhance evapotranspiration and provide a stable, long-term cover for the site. The ryegrass is an annual that germinates in early spring and is intended to provide shade and increased soil water retention in the first year, thereby enhancing the germination of the other grasses later in the spring. Shallow-rooted grasses were preferred to minimize contact with radioactive contamination remaining on the original ground surface beneath the former asphalt pad area. After seeding, the site was smoothed with a wood and wire drag to cover the seed with a thin layer of soil and minimize losses to birds and rodents. Additional information on the selection of plants for revegetation is presented in Appendix C.

2.9 Placing Erosion Protection Gravel

Immediately after seeding, the site was covered with a thin layer of gravel to increase erosion protection. The gravel is also expected to protect the seed from animals and act as a mulch to enhance germination. About 160 yd^3 of gravel was used; this volume was greater than originally planned because of the greater extent of the stabilized area. The gravel was placed with a front-end loader and hand raked to achieve the desired final coverage. Over most of the site, the gravel was placed as a single layer with 70% coverage to simulate a natural desert pavement. This simulated desert pavement had been successfully used for erosion protection in landfill cover experimental test plots at Los Alamos (Nyhan et al. 1995, 63111, p. 282). A 2-in. thickness of gravel was placed on the steeper slopes on the north and northeast sides of the site for increased erosion protection. The gravel was obtained from sources in the Española Valley east of Los Alamos. The gravel consisted of nonuniform, angular crushed rock with a D_{50} value of about 0.75 in. and a D_{100} value of 1 in. A specification sheet for the gravel is presented in Appendix D along with documentation of the acceptability of this gravel for protecting the site against a 100-yr, 24-hr storm event. Photographs of the gravel erosion protection layer are shown in Figures 2-13 and 2-14.

2.10 Biointrusion Barrier

The potential for biointrusion is of concern because of the radioactive contamination remaining on the original ground surface at depths of about 4 ft to 7 ft beneath the final stabilized surface. Biointrusion by deep-rooted plants will be controlled by manually removing such plants from the site, as discussed in Chapter 4. Biointrusion by gophers is a more significant concern because gophers are numerous at the site and have in the past unearthed radioactive materials. In cooperation with ESH-20 personnel, a continuous wire mesh barrier was designed to control burrowing gophers. Chainlink fence material fabricated from galvanized, 11-gauge steel with 1/2-in. openings was selected for this purpose. This material was laid directly on the graveled surface over the part of the site where near-surface contamination had been found or was suspected. This included the area where the asphalt pad had been and the slopes on the northern and northeastern sides of the site where gophers had unearthed radioactive materials. Additional information on the design and installation of the biointrusion barrier is presented in Appendix E.

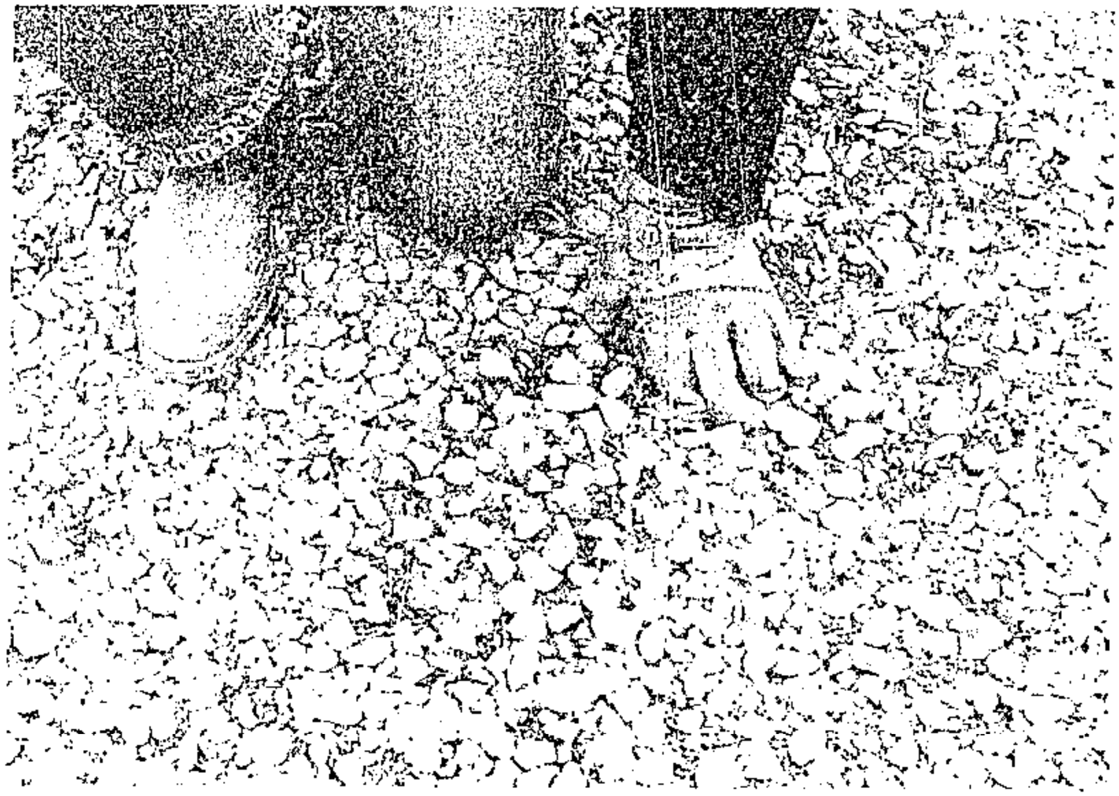

Figure 2-13. Gravel cover

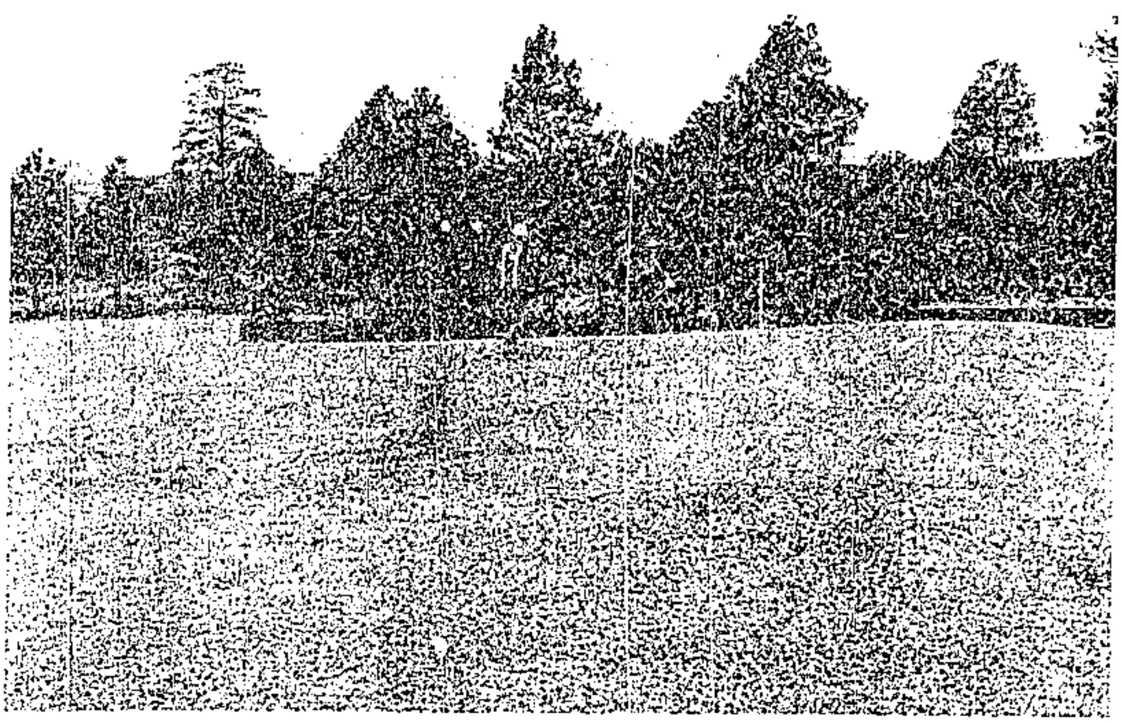

Figure 2-14. Gravel cover on Area 2

The edge of the wire mesh was buried in a 2-ft-deep vertical trench to keep gophers from burrowing under the edge. Individual sheets of wire mesh were approximately 12 x 25 ft in size and were overlapped a minimum of 6 in. About 140 sheets were used to form the barrier. The individual sheets were clipped together with steel hog rings placed about 12 in. apart. The trunk of a pine tree penetrating the barrier was wrapped with wire mesh to a height of about 3 ft, and the openings between the wire mesh and the two 150-ft RFI wellheads were closed with approximately 2-ft by 2-ft surface seals of concrete. The wire mesh biointrusion barrier covered approximately 33,050 ft^2, or 55%, of the 60,260 ft^2 area affected by the stabilization activities. The area covered by the wire mesh biointrusion barrier is shown in Figure 2-1. Photographs of the barrier and its installation are shown in Figures 2-15 and 2-16.

2.11 Site Cleanup and Fencing

After completing the principal stabilization activities, the site was cleaned of all construction debris. Wooden pallets that had previously been stored on the site were removed. A silt fence was constructed around the downgradient edges of the stabilized area, and the MDA AB perimeter road was regraded and regraveled where required. Grade markers that were planned to be placed on the part of the stabilized area not covered by the biointrusion barrier could not be installed because of frozen ground. No markers are needed on the part of the site with biointrusion protection because the wire mesh barrier will serve as a benchmark for visually identifying the depth of erosion. Additional discussion of erosion and the associated inspection and maintenance requirements is presented in Chapter 4.

The site chainlink security fence was relocated around the edge of the stabilized area. Delineator reflectors were placed where the site perimeter road curves around Area 2. The old gate on the eastern side of the site was not replaced because of a concern that it would encourage vehicular traffic across the stabilized area and the biointrusion barrier. However, a new gate was installed on the northwestern side of the site to permit vehicular access to the edge of the stabilized area for borehole drilling and other purposes. Posts for the chainlink fence were placed in 3-ft-deep holes and backfilled with concrete. The soil near the bottoms of two postholes at the northeast corner of the site was nearly saturated with water. These holes were located downgradient from the damp soil encountered when lowering the surface slope in the northeast corner, and the wet conditions are likely associated with the lateral movement of moisture that had accumulated beneath the former asphalt pad. The locations of the stabilized area silt fence, new security fence, wet postholes, and new access gate are shown in Figure 2-1. Photographs of the fences are shown in Figures 2-17 and 2-18.

2.12 Poststabilization Land Survey

The regrading of the site resulted in a crowned final grade that allows runoff to exit the site in all directions (Figure 2-1).

2.13 Final Inspection and Project Acceptance

On February 3, 1999, a final site inspection was conducted by the contractor and the Laboratory's technical representative. The inspection included all aspects of the stabilization measure construction activities and final site cleanup. At the end of the inspection, the Laboratory's technical representative concurred that all project construction activities had been satisfactorily completed.

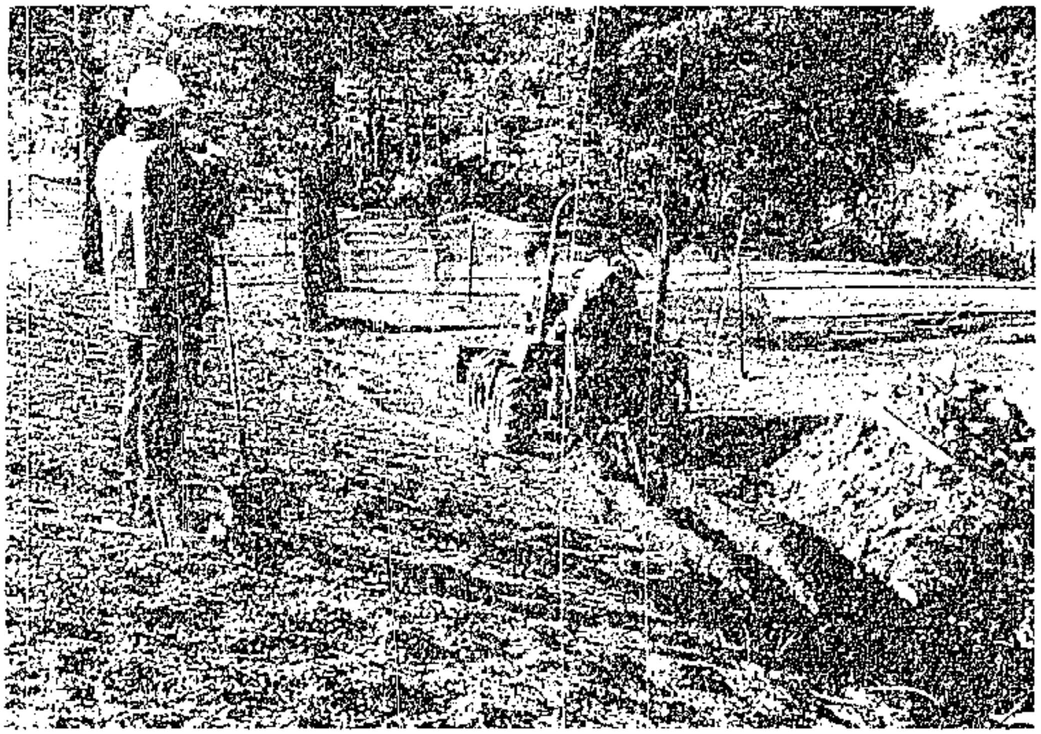

Figure 2-15. Trenching for the barrier

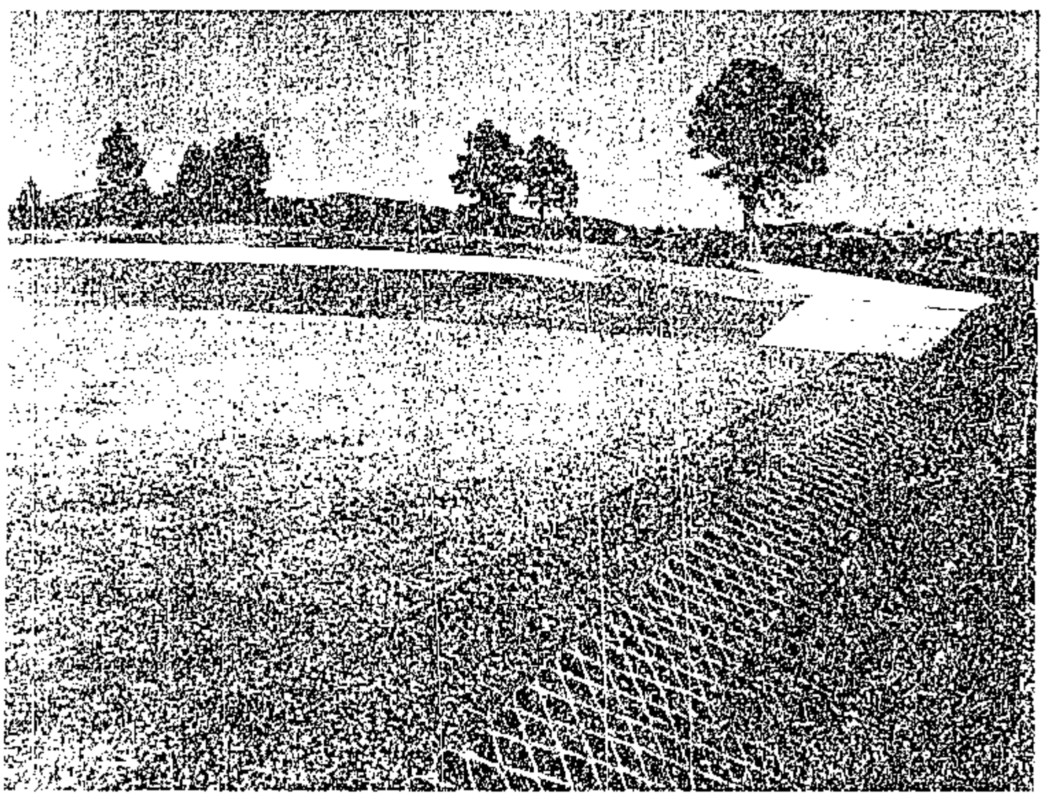

Figure 2-16. Gopher barrier

Figure 2-17. Installing the silt fence

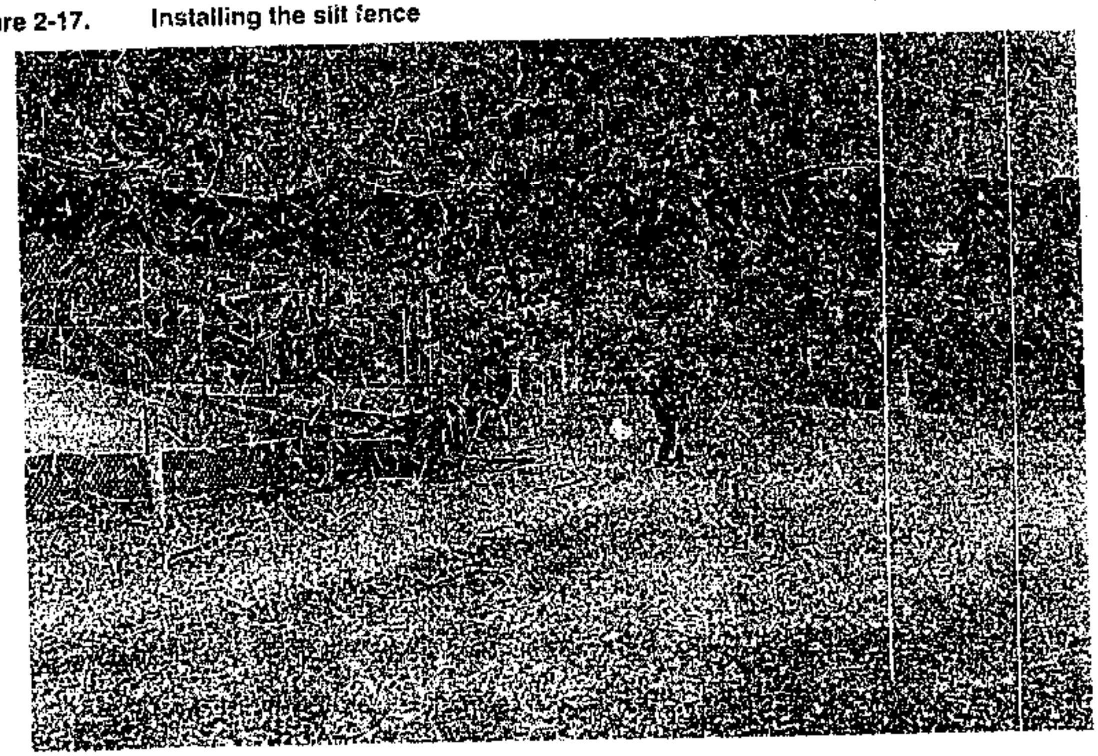

Figure 2-18. New security fence around the area

3.0 MONITORING

Plans for long-term monitoring of the stabilized area and its vicinity have been presented in two documents (LANL 1998, 59641, Chapter 6; Environmental Restoration Project 1998, 62040, Attachment A). The monitoring program will focus on periodic measurement of moisture levels in the subsurface soils and tuff. Monitoring of air, surface water, and sediment quality is also conducted in the vicinity of Area 2 as part of other Laboratory programs. No poststabilization monitoring data to evaluate the effectiveness of the interim measure were available from the site at the time this report was prepared. Extensive monitoring programs to determine effectiveness have been planned and are described below. Because this stabilization effort was not a cleanup activity, no confirmatory sampling was conducted.

3.1 Moisture Monitoring

Because high moisture levels were present at the site, the planned monitoring program will focus principally on moisture monitoring. On a monthly basis, the Laboratory plans to use neutron probes to monitor moisture contents between the ground surface and the soil-tuff interface in the three boreholes in the former pad area (CH-2, 49-2906, and 49-2907) and the two off-site boreholes (TH-1 and TH-3) (Figure 2-1) In addition, on a quarterly basis, the Laboratory plans to monitor all (10) site boreholes to total depth. This program will continue for at least two years, during which time the data will be analyzed for trends. Contingencies that will be taken if a significant trend of increasing moisture content is found are described in an ER Project document (1998, 62040, Attachment A). The results of past moisture monitoring in the existing off-site boreholes are shown in Appendix F. These results show a remarkably consistent pattern below a depth of about 3 ft, indicating relatively stable conditions beneath the zone influenced by seasonal trends and individual storm events.

The results obtained from the August 1998 measurements are the only neutron probe data available from boreholes CH-2, 49-2906, and 49-2907. The results from 4-in.-diameter CH-2 are presented in Appendix F. They were measured before the well was plugged and abandoned and illustrate the elevated moisture levels present beneath the former asphalt pad area. The results from the two 150-ft RFI boreholes (49-2906 and 49-2907) have not been included in this report. They appear to have been significantly attenuated and suggest that the neutron probe may not have been properly calibrated for these larger 8-in.-diameter holes. Additional monitoring planned for Fiscal Year 2000 will include a check on the ability of the instrument to make adequate measurements in these larger holes.

3.2 Stormwater and Sediment Monitoring

Stormwater and sediment monitoring are being conducted at locations AB-2 to the northwest and AB-3 to the northeast of the stabilized area. The locations of these monitoring stations are shown in Figure 2-1. This monitoring is part of ESH-18's site-wide surface water program. ESH has taken sediment samples annually at the two stations since the 1970s, and the above-background radionuclide levels occasionally found focused attention on Area 2. This eventually led to the stabilization effort described in this report. Because of the ephemeral nature of runoff events, there is little data on the quality of stormwater; however, ESH did take water samples at Station AB-2 in 1987 and 1998. The 1987 results were published in the annual environmental surveillance report for that year, and analyses for a limited number of radionuclides, metals, and major ions showed no values exceeding drinking water standards (ESG 1988, 6877, p. 263). The more comprehensive analysis performed on the 1998 sample showed

- no detectable Aroclors,
- gamma spectrometry results that were below detection limits or less than the 2-sigma total propagated uncertainty for all nuclides,
- metals that were either not detected or at the reporting limit (except aluminum at 3.1 mg/l),
- nitroaromatics and nitramines (high explosives) that were below reporting limits, and
- no reportable semivolatile organic compounds (SVOCs).

The results of the 1998 analyses are included in the site storm water pollution prevention (SWPP) plan (MK/PMC Los Alamos Project Team 1998, 62910, Appendix D).

4.0 INSPECTION AND MAINTENANCE

A program of inspections for excessive erosion rates, biointrusion, and general site integrity is described in the stabilization plan (LANL 1998, 59641, Chapter 7). During quarterly monitoring, the site will be inspected for erosion of the regraded surface, deep-rooted plants growing on the site, gopher burrows, evidence of ponding, integrity of the site security fence and signs, and the proper performance of erosion control measures installed as BMPs. Areas with more than 4 in. of erosion will be restored by placing additional topsoil, crushed tuff, and gravel, as needed. The depth of gullying for the 100-yr, 24-hr. storm is estimated to be about 4 in., and the minimum thickness of new cover over the prestabilization ground surface is about 12 in. If the 100-yr storm occurred after the first 4 in. had eroded, the last 4 in. would provide a buffer against erosion to the prestabilization surface. However, it should be noted that site inspection will be performed after major rainfall events to ensure that significant erosion has not occurred.

Breaches in the gopher barrier will be repaired, gophers on the site within the area of the barrier will be removed, and the effects of their burrows will be repaired. Low-lying areas will be filled with soil or crushed tuff. The site security fence will be inspected and repairs will be performed, as needed. Warning and hazard signs installed at the site during the stabilization activities will be inspected and repaired or replaced, as needed. Site inspections and maintenance will be documented on the inspection and maintenance form presented in Appendix G. Completed forms will be maintained by the ER Project's MDA focus area leader. Routine inspections for the proper performance of off-site erosion control measures will be performed and documented as part of the site's SWPP plan (MK/PMC Los Alamos Project Team 1998, 62910).

5.0 WASTE MANAGEMENT

Waste materials generated during the interim measure activities at Area 2 were managed in accordance with the waste characterization strategy form prepared for this project (Environmental Restoration Project 1998, 57587).

5.1 Asphalt

Before the asphalt paving at Area 2 was removed, it was characterized by direct sampling of the asphalt and moisture sampling in the underlying fill material (Figure 5-1). One sample of asphalt taken from above Shaft 2-M in the center of the pad area was analyzed for volatile organic compounds (VOCs), SVOCs, and polychlorinated biphenyls/pesticides. No organic constituents were detected. Five composite asphalt samples taken from the four corners and center of the pad area were analyzed for target analyte list (TAL) metals and radionuclides (isotopic americium, plutonium, and uranium). The metals were detected at levels below RCRA limits for hazardous classification, and the radiochemical analyses indicated background activity ranges. Soil moisture samples taken directly beneath the asphalt at each shaft location and at six supplemental locations were analyzed for tritium. Results for the 28 soil moisture samples ranged from 0 pCi/ml to 4340 pCi/ml and were generally above the background level of about 6 pCi/ml. Detailed results of the asphalt and tritium sampling will be included in the MDA AB data summary report. The above-background tritium levels were found throughout the pad area and probably originated from tritium used in the 1960s nuclear safety tests at the site. A description of those tests is presented in the stabilization plan (LANL 1998, 59641, Chapter 2). Because of the presence and widespread distribution of elevated tritium levels and because of the ability of asphalt to uptake tritium into the structure of its organic compounds, all asphalt was managed as low-level radioactive waste.

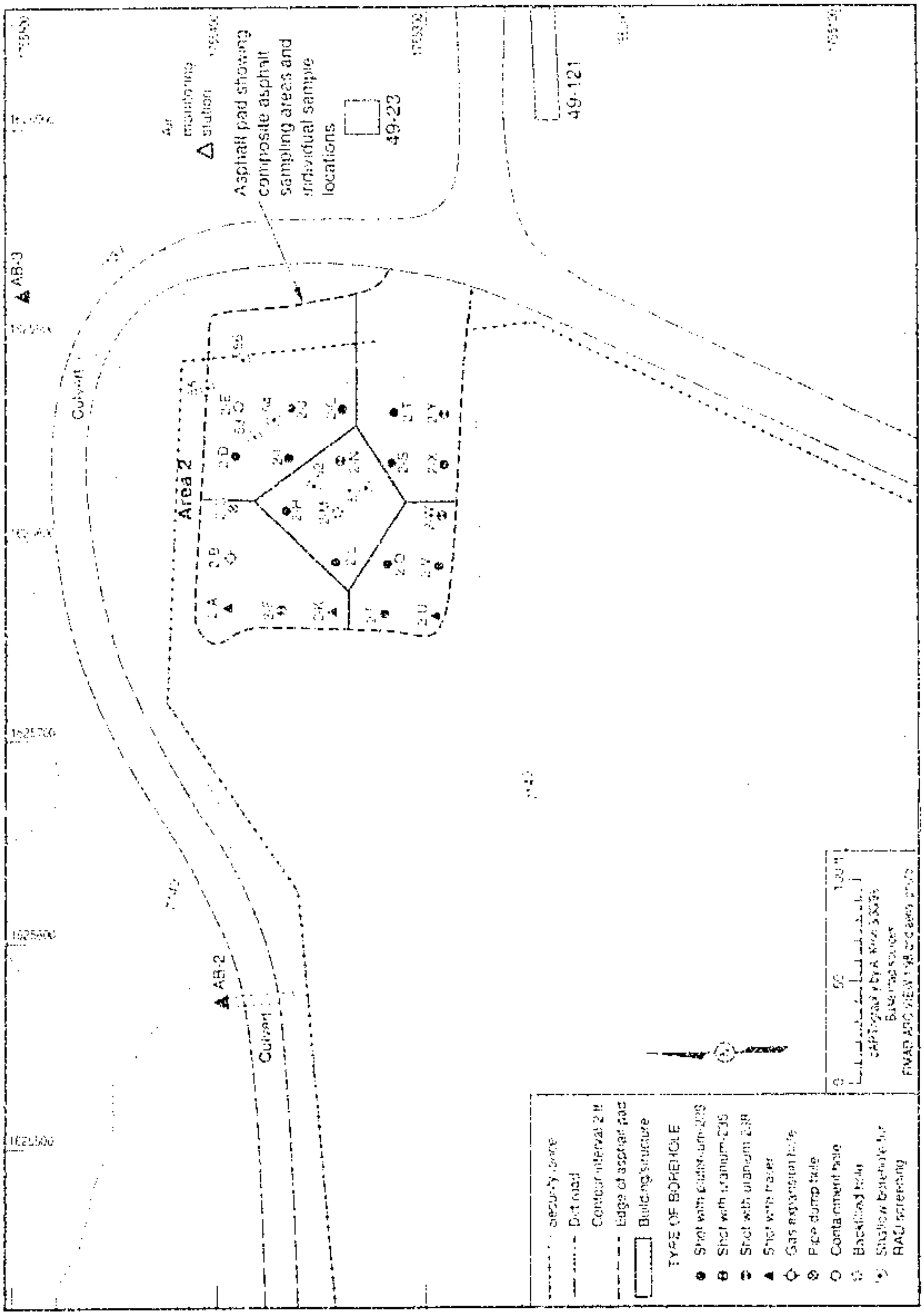

Figure 5-1. Asphalt and tritium sample locations

During transport, the asphalt was covered by tarps. Waste shipments were coordinated with TA-54's operating schedule. The asphalt was placed in disposal pits as directed by TA-54 personnel.

5.2 CH-2 Casing

CH-2 was originally completed with 500 ft of 2-in.-diameter galvanized steel pipe casing that had threaded joints and was installed ungrouted into an approximately 4-in.-diameter borehole. The casing was removed, and the hole was plugged and abandoned in August 1998 as part of the stabilization effort. The casing was disassembled by unscrewing it at the threaded joints as it was removed from the hole. Wet soil and/or bentonite mud coated the casing over its entire length. The thickness of this coating ranged between a thin film and about 1/4 in. and averaged about 1/8 in.

At a depth of about 25 ft, above-background levels of radioactivity were detected on the casing and the attached mud during field screening. All coating scrapings within the depth interval of 21.5 to 103.5 ft were collected to obtain sufficient volume for a sample. The sample was analyzed for TAL metals, VOCs, SVOCs, gross alpha/beta/gamma, tritium, and moisture content. Above-background gross alpha readings were obtained from the sample. Samples were also taken of the soil on top of the concrete surface seal on CH-2 and of the soil/mud coating on the casing within the depth intervals of 223.5 to 243.5 ft and 473.5 ft to total depth The analytical results indicated the presence of total lead at a maximum concentration of 570 ppm. The soil/mud samples were resubmitted for toxicity characteristic leaching procedure metal analysis and were below RCRA limits for hazardous classification. The soil/mud samples were also measured for gross alpha, beta, and gamma radioactivity.

Initially, the casing was to be cleaned so it could be recycled or used as scrap metal; however, this alternative could not be implemented because equipment needed to screen the inside of the casing for radiological constituents was not available. Swipe samples taken of the casing indicated no detectable radioactive contamination. Because the swipe results were negative, the casing could not be accepted for disposal at TA-54. However, the earlier field-screening results and process knowledge of the site indicated that the casing could be radiologically contaminated. The casing was shipped in May 1999 to GTS Duratek, a facility in Oak Ridge, Tennessee, that processes radioactively contaminated metals. The casing was cut into approximately 5-ft lengths and stored on site in a metal B-25-type box before shipment.

5.3 Other On-Site Waste and Salvage Materials

Other waste and salvage materials consisted of wood pallets, vegetation removed from the work area, plastic sheeting, fence materials, personal protective equipment (PPE), and sample residuals. A stack of old wood pallets was found between Areas 2 and 2B. Swipe samples indicated the pallets were free from detectable radioactive contamination, and they were removed from the site by the construction subcontractor for disposal or reuse. Vegetation was cut up and added to the erosion control structures to help minimize erosion. The chainlink security fence at Area 2 was removed during construction. Swipe samples of the fence materials indicated that they were free from detectable radioactive contamination. Damaged sections were removed from the site for disposal; other sections were reused. Based on process knowledge, PPE was drummed for disposal at TA-54 as low-level radioactive waste.

Polyethylene sheeting was used to protect the waste asphalt from rain and to temporarily cover tools and other field equipment. The sheeting was also used to wrap fencing materials, corrugated pipe, hand tools, and other items that were removed from the site and possibly contaminated. Swipe samples were taken of the sheeting; they were free from detectable radioactive contamination, and the sheeting was transported to the Los Alamos County Landfill for disposal. The polyethylene sheeting used to cover the ground when CH-2 was plugged and abandoned was bagged for disposal. Swipe samples were taken of the sheeting; detectable radioactive contamination was found in 1 of the 12 bags. The bag with detectable radioactive contamination was segregated and drummed for disposal at TA-54; the other bags were disposed of at the Los Alamos County Landfill. Swipe samples were taken of the 20-mil HDPE liner used to cover the fill materials underlying the removed asphalt; they were free from detectable radioactive contamination, and the sheeting was disposed of at the Los Alamos County Landfill.

Most sample residuals were returned to the original sampling locations. One sample from a shallow boring above Shaft 2-N and the associated PPE and sampling equipment were isolated for off-site disposal because the sample contained transuranic (TRU) levels of radiological materials. Because the level of radioactivity was high (129,223 cpm alpha activity, 20,083 dpm beta activity, and 8,207,127 dpm gamma activity) and the sample was located at the original ground surface, it is likely the contamination found above Shaft 2-N originated from the 1960 accidental release from adjacent Shaft 2-M. Additional discussion of this release is presented in the stabilization plan (LANL 1998, 59641, Chapter 2). The lead, which was also used in the nuclear safety tests, is regulated under RCRA and could be collocated with the radionuclides. Therefore, sample residuals and associated PPE and sampling equipment from Shaft 2-N were managed as mixed TRU waste and drummed for storage at TA-54 pending the availability of an appropriate disposal facility. Detailed information on the sampling results will be presented in the MDA AB, Area 2, data summary report.

6.0 SCHEDULE

The Laboratory's ER Project internal peer review of the Area 2 interim measure activities occurred on April 8, 1998, and the readiness review for field implementation occurred on September 8, 1998. Implementation of the interim measure activities began on September 14, 1998, and was completed on January 19, 1999. A detailed schedule of key project activities is presented in Table 6-2.

Table 6-2
Schedule of Interim Measure Activities

Date	Activity
8/17/98	Mobilized equipment for plugging and abandoning CH-2
8/20/98	Began pulling casing on CH-2
8/24/98	Completed pulling casing on CH-2
8/24/98	Began grouting CH-2
8/25/98	Completed grouting CH-2
8/28/98	Completed equipment demobilization
9/14/98	Began site preparation work
9/17/98	Began placement of crushed tuff around pad perimeter
9/18/98	Completed placement of crushed tuff around pad perimeter
9/21/98	Began asphalt removal with excavator
9/22/98	First shipment of asphalt sent to TA-54 for disposal
10/15/98	Completed asphalt removal with excavator
10/19/98	Completed hand raking and removal of smaller asphalt pieces
10/20/98	Last shipment of asphalt sent to TA-54 for disposal
10/28/98	Began site regrading with crushed tuff
11/10/98	Installed 4-ft extensions to the two 150-ft RFI boreholes at Area 2

Table 6-2 (continued)

Date	Activity
11/13/98	Completed site regrading with crushed tuff
11/18/98	Began placing topsoil on regraded area
11/23/98	Recontoured northeast corner (gopher area)
11/23/98	Began installing site silt fence
12/03/98	Completed placing topsoil on regraded area
12/04/98	Seeded topsoil with shallow rooting grasses
12/07/98	Began placing gravel erosion protection
12/15/98	Began installing gopher barrier
12/16/98	Installed drop structure for northeast corner culvert
12/21/98	Completed installing gopher barrier
12/23/98	Completed placing gravel erosion protection
12/24/98	Completed installing site silt fence
1/04/99	Began final cleanup of construction debris
1/06/99	Began installing site security fence
1/07/99	Installed grate for drop structure
1/15/99	Completed installing site security fence
1/19/99	Completed final cleanup of construction debris and demobilization
2/03/99	Performed final site inspection and project acceptance

7.0 REFERENCES

The following list includes all references cited in this document. Parenthetical information following each reference provides the author, publication date, and the ER record identification (ID) number. This information also is included in the citations in the text. ER ID numbers are assigned by the Laboratory's ER Project to track records associated with the Project. These numbers can be used to locate copies of the actual documents at the ER Project's Records Processing Facility and, where applicable, within the ER Project reference library titled "Reference Set for Material Disposal Areas, Technical Area 49."

Copies of the reference library are maintained at the NMED Hazardous and Radioactive Materials Bureau; the Department of Energy Los Alamos Area Office; United States Environmental Protection Agency, Region VI; and the ER Project MDAs Focus Area. This library is a living collection of documents that was developed to ensure that the administrative authority (AA) has all the necessary material to review the decisions and actions proposed in this document. However, documents previously submitted to the AA are not included in the reference library.

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Environmental Restoration Project, August 11, 1998. "LANL ER Project Site-Specific Health and Safety Plan (SSHASP), Best Management Practices Stabilization (BMP/S) at Material Disposal Area (MDA) AB, Areas 2, 2A, and 2B - PRSs 49-001 (b, c, d, and g)," SSHASP No. 204, Los Alamos National Laboratory, Los Alamos, New Mexico. (Environmental Restoration Project 1998, 63114)

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NMED (New Mexico Environment Department), August 15, 1992. "Monitor Well Construction and Abandonment Guidelines," Ground Water Bureau, Santa Fe, New Mexico. (NMED 1992, 53805.16)

Nyhan, J. W., T. G. Schofield, and R. H. Starmer, 1996. "A Water Balance Study of Four Landfill Cover Designs Varying in Slope for Semiarid Regions," Los Alamos National Laboratory report LA-UR-4093, Los Alamos, New Mexico. (Nyhan et al. 1996, 63111)

Appendix A

Acronyms and Abbreviations

AA	administrative authority
BMP	best management practice
CH-2	Corehole 2
cpm	counts per minute
DOE	Department of Energy
dpm	disintegrations per minute
ESH	Environment, Safety, and Health (Division)
FIDLER	field instrument for detection of low-energy radiation
GH	gopher hole
HDPE	high-density polyethylene
Laboratory	Los Alamos National Laboratory
MDA	material disposal area
MK/PMC	Morrison Knudsen/Program Management Company
NMED	New Mexico Environment Department
PPE	personal protective equipment
PRS	potential release site
RCRA	Resource Conservation and Recovery Act
RFI	RCRA facility investigation
TA	technical area
TAL	target analyte list
TRU	transuranic
VOC	volatile organic compound

Appendix B

Borehole Plugging and Abandonment Summary

MEMORANDUM

From: C.R. Wilson, MK/PMC Team

To: Project Files

Date: 9 September 1998

Subject: PLUGGING AND ABANDONMENT SUMMARY FOR COREHOLE 2 AT TA-49, MDA AB AREA 2

BACKGROUND

Corehole 2 (CH-2) was drilled in 1959 to provide geologic and hydrologic information on MDA AB Area 2 at TA-49 prior to selecting the site for nuclear safety tests. The hole was plugged and abandoned because of concerns that it could provide a pathway for vertical contaminant migration given the elevated moisture content of the near-surface soils and tuff at the site. This hole was plugged and abandoned in accordance with State of New Mexico Environment Department Ground Water Section *Monitor Well Construction and Abandonment Guidelines* (Ground Water Section, August 15, 1992), LANL Environmental Restoration Project Standard Operating Procedure 5.03, R0, *Monitor Well and RFI Borehole Abandonment* (May 23, 1997), and the Monitoring Well and Borehole Abandonment Plan included as Attachment 3 to LANL's draft *Stabilization Plan for Implementing Interim Measures and Best Management Practices at PRSs 49-001 (b, c,d, and g)* dated July 1998. The work was performed by Stewart Brothers Drilling Company of Grants, New Mexico, under direct contract to the Laboratory. Field direction for drilling operations, waste management, and radiological monitoring were provided by the MDA AB team of LANL and MK/PMC team personnel.

PLUGGING AND ABANDONMENT ACTIVITIES

Monday, 8/17 — Morning: Conducted SSHASP and other project-related training.
Afternoon: Mobilized grout trailer and tremie pipe to site.

Tuesday, 8/18 — Completed pre-operational radiation checks of grout trailer and tremie pipe.

Wednesday, 8/19 — Mobilized rig and other support equipment to site, set up contamination control zones, and established decontamination area for casing.

Thursday, 8/20 — Inspected equipment and completed pre-operational radiation checks of rig and remaining support equipment. Started casing pull. The casing consisted of approximately 20-ft lengths of 2-in. diameter galvanized pipe with threaded joints. Completed casing pull from collar to 43.5 ft depth, measured from top of collar which extended about 2 ft above the asphalt surface.

Found concrete surface-type seal at a depth of about 1 ft extending to a depth of about 3 ft below the asphalt surface. This depth would place the top of the seal at about the original ground surface. The seal dimensions were about 2 x 2 x 1 ft thick. The concrete was competent and intact, forming a tight seal with the casing. It was separated from the casing with a jackhammer.

One sample was taken of the soil on top of the concrete seal (ID #MD49-98-0140). The sample was analyzed for TAL metals, VOCs, SVOCs, PCBs, gross alpha/beta/gamma, tritium, and moisture content. Analytical results are expected by about mid-September.

Wet soil and/or bentonite mud was found to be coated the casing over its entire length. The thickness of this coating ranged from a thin film to about 1/4 in. and averaged about 1/8 in..

The mud-coated outer surface of the casing was continuously screened for radiation after it was pulled from the ground. Above background levels of radiation were found only at one location, at a depth range of about 24.5 to 25 ft below the collar. Sampling the soil/mud coating at this depth required collecting all coating scrapings within the depth interval of 21.5 to 103.5 ft to obtain sufficient sample volume. One sample was taken (ID #MD49-98-0141) and analyzed for TAL metals, VOCs, SVOCs, gross alpha/beta/gamma, tritium, and moisture content. Analytical results are expected to be available by about mid-September. The casing was unscrewed at the threaded joints as it was removed from the hole.

Friday, 8/21 — Pulled casing from 43.5 ft to about 383 ft, then sounded through casing to see if there was a cap on the bottom end. A cap was found, meaning that the tremie pipe could not be extended through the casing until the cap was removed. Wrapped all pulled casing in plastic as protective measure. Casing from 0 to 123 ft was wrapped separately because of potential radioactive contamination.

A sample was taken (ID #MD49-98-0142) of the soil/mud coating within the depth interval of 223.5 to 243.5 ft to obtain sufficient sample volume. The sample was analyzed for TAL metals, VOCs, SVOCs, PCBs, gross alpha/beta/gamma, tritium, and moisture content. Analytical results are expected to be available by about mid September.

Brian Carlson from TA-54 inspected casing and determined that because of the mud coating it had to be cleaned at TA-50 before he could determine its acceptability for recycling or use as scrap metal. Thus Plan A of the CH-2 guidance (copy attached) will be followed.

Monday, 8/24 — Pulled last of casing, from 383 ft to total depth at about 500 ft. The bottom approximately 20 ft of casing was rusty and thickly coated with bentonitic type mud. All but one of the slots that had been cut in this length of casing to provide a well screen were completely concealed and appeared to be plugged by the mud and rust. After scraping the pipe, the slots were found to be about 6 to 8 in. long and 6 to 8 in. apart vertically, and cut 90° apart around the casing circumference possibly with a torch. The casing and slots were highly rusted. It is likely that galvanized pipe was not used for this length of casing. Except for the well screen at the bottom, the casing was found to be intact with no breaks, holes, or faulty joints over its entire length.

A sample was taken of the soil/mud coating at the bottom of the hole (ID #MD49-98-0143). Sampling at this depth required collecting all coating scrapings within the depth interval of 473.5 ft to total depth to obtain sufficient sample volume. The sample was analyzed for TAL metals, VOCs, SVOCs, PCBs, gross alpha/beta/gamma, tritium, and moisture content. Analytical results are expected to be available by about mid September 1998.

The casing was re-inserted into the hole and reassembled to a depth of about 120 ft. This casing was suspended in the hole to protect the tremie pipe from possible contamination in the upper part of the hole. Type I/II Portland cement with 5 % to 7% added bentonite was used for all grouting operations. The tremie pipe was then lowered into the hole to within about 40 ft of the bottom and grout was injected to above the level of the bottom of the tremie. The tremie pipe was then lifted 20 ft and the next 20 ft of hole was grouted. This process was repeated at 20 ft intervals until operations were suspended for the day at an estimated depth to grout of about 170 ft. The process provided a nominal maximum grout drop of about 20 ft. The approximately 500 ft depth of the hole precluded grouting the entire hole in a single, continuous pour.

Tuesday, 8/25 — Before recommencing grouting, the hole was sounded with a weighted tape to check the depth to grout placed the previous day. The depth was determined to be 168 ft, which was only 2 ft off the estimate of 170 ft.. This was considered to be an excellent correlation. Grouting was continued at 20 ft intervals as before, and the hole was periodically sounded. The interval from 168 ft to 90 ft was found to require approximately 4 times more grout than was expected based on the dimensions of the hole, possibly indicating a larger diameter hole or grout loss into a permeable zone or zones in the tuff. The hole filled normally after a depth of 55 ft was reached. Grouting was completed to the original ground surface, about 18 in. below the top of the asphalt, and left overnight to settle before placing the surface seal. The rig and tools that were inside the exclusion zone were screened out of the site. The grout trailer was kept outside the zone during the operation.

Wednesday, 8/26 — The grout level was checked and found to have settled about 4 ft. The hole was topped off with additional grout and sealed to within about 1 ft below the asphalt surface. The hole was not sealed to the asphalt surface so the seal would not be disturbed when the asphalt is removed and the site is regraded. All equipment used in the exclusion zone was screened out of the site.

Friday, 8/28 — Checked grout level in hole and found no settlement. A total of 65 bags of Portland cement was used to seal CH-2.

Appendix C

Selection of a Seed Mix for Revegetating MDA AB Area 2

MEMORANDUM

From: C.R. Wilson, MK/PMC Team

To: Files

Date: 3 December 1998

Subject: SELECTION OF A SEED MIX FOR REVEGETATING MDA AB AREA 2

The revegetation of Area 2 following site regrading with shallow-rooting grasses was included as an element of the stabilization plan to enhance evapotranspiration and help control erosion (LANL, 1998, Section 5.6). A 50/50 mix of blue grama (Bouteloua gracilis) and western wheatgrass (Agropyron smithii) was contemplated for this purpose because of its successful use in tests of alternative landfill cover designs (Nyhan et al., 1990, p. 282). On 2 December 1998, Leslie Hansen of ESH-20 was contacted regarding the appropriateness of this mixture. In response, Ms. Hansen contacted Terry Foxx of ESH-20 and provided the attached seed mix recommendations that had previously been prepared for the Laboratory by Ms. Foxx. Because MDA AB Area 2 is in an ecotone between the ponderosa pine and pinyon-juniper zones, we could select plants from either zone. I was told that both of our grasses were on the list, they were shallow rooted in the intended environment, and they were appropriate for the intended use.

In further discussion on 3 December 1998, Ms. Foxx recommended that we also apply an annual ryegrass seed and that we till the seed under a thin layer of soil. The ryegrass is a cool season grass that sprouts in early spring and would provide earlier stabilization than the other two grasses, which do not sprout until the soil warms up. The ryegrass would also provide shade to help the other grasses germinate. Because the ryegrass is a non-native annual, it would not be expected to reseed itself after the first year. Tilling the seed mixture under a layer of soil would help protect it from being eaten by birds or rodents in the event that the site remains for a period of time after seeding without a protective snow cover. Both recommendations were accepted and a 20/40/40 mixture of ryegrass, blue grama, and western wheatgrass will be applied to the site.

REFERENCES

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Cc: Dwain Farley, LANL

Leslie Hansen, LANL

John DeJoia, MK/PMC

Project File

Appendix D

Erosion Control Gravel Design and Specifications

MORRISON KNUDSEN CORPORATION

INTER-OFFICE CORRESPONDENCE

DATE: January 15, 1999

TO: John DeJoia
Charlie Wilson

LOCATION: LANL

FROM: John Bessaw

LOCATION: Boise

SUBJECT: Riprap Sizing for TA-49 Temporary Cover

This IOC presents the results of an analysis to size the riprap for the temporary cover for TA-49. The approach was based on the method presented in NUREG/CR-4651, ORNL/TM-10100/v2, "Development of Riprap Design Criteria by Riprap Testing In Flumes: Phase II", Colorado State University, 1998.

The primary assumptions are that the riprap rock is angular and runoff from the cover would be concentrated to 10 ft wide section near the break in the cover slope. The peak design flow was determined using the Corps of Engineers HEC-1 model and was based on a 100-yr, 24-hr storm event for the Los Alamos area.

Based on the analysis it was determined that riprap for the cover slopes should have a $D_{50} \sim 0.8$ inches and a $D_{max} \sim 1.6$ inches. Ready available aggregate has a D_{50} of ~ 0.75 inch and a maximum diameter of ~ 1 inch. While the maximum aggregate size is slightly smaller than the design value, the D_{50} is right on. The coefficient of uniformity for the available material also meets the design requirements.

The design calls for the riprap to be covered with a chain link mesh, with a ~ .75 inch opening, to prevent animal intrusion into the cover. The mesh will provide additional anchorage for the riprap and the slight under sizing is not considered a problem. In addition, the cover is a temporary measure (5 to 10 years) and the design method were develop to provide protection for permanent facilities (100+ year design life).

The proposed 1 inch minus aggregate should be adequate for the side slope protection when combined with the wire mesh cover.

Western Technologies Inc.
The Quality People
Since 1955

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PHYSICAL PROPERTIES OF AGGREGATES

Date of Report 08/12/98
Job No. 3248JA015
Event / Invoice No. 32480823
Lab No.
Authorized By L. TRUJILLO Date 06/01/98
Sampled By GALLEGOS Date 06/01/98
Submitted By GALLEGOS Date 06/01/98

Client LOS ALAMOS TRANSIT MIX
POST OFFICE BOX 747
LOS ALAMOS, NEW MEXICO 87544

Project GENERAL PROJECT SUBMITTAL
Contractor VARIOUS
Type / Use of Aggregate COARSE AGGREGATE
Sample Source / Location ESPANOLA, NEW MEXICO
Reference: ASTMC-33 #56
Special Instructions.

Location ALBUQUERQUE LABORATORY
Arch. / Engr N/A
Supplier / Source ESPANOLA TRANSIT MIX PIT
Source / Location Desig. By L. TRUJILLO Date 06/01/98

TEST RESULTS

SIEVE ANALYSIS [X] ASTM C136 [ ] AASHTO T27

SIEVE SIZE	ACCUMULATIVE % PASSING	SPECIFICATION
4 IN.		
3		
1 1/2		
1 1/4		
1	100	90-100
3/4	65	40-85
1/2	20	10-40
3/8	8	0-15
1/4		
NO. 4	1	0-5
8		
10		
16		
30		
40		
50		
100		
FINER THAN NO. 200 [ ] ASTM C117 [ ] AASHTO T11	0.2	0-1

FINENESS MODULUS, ASTM C136 →

LIQUID & PLASTIC PROPERTIES
[X] ASTM D4318 [ ] AASHTO T89 & T90
METHOD [X] A [ ] B

	RESULT	SPECIFICATION
LIQUID LIMIT		
PLASTIC LIMIT	N/A	
PLASTICITY INDEX	N/A	

SAMPLE AIR DRIED: [X] YES [ ] NO

CLEANNESS VALUE C4227 →

ORGANIC IMPURITIES [X] ASTM C40 [ ] AASHTO T21
ORGANIC PLATE NO. → 1

PHYSICAL PROPERTIES		TEST RESULTS	SPECIFICATION
UNIT WEIGHT & VOIDS [X] ASTM C29 [ ] AASHTO T19; [X] RODDING [ ] JIGGING [ ] LOOSE	FINE AGGREGATE UNIT WEIGHT, PCF →		
	FINE AGGREGATE VOIDS, % →		
	COARSE AGGREGATE UNIT WEIGHT, PCF →	100.2	
	COARSE AGGREGATE VOIDS, % →		
SPECIFIC GRAVITY & ABSORPTION — FINE AGGREGATE [ ] ASTM C128 [ ] AASHTO T84; AGGREGATE DRIED [ ] YES [ ] NO	BULK SPECIFIC GRAVITY →		
	BULK SPECIFIC GRAVITY (SSD) →		
	APPARENT SPECIFIC GRAVITY →		
	ABSORPTION, % →		
SPECIFIC GRAVITY & ABSORPTION — COARSE AGGREGATE [X] ASTM C127 [ ] AASHTO T85; AGGREGATE DRIED [X] YES [ ] NO	BULK SPECIFIC GRAVITY →	2.572	
	BULK SPECIFIC GRAVITY (SSD) →	2.601	
	APPARENT SPECIFIC GRAVITY →	2.646	
	ABSORPTION, % →	1.1	
SAND EQUIVALENT VALUE [ ] ASTM D2419 [ ] AASHTO T176	% →		
RESISTANCE TO DEGRADATION — SMALL COARSE AGGREGATE [X] ASTM C131 [ ] AASHTO T96 GRADING	100 REV., % LOSS →		
	500 REV., % LOSS →	23.2	50 MAX
RESISTANCE TO DEGRADATION — LARGE COARSE AGGREGATE [ ] ASTM C535 GRADING	200 REV., % LOSS →		
	1000 REV., % LOSS →		
LIGHTWEIGHT PIECES [X] ASTM C123 [ ] AASHTO T113	FINE AGGREGATE, % →		
	COARSE AGGREGATE, % →	2.2	3 MAX
CLAY LUMPS & FRIABLE PARTICLES [X] ASTM C142 [ ] AASHTO T112	FINE AGGREGATE, % →		
	COARSE AGGREGATE, % →	0.5	2 MAX
FRACTURED FACES, COARSE AGGREGATE BY WEIGHT [ ] AZ 212 [ ] FLH T507 [ ] FAA	ONE OR MORE FACES, % →		
	TWO OR MORE FACES, % →		
DURABILITY INDEX [ ] ASTM D3744 [ ] AASHTO T210; PROCEDURE A [ ] COARSE B [ ] FINE C [ ] COARSE & FINE	D_c →		
	D_f →		
UNCOMPACTED VOID CONTENT [ ] AZ 247 [ ] ASTM C1252 METHOD	% →		

Comments

Copies To. CLIENT (3)

REVIEWED BY

470695(NT) 03/188

Appendix E

Selection of a Temporary Biointrusion Barrier for MDA AB Area 2

MEMORANDUM

From: C.R. Wilson, MK/PMC Team

To: Files

Date: 7 October 1998

Subject: SELECTION OF A TEMPORARY BIOINTRUSION BARRIER FOR MDA AB AREA 2

The highest levels of radioactivity in surface soils at MDA AB Area 2 have historically been associated with gopher diggings in the northeast corner of the site. It is believed that the radioactive materials are being brought to the surface when the gophers extend their burrows through a contaminated soil horizon. An asphalt cap at Area 2 is currently being removed and the site is being regraded with clean soil to improve drainage. It is important that gopher activity at the site be essentially eliminated to avoid contaminating the clean surface that will be established.

Design of a temporary measure to keep gophers out of the site began in August 1998 when members of the TA-49 team contacted ESH-20 personnel to discuss the issue. The first meeting was held on 19 August and attended by Carey Bare, Leslie Hansen, and Gil Gonzales of ESH-20 and by Charlie Wilson representing the TA-49 team. The conditions at the site were reviewed and alternatives discussed. The required lifetime of the gopher barrier was estimated to be 2 to 5 years. The concept of covering the previously asphalted area and adjacent northeast slope at Area 2 with a wire mesh mat appeared to be the most effective deterrent. A maximum mesh opening size of 1/2 in. and minimum perimeter burial depth of 18 in. were offered as initial estimates by Leslie Hansen. It was agreed that ESH-20 personnel would review the issue and get back to us.

The results of ESH-20's review were transmitted in a memo from Leslie Hansen to Carey Bare dated 31 August 1998 (copy attached). In that memo Ms. Hansen confirmed the maximum mesh opening size of 1/2 in., identified several possible suppliers,

identified possible problems with erosion, woody vegetation, and panel joints, and recommended use of an ultrasonic device to drive gophers away before the mat is installed.

On 22 September a wire mesh product and supplier review was completed by Morrison Knudsen Corporation. Samples of both chainlink and woven wire meshes were included. These samples were shown to Leslie Hansen during a meeting with Dwain Farley, John DeJoia, and Charlie Wilson on 2 October. The various wire mesh products, costs, and installation procedures were reviewed. Ms. Hansen stated that while she was aware of no precedent for the type of wire mesh mat installation we were contemplating, she saw no reason why it would not be effective. In responding to Ms. Hansen's concerns, it was clarified that an underlying gravel layer rather than the wire mat would be relied upon for erosion protection, that woody vegetation would be removed by clipping at the base, and that wire mesh panels would be joined with metal clips spaced at sufficiently close intervals (estimated at about 1 ft) to keep gophers from squeezing between the panels.

Alternatives to the wire mesh mat were discussed with Ms. Hansen in the meeting of 2 October and in subsequent telephone conversations. It was agreed that ultrasonic devices could be used as recommended to drive gophers out before the mat was installed, but would not be appropriate as the sole gopher deterrent for a multiyear period because of intensive maintenance requirements. The alternative of a vertical wire mesh fence that extended 1 to 2 ft above ground and 3 to 4 ft below ground was also considered. It was agreed that although the fence would be considerably cheaper than the mat, it would not be as effective and would require more intensive maintenance. For the fence to be effective, trees or branches that fell over it would have to be quickly identified and removed, gates and other breaches in fence continuity would have to be designed and maintained with no openings greater than 1/2 in., gates left open could allow gopher access, all gophers would have to be driven from the site before the fence was built, and any gophers found inside the fence would have to be trapped and removed. In view of the intensive inspection and maintenance requirements and reduced effectiveness of the fence alternative, it was agreed that the mat alternative was preferred.

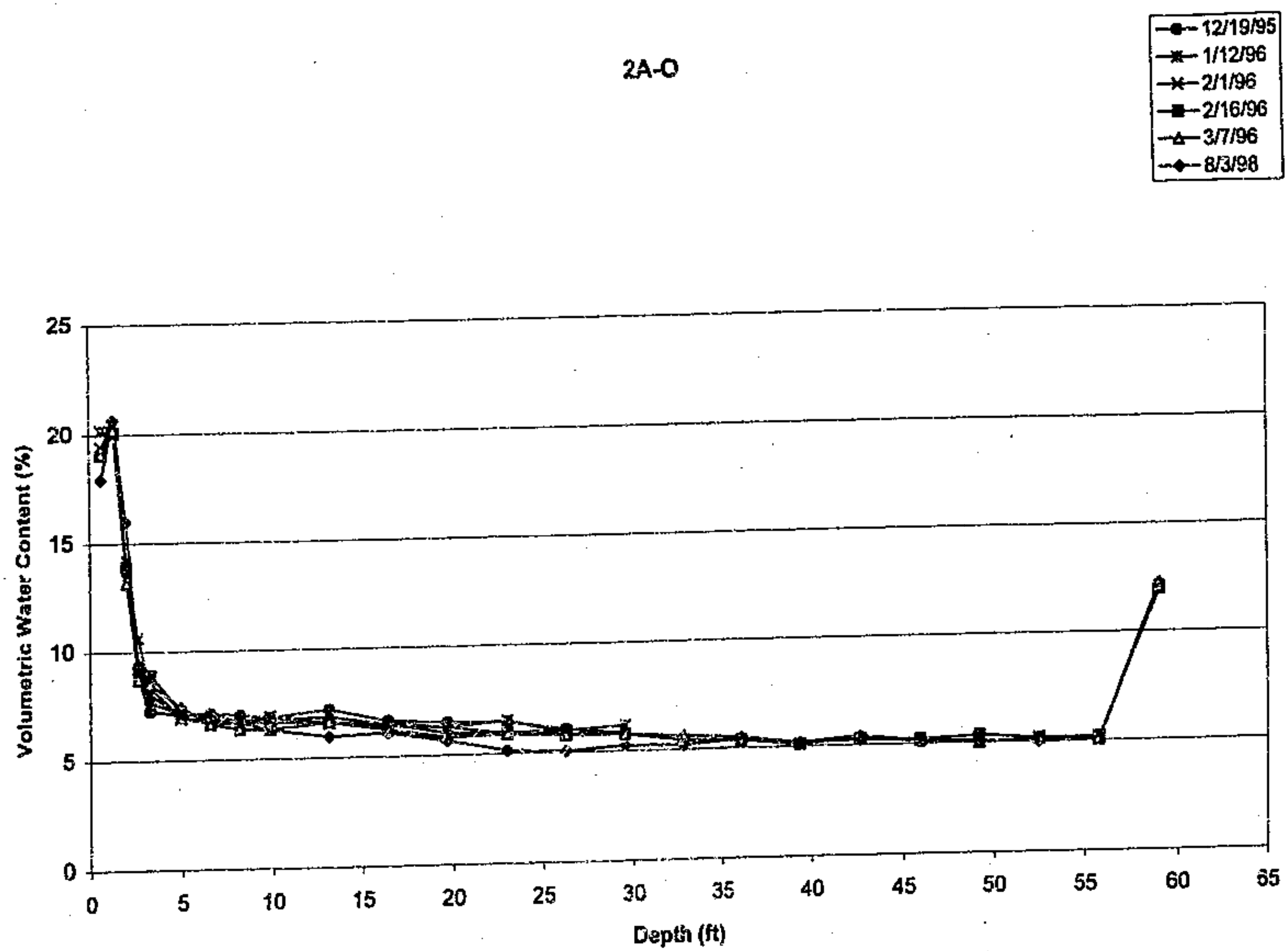
During the meeting of 2 October, Dwain Farley of LANL verbally authorized John DeJoia and Charlie Wilson of the MK/PMC Team to procure and install the wire mesh needed to provide a gopher deterrent mat across MDA AB Area 2. The lead time for this procurement was estimated to be about 1 month. The following principal design elements were agreed upon:

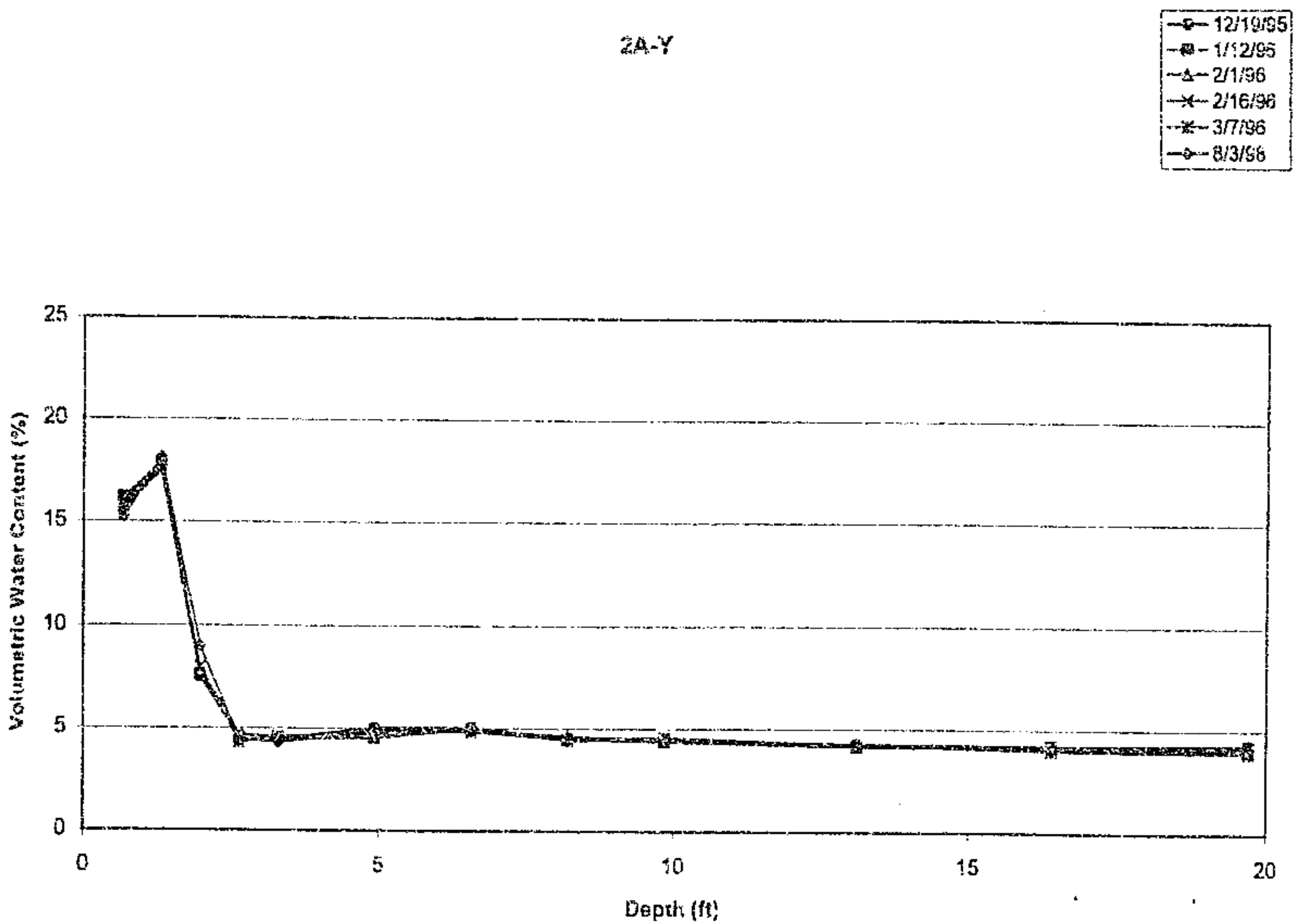
- Use of a chainlink wire mesh of 11 or 12 gauge galvanized iron wire with 1/2 in. openings in approximately 14 ft wide rolls;
- Installation with a nominal 6 in. mesh panel overlap attached at approximately 1 ft intervals with metal clips;
- A nominal 2-ft depth of anchor trench on all sides of the installation;
- The wire mesh mat is to be placed above the soil and gravel layers of the temporary cover;
- Site seeding may have to occur through the mesh depending on climatic conditions at the time of installation;
- A preliminary material cost estimate of $1.00 per square foot of mesh covering a 200 x 200 ft area (40,000 square ft) totaling about $40,000.

It was agreed with Dwain Farley that the procurement would be stopped if the final cost estimate was significantly greater than $40,000.

Appendix F

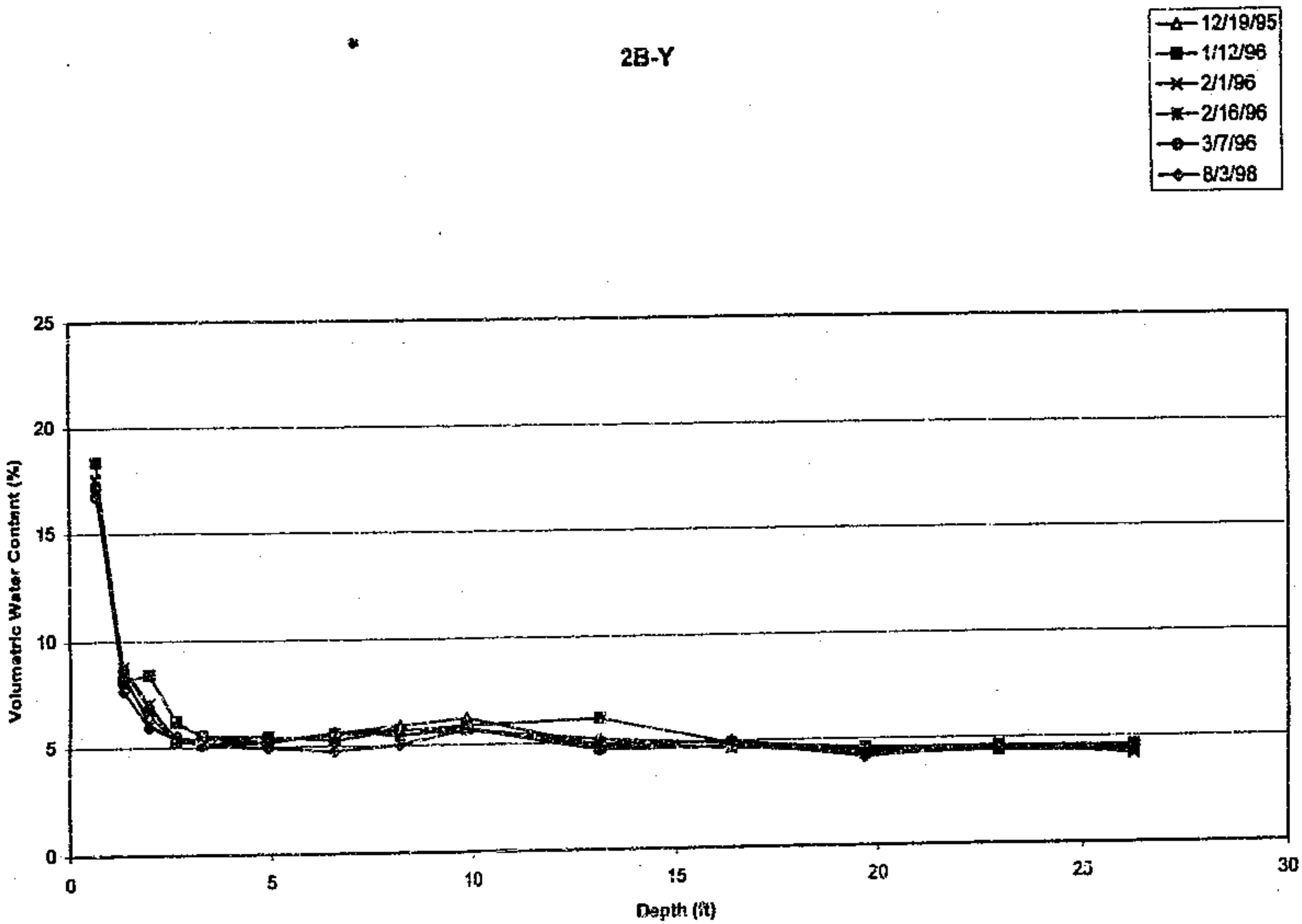
Moisture Content Measurements


2A-O
12/19/95
1/12/96
2/1/96
2/16/96
3/7/96
8/3/98
Volumetric Water Content (%)
0
5
10
15
20
25
Depth (ft)
0
5
10
15
20
25
30
35
40
45
50
55
60
65



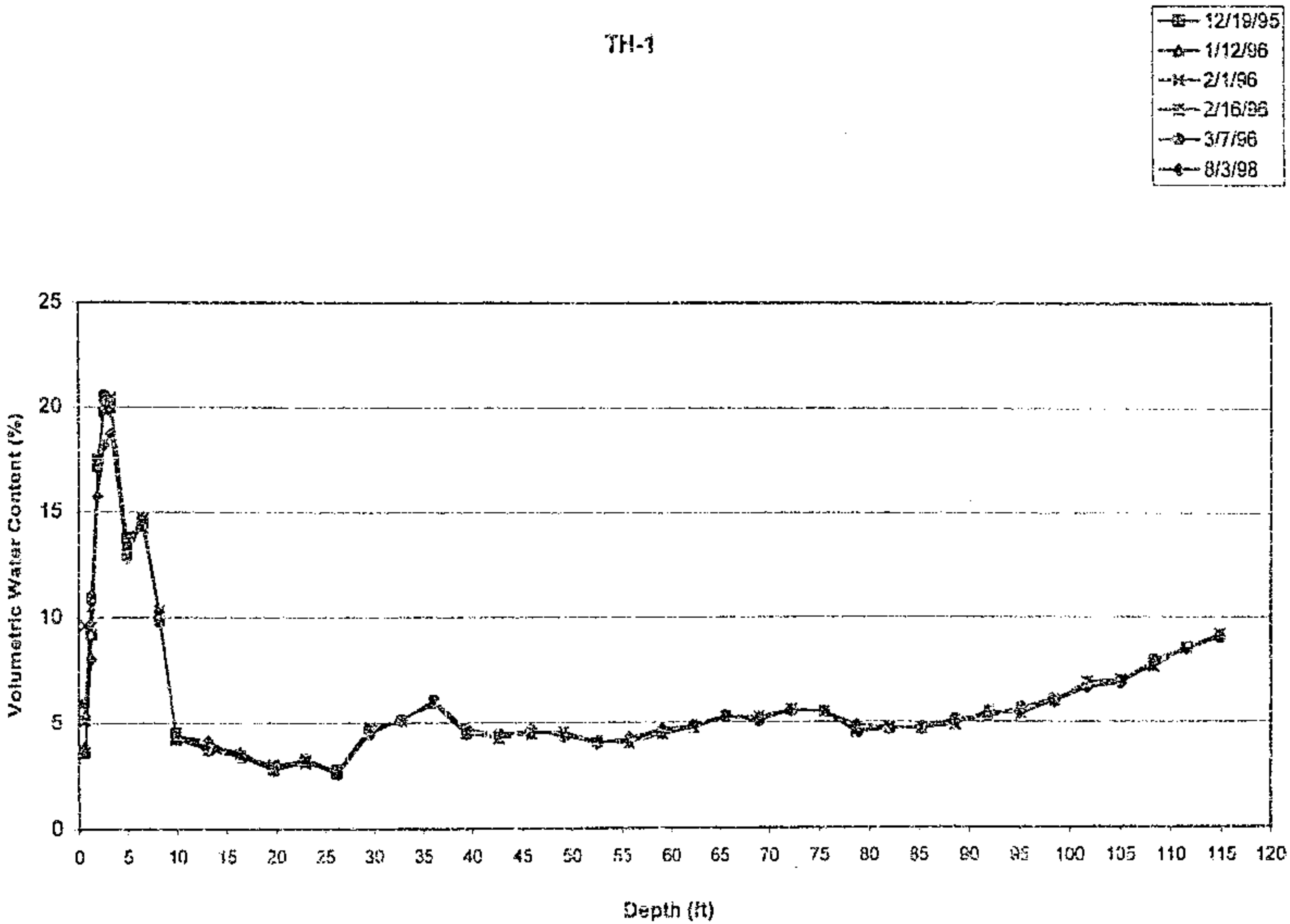
2A-Y
12/19/95
1/12/96
2/1/96
2/16/96
3/7/96
8/3/96
Volumetric Water Content (%)
25
20
15
10
5
0
Depth (ft)
0
5
10
15
20

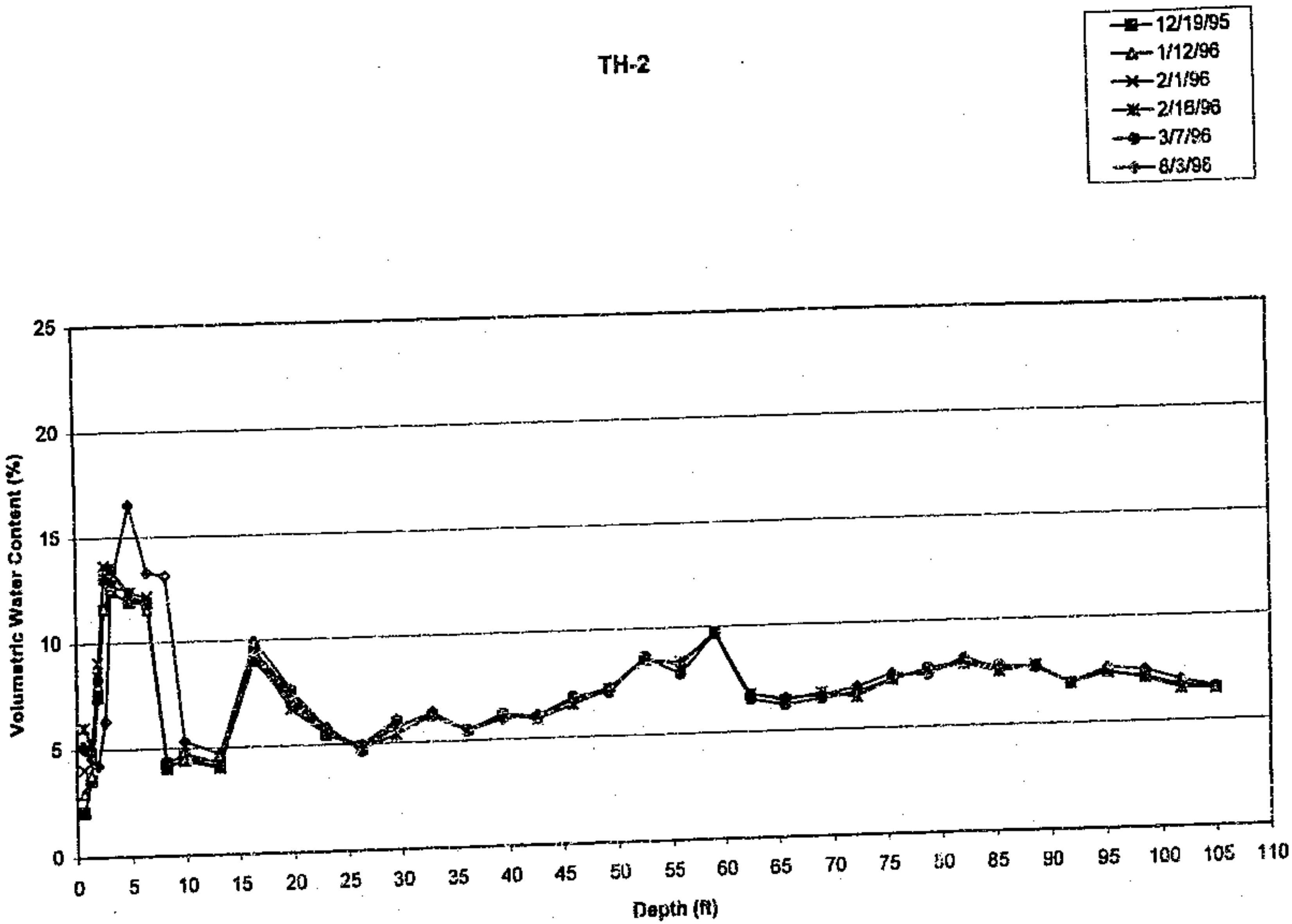
2B-Y

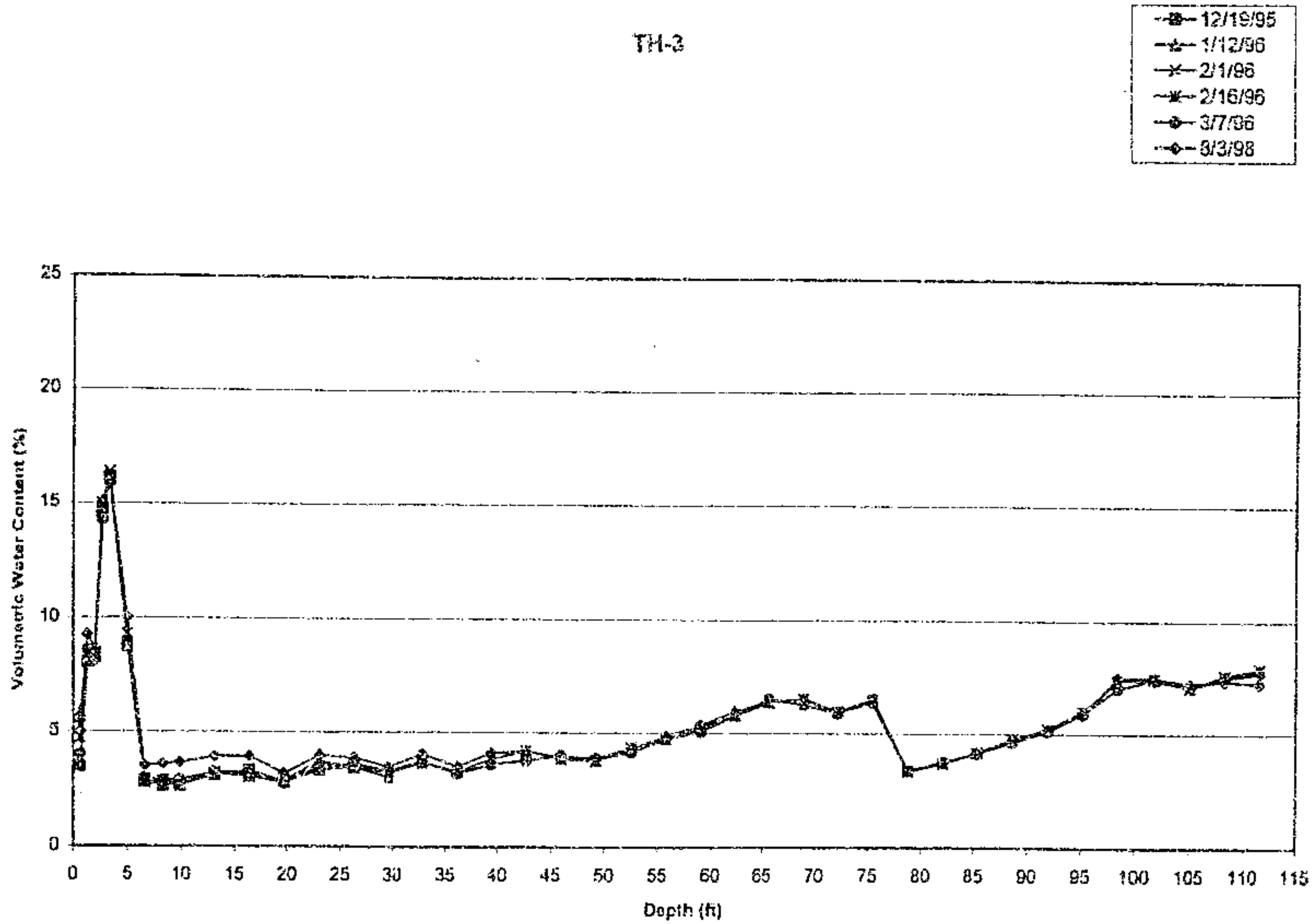


12/19/95
1/12/96
2/1/96
2/16/96
3/7/96
8/3/98
Volumetric Water Content (%)
25
20
15
10
5
0
Depth (ft)
0
5
10
15
20
25
30

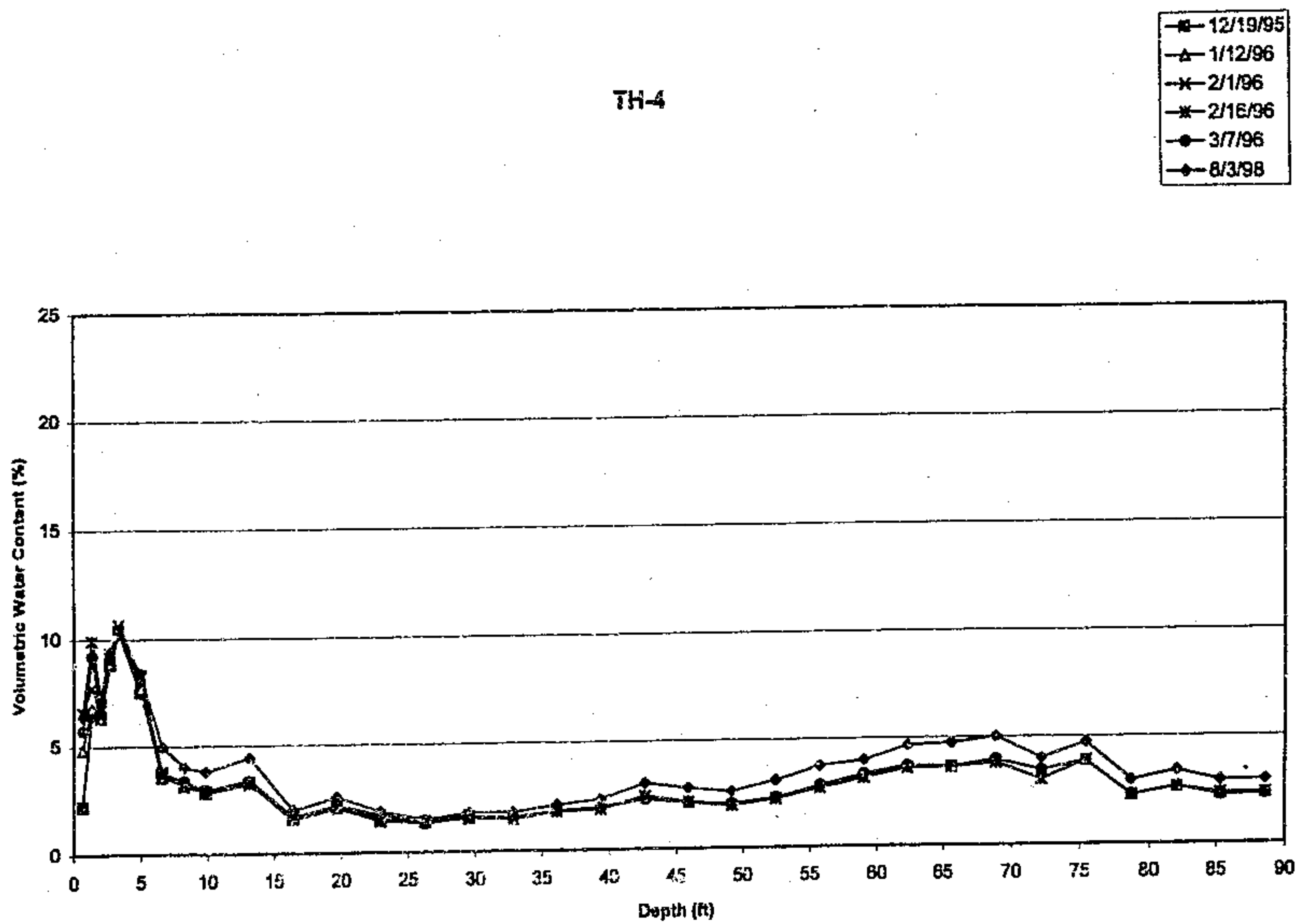
TH-1


12/19/95
1/12/96
2/1/96
2/16/96
3/7/96
8/3/98
Volumetric Water Content (%)
Depth (ft)
0
5
10
15
20
25
0
5
10
15
20
25
30
35
40
45
50
55
60
65
70
75
80
85
90
95
100
105
110
115
120

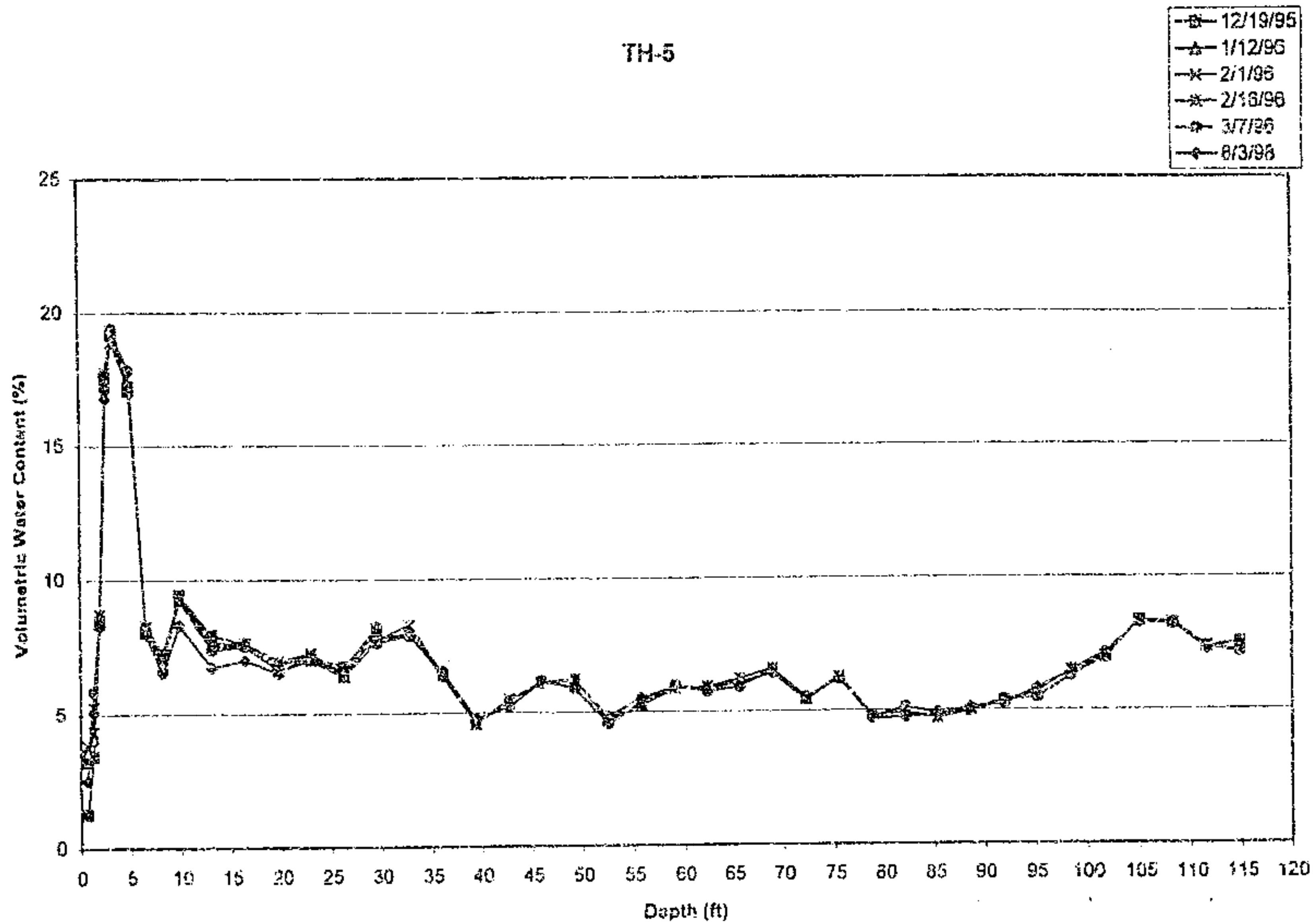

TH-2
12/19/95
1/12/96
2/1/96
2/16/96
3/7/96
8/3/96
Volumetric Water Content (%)
Depth (ft)
0
5
10
15
20
25
30
35
40
45
50
55
60
65
70
75
80
85
90
95
100
105
110



TH-3
12/19/95
1/12/96
2/1/96
2/16/96
3/7/96
3/3/98
Volumetric Water Content (%)
Depth (ft)
0
5
10
15
20
25
30
35
40
45
50
55
60
65
70
75
80
85
90
95
100
105
110
115

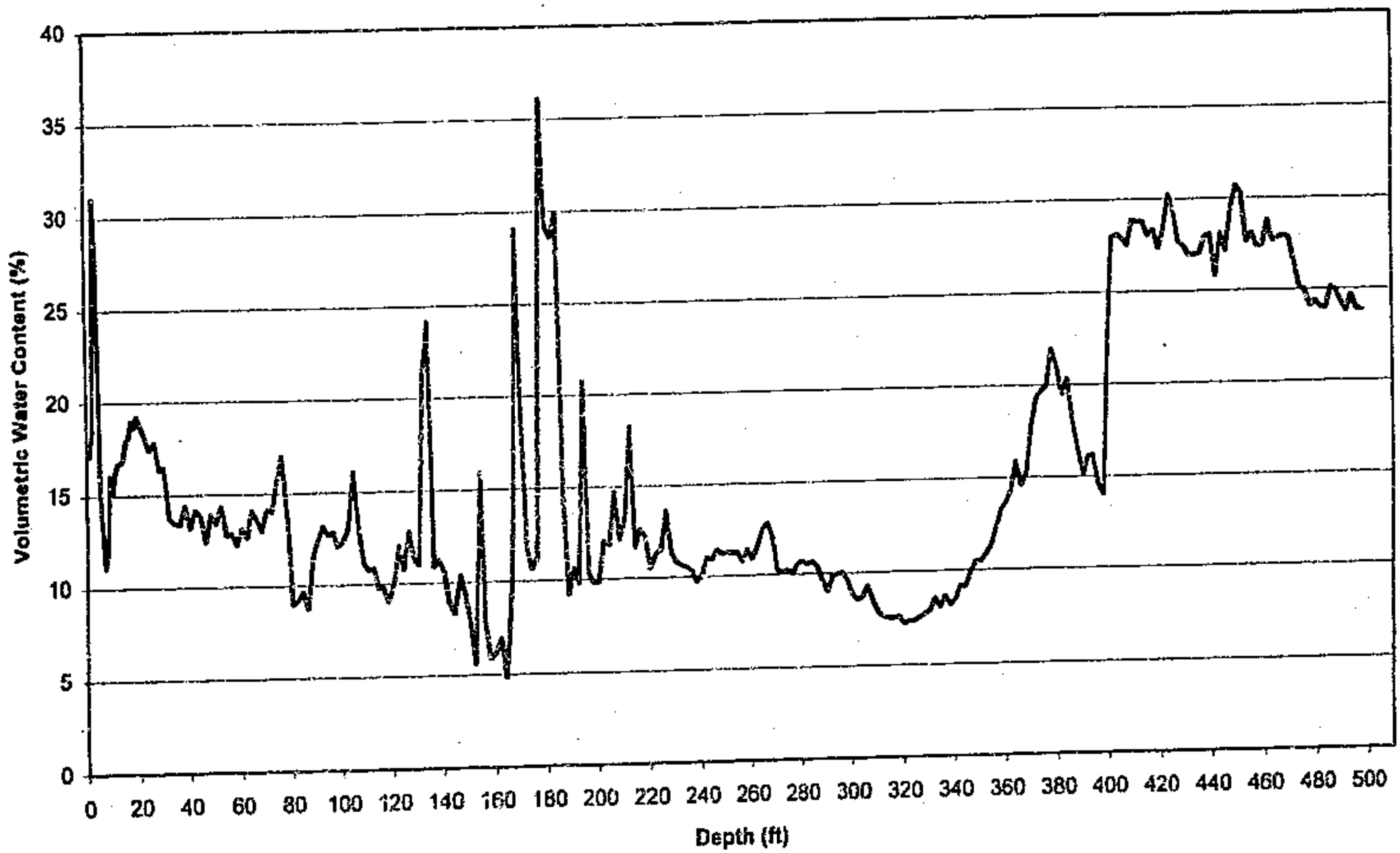


TH-4
12/19/95
1/12/96
2/1/96
2/16/96
3/7/96
8/3/98
Volumetric Water Content (%)
Depth (ft)
0
5
10
15
20
25
30
35
40
45
50
55
60
65
70
75
80
85
90



TH-5
12/19/95
1/12/96
2/1/96
2/16/96
3/7/96
8/3/96
25
20
15
10
5
0
Volumetric Water Content (%)
0
5
10
15
20
25
30
35
40
45
50
55
60
65
70
75
80
85
90
95
100
105
110
115
120
Depth (ft)

Core Hole 2
July 31, 1998



Appendix G

Inspection and Maintenance Form for Stabilization Measures at MDA AB Area 2

Inspector's Name:______________________________ Date:______________

	Yes	No
1. Is the site security fence adequately posted?		
2. Does the site security fence adequately control site access?		
3. Was the site access gate locked or entry adequately controlled?		
4. Is the site gopher barrier in functional condition?		
5. Was evidence of recent gopher activity observed beneath barrier?		
6. Is the site silt fence in functional condition?		
7. Was evidence of erosion exceeding a depth of 4 in. observed?		
8. Were deep-rooted plants observed growing in the regraded area?		
9. Was evidence of surface water ponding observed?		

Comments:____

Required Maintenance:______________________________________

Maintenance to be conducted by:____________________________

Inspector's Signature:______________________________

2/22/99