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Los Alamos National Laboratory
Environmental Restoration Project

RCRA Facility Investigation Stabilization Measures Preparatory Activities Plan

Areas 2, 2A, and 2B
Material Disposal Area AB
Technical Area 49

June 1998
Revision 0

4022

1.0 INTRODUCTION

1.1 Purpose and Scope

This plan has been prepared to document the types of preparatory activities to be performed to help assure worker health and safety during field stabilization activities at Material Disposal Area (MDA) AB Areas 2, 2A, and 2B at TA-49. These activities are part of the RCRA Field Investigation (RFI) of MDA AB. They include radiation screening of surface and near-surface soils, waste characterization sampling of the asphalt at the site, collection of data to support stabilization measure design, baseline measurements of insitu moisture conditions, and sampling for high explosive (HE) residues at the site of a minor accidental release. These activities began in February 1998 and will continue into the summer of that year as needed to support stabilization activities.

The stabilization activities have been designed to improve adverse moisture conditions at the site and will consist of installing a surface water diversion channel to divert surface run-on away from the site, removing an asphalt pad to enhance evaporation of direct precipitation on the site, and regrading the site to improve surface water drainage and eliminate ponding. Detailed descriptions of the stabilization activities and their justification are presented in the document *Stabilization Plan for Installing Best Management Practies at Potential Release Sites 49-001 (b, c, d, and g)* (LANL 1998). The results of the activities described in this plan will be documented in an RFI status report.

1.2 Site Description

MDA AB is located in TA-49 in the southernmost part of the Laboratory. TA-49 is just north of State Road 4 and Bandelier National Monument. It sits at an elevation of approximately 7100 feet on what is known as Frijoles Mesa, on the southern boundary of Water Canyon. MDA AB consists of the four test Areas 1, 2, 3, and 4, of which Area 2 has been subdivided into Areas 2, 2A, and 2B. The locations of these areas are shown in Figure 1-1.

1.3 Problem Definition

MDA AB is the location of underground nuclear safety tests and related experiments conducted from late 1959 to mid-1961. These tests are the source of virtually all contaminants expected to exist at TA-49. The nuclear safety tests at Areas 2, 2A, and 2B were conducted at the bottoms of approximately 60-foot deep shafts (Figure 1-2) and were designed to determine whether an accidental detonation of the high explosives (HE) in a nuclear weapon would trigger a nuclear explosion. The shafts were backfilled with sand and crushed tuff to contain the test explosions. Although only HE was detonated, special nuclear materials were used as part of the tests. Following each test, the shafts were topped off with sand to compensate for settlement and covered at the ground surface with puddled concrete. The test apparatus including kilogram quantities of plutonium, uranium, beryllium, and lead remain underground in the shafts.

The adverse moisture conditions at the site are primarily related to poor site drainage and the presence of an asphalt pad that was placed over Area 2 in 1961 following an accidental release of radioactive materials that contaminated the original ground surface at the site. The release occurred when contaminated materials were accidentally encountered when excavating a side drift at the bottom of Shaft 2-M. In January 1961 the surface of Area 2 was covered with 2 to 3 feet of compacted clay and gravel and in September 1961 the area was paved with asphalt. Although the asphalt was placed in an effort to retard infiltration of moisture, moisture that does collect under the asphalt cannot escape. Through the years the moisture content beneath the pad has increased to near saturation levels. Because a high moisture content has the potential to mobilize contaminants in the underlying soil and tuff, stabilization measures have been proposed for the site to increase evaporation, reduce surface ponding, and reduce surface water run-on. These stabilization measures will consist of excavating a surface water run-on diversion channel, removing the asphalt pad, and regrading the site to eliminate surface ponding.

1.4 Historical Data

Existing data on the site were reviewed to determine the levels of constituents at and near the ground surface that may be of concern for worker protection during the stabilization activities. These concerns affect only the activities in and near the test areas. The surface water run-on diversion channel is outside of the test areas where no contaminants are expected to be present.

Surface soil samples have been taken at and near Area 2 since 1987. Early results are summarized in the OU 1144 RFI Work Plan (LANL 1992, Chapter 7), and 1993/1994 results from the early phase of the RFI will be presented in an RFI Status Report currently in preparation. The historical data indicate that levels of constituents were at or only slightly above regional background levels at all locations except along the perimeter of the pad. The highest levels in the surface soils were found in the northeast corner of the pad where gophers have exhumed soil from beneath the asphalt. As documented in the RFI Work Plan (LANL 1992, page 7-37), one sample taken in 1987 in the northeast corner of the pad yielded the following results: 135 pCi/g gross alpha; 24 pCi/g plutonium-238; 43 pCi/g plutonium-239; and 38 pCi/g americium-241. Another sample yielded 44 ppm beryllium. Resampling in the northeast corner in 1991 yielded a gross alpha activity of 1,200 pCi/g. All of these results are above regional background levels and some results exceeded the ER Project's risk-based screening action levels (SALs) for a residential scenario. Despite the elevated levels of constituents found in the earlier sampling, later surface soil samples collected around the perimeter of the pad in 1993 as part of the RFI showed that only plutonium results exceeded background, all metals were within the background range, and no radionulcides or metals exceeded SALs. Because the duration of exposure is shorter, action levels for worker health and safety are typically considerably higher than the ER Project's SALs.

Near-surface soil samples were taken in six coreholes drilled into the asphalt pad in 1994 as part of the RFI. Of 12 samples submitted for laboratory analysis in the zero to 10-foot depth range, above background results were obtained only from one sample at the 2.5 to 3.0-foot level of Corehole 49-2905, located in the northeast corner of the pad (Figure 1-3). This depth level corresponds to the original ground surface beneath the pad, and may be illustrative of the

contaminated surface that the pad was designed to cover. The Corehole 49-2905 sample yielded 4.8 pCi/g plutonium-238, 224.5 pCi/g plutonium-239, and 45.5 pCi/g americium-241. Analyses of the same samples for RCRA constituents yielded no detected organic analytes and all metals were consistent with background ranges.

2.0 PLAN DESIGN

Although most sample results were at or slightly above regional background levels, the above background results obtained around the perimeter of the pad, and particularly on the original soil surface in the northeast corner, prompted the field activities described in this plan to help assure worker health and safety when implementing the stabilization measures.

The planned data collection activities at the site will provide both design information needed to help avoid inadvertant intrusion into the original contaminated surface beneath the asphalt pad and screening data on the levels of radioactivity that may be encountered. Radioactive constituents were targeted in this screening because of the almost universal lack of above background levels of RCRA inorganic constituents in the surface and near-surface soils at the site, and the lack of detection of RCRA organic constituents. The principal objectives of the preparatory activities in this plan are as follows.

- Identify near-surface structures or debris remaining from the nuclear safety tests to support implementation of the stabilization activities.
- Confirm the presence and elevation of the top of the puddled concrete caps above all test shafts to provide design information for the planned asphalt removal and site regrading;
- Identify radioactive hazards in the fill above the test shafts for worker health and safety purposes during excavation and to clarify disposal or reuse issues;
- Identify radioactive hazards in the surface soils in Area 2 and in downgradient drainage channels for worker health and safety purposes and to support channel stabilization activities; and
- Provide waste characterization information for the asphalt in Area 2.

A land survey will be performed to locate the positions of the test shafts and to lay out a grid for the geophysical and radiological surveying. A geophysical survey will then be performed to locate near-surface structures or debris remaining from the nuclear safety tests that may be contaminated and present a potential hazard if excavated. During the geophysical survey, a radiological survey of the surface soils will be performed using a Field Instrument for the Detection of Low Energy Radiation (FIDLER). Each land survey, geophysical, and radiological measurement result and location will be documented.

The presence, location, and elevation of the concrete cap placed on the top of most shafts will be confirmed, where not visible on the ground surface, by using a hand auger to penetrate the subsurface and tag the tops of the shafts. The locations and depths of the shafts are important because care will be taken during site stabilization to not disturb the concrete caps and not penetrate to the original, potentially contaminated ground surface. Extra borings to the original

ground surface will be made in the northeast quadrant of the pad where historical sampling has shown elevated radionuclide levels. During the verification of shaft locations, subsurface media will be sampled every 12 inches and field-screened for gross alpha, beta, and gamma radiation. Approximately 20 of the samples will be submitted to the ESH-1 count lab for additional screening analysis.

The soil immediately underlying the asphalt will be sampled from the aforementioned asphalt pad borings and analyzed for tritium at the ESH-1 count lab. Samples of the asphalt will also be taken and sent to the ESH-1 count lab for wet-swipe sampling for tritium and to an off-site lab for waste characterization analyses.

Additional activities to be performed as part of this plan include: a series of approximately 20 borings to competent tuff around the upgradient perimeter of the site to provide information on subsurface interflow, temporary stabilization of downgradient drainage channels with straw bales, sampling for HE at approximately 3 locations around Shaft 2B-H where a minor accidental release occurred in 1961, and baseline measurements in the existing monitoring wells around the site prior to initiating the stabilization activities. Implementation of these activities is described in the following section.

3.0 PLAN IMPLEMENTATION

3.1 Land Survey

Land survey personnel will locate and mark each of the shafts on the site to indicate the locations of the subsequent borings and will lay out a 6 x 6 foot grid for the geophysical and radiological surveys. State plane coordinates for the locations of the shafts at the site are given in Table 2-1. The locations of potentially hazardous subsurface anomalies indicated by the geophysical surveys will also be determined and marked by the land survey personnel. All land surveying will be performed in accordance with LANL-ER-SOP-3.01.R1 *Land Surveying Procedures* by a licensed surveyor.

3.2 Geophysical Survey

Electromagnetic and magnetic methods will be used to survey around the shafts and in areas where activities associated with the nuclear safety tests could have occurred. The geophysical instruments will include an EM-31, an EM-61, and a magnetometer. Measurements will be made on 3-foot and 6-foot grids covering the entire surface of Areas 2, 2A, and 2B. The surveys are expected to locate subsurface metal objects, help determine the locations of shafts, and help determine whether or not surface casings were used in the shafts.

3.3 Radiological Survey

A FIDLER radiological survey will be conducted using the same 6-foot grid as the geophysical survey. Locations with elevated levels of radiation will be field marked, and the locations of all measurements will be determined using a Ground Positioning System (GPS) or by land surveying. The surveyed area will include Areas 2, 2A, and 2B as well as downgradient runoff channels. The FIDLER survey will be performed in accordance with LANL-ER-SOP-10.04 *FIDLER Instrument System.*

3.4 Asphalt Pad Borings

Approximately 29 holes will be bored through the asphalt to the depths of the tops of the shafts or to the original ground surface beneath the asphalt pad. Of these, 23 holes will be placed above shafts and 6 supplemental holes will be bored to the original soil surface in the northeastern quadrant of the pad. The locations of these holes are shown in Figure 3-1. Based on previous RFI drilling into the asphalt pad, the soil-tuff interface is typically about 9 to 10 feet deep. Historical information indicates that the maximum thickness of fill above the original soil surface is about 6 feet. Therefore, if no concrete plug is encountered, the depth of borings over shafts will not exceed approximately 8 feet. All boring locations will be entered into the Facility for Information Management, Analysis, and Display (FIMAD) database.

3.5 Borehole Cuttings Collection and Field Screening

Cuttings from the asphalt pad borings (Section 3.4) will be collected at 12-inch intervals for the entire depth of each hole. The collected cuttings will be immediately screened at the drill site for gross alpha, beta, and gamma radiation levels. This initial screening will be performed using an ESP-1 beta/gamma meter and a Ludlum-139 ratemeter with an alpha probe. Following initial screening, the cuttings will be placed in Ziplock™ bags, labeled, and stored in a radiologically controlled area in the field. A sample will then be taken from each 12-inch interval and analyzed in the field for soil moisture content using a gravimetric technique (ASTM D4959-89).

The samples will then be dried and screened for gross radiation levels in accordance with LANL-ER-SOP-10.12 *Environmental Restoration Soil Sample Field Screening for Radiation.* Field screening radiation instrumentation will include a Ludlum 44-10 sodium iodide 2 X 2 gamma scintillation detector, a Ludlum 44-40 shielded Geiger Mueller pancake probe, a Ludlum 43-1 zinc sulfide alpha scintillation detector, and a Ludlum 2350-1 Datalogger.

3.6 Borehole Cuttings Sampling and Laboratory Analysis

About 20 cuttings samples representing a range of field screening levels, field locations, and geologic media will be sent to the ESH-1 count lab for verification of the field screening. The samples will be analyzed for gross alpha, beta, and gamma radiation.

3.7 Asphalt Waste Characterization

The asphalt removed from the pad at Area 2 will be disposed of off-site either as a waste material if contaminated, or by recycling if not contaminated. The asphalt will be characterized for waste disposal as described in the Waste Characterization Strategy Form for the Area 2 stabilization activities (Environmental Restoration Project, 1998). Asphalt samples will be taken by scraping the wall of each of the asphalt pad borings described in Section 3.4. Five composite samples will be prepared from the borings in the five sectors of the pad shown in Figure 3-2. It is noted that these composite samples are being taken for purposes of waste characterization rather than site characterization. The composite samples will be analyzed in an offsite laboratory for RCRA metals and isotopic plutonium, uranium, and americium. An uncomposited sample from above Shaft 2-M at the center of the pad will be analyzed for VOCs, SVOCs, pesticides, and PCBs. In addition, asphalt samples will be sent to the ESH-1 count lab for swipe sampling for tritium.

Samples of the soil immediately beneath the asphalt will also be taken for asphalt waste characterization and analyzed for tritium and moisture content. These samples will be taken by scraping the borehole wall beneath the asphalt immediately after the first 12-inch hole segment is bored. Rapid collection and bagging of these samples is necessary to minimize soil moisture loss from evaporation. These samples will be analyzed individually at the ESH-1 count lab and will not be composited.

3.8 Borings to Tuff

Approximately 20 holes will be bored with a hand auger around the upgradient perimeter of Areas 2, 2A, and 2B to determine the depth to competent tuff and to identify any significant irregularities in the elevation of the tuff surface. This information will be used in determining the extent to which interflow may be concentrated by buried channels on the tuff surface and will be used to help determine the importance of interflow as a source of moisture in these areas. The presence of any excessive moisture in the cuttings will be noted in the field log and a preliminary vertical section of the soil-tuff interface will be produced. The approximate locations of the holes are shown on Figure 3-3.

3.9 Sampling for HE

Three surface soil samples and one duplicate will be collected around the perimeter of the concrete cap at Shaft 2B-H and analyzed for HE. Shaft 2B-H is the location of an accidental release in 1961 that could have included HE. The samples will be analyzed using EPA Method 8330. This method covers all the common explosive compounds with the exception of PETN. However, because PETN was developed after 1961, it is not expected to be present in Area 2. The samples will be screened using field spot tests for HE as required for shipping purposes.

3.10 Baseline Monitoring Well Measurements

The moisture content of the soil and tuff will be measured in the boreholes at the site at the time construction is initiated. Measurements will be made in holes CH-2, TH-1 through TH-5, 49-2906, 49-2907, 2A-O, 2A-Y, and 2B-Y. The locations of these holes are shown in Figure 1-3. If standing water is present in Core Hole 2, the water level will be measured and filtered and unfiltered water samples will be taken. Those samples will be analyzed for isotopic uranium, plutonium, americium, total RCRA metals, and HE. The results of the moisture measurements will be compared with those of the postconstruction monitoring to help determine the effectiveness of the BMPs.

4.0 SCHEDULE

Table 4-1 presents the planned schedule for this screening effort.

Table 4-1. Planned Schedule of Activities

Activity	Planned Implementation Dates
Planning, permitting, and readiness review	1/01 - 2/28/98
Mobilization, geophysical and land surveys	3/01 - 3/07/98
Surface soil FIDLER survey	3/07 - 4/30/98
Asphalt pad borings and cuttings screening	3/14 - 4/15/98
Asphalt pad cuttings tritium sampling and analysis	3/14 - 4/15/98
Asphalt pad cuttings rad sampling and analysis	4/15 - 5/15/98
Asphalt sampling and analysis	3/14 - 5/01/98
Borings to competent tuff	5/15 - 5/30/98
HE sampling and analysis	6/01 - 6/30/98
Baseline moisture monitoring	6/01 - 6/30/98

5.0 DATA ASSESSMENT

5.1 Field Screening Data

Field screening data will be assessed as they are collected in the field, and decisions for further sampling and analysis will be made based on the results obtained. Data from the FIDLER surface soil screening will be mapped and locations of elevated radioactivity will be identified. Data from rad screening of cuttings from the asphalt pad borings will be used to select samples for laboratory analysis as described in Section 5.2. These will include samples taken from cuttings with the highest field screening results.

5.2 Selection of Samples for Analyses

About 20 cuttings samples will be selected from borings into the asphalt pad for laboratory analysis to verify the field screening. These samples will be selected to represent a range of field screening levels, field locations, and geologic media. The samples will be sent to the ESH-1 count lab and analyzed for gross alpha, beta, and gamma radiation.

5.3 Verification and Routine Data Validation

All data to be used for site decision-making will be submitted for storage in the Oracle database maintained by FIMAD. These data will include field sample information, field measurements, and the results of laboratory analysis.

5.4 Data Quality Assessment

Data quality assessment (DQA) for the results from the implementation of this screening plan will use the general framework outlined in Section D3 of the LANL ER Project QAPP (LANL 1996, 1379).

6.0 REFERENCES

Environmental Restoration Project 1998. *Waste Characterization Strategy Form, MDA Focus Area, TA-49, RFI Sampling, BMP Activities, and Apshalt Pad Removal, Material Disposal Area AB - Areas 2, 2A, and 2B.* Los Alamos National Laboratory, Los Alamos, New Mexico. ER ID 57587.

LANL 1992. *Operable Unit 1144 RFI Work Plan.* LA-UR-92-900, Los Alamos National Laboratory, Los Alamos, New Mexico, May. ER ID 7670.

LANL 1996. *Quality Assurance Project Plan Requirements for Sampling and Analysis.* LA-UR-96-441, Los Alamos National Laboratory, Los Alamos, New Mexico, March. ER ID 1379.

LANL 1998. *Stabilization Plan for Installing Best Management Practies at Potential Release Sites 49-001 (b, c, d, and g).* LA-UR-98-1534, Los Alamos National Laboratory, Los Alamos, New Mexico, June.

Purtymun, W.D., and A.J. Ahlquist, 1986. *Geologic and Hydrologic Evaluation of Technical Area 49.* Environmental Surveillance Group, Report HSW-8-86-1183. Los Alamos National Laboratory, Los Alamos, New Mexico. ER ID 14722.

Table 2-1. Estimated Locations of Shafts in Areas 2, 2A, and 2B

Shaft Designation	Northing	Easting	Shaft Description
NA	1755393.36	1625806.55	pipe dump hole
NA	1755392.57	1625824.53	pipe dump hole
NA	1755392.18	1625833.52	pipe dump hole
NA	1755391.35	1625852.51	pipe dump hole
1-2-A	1755395.14	1625765.59	shot
1-2-B	1755394.05	1625790.57	gas expansion
1-2-C	1755392.96	1625815.54	pipe dump hole
1-2-D	1755391.87	1625840.52	shot
1-2-E	1755390.79	1625865.49	shot
1-2-F	1755370.17	1625764.5	shot
1-2-H	1755367.99	1625814.45	shot
1-2-I	1755366.9	1625839.43	shot
1-2-J	1755365.81	1625864.4	shot
1-2-K	1755345.19	1625763.41	shot
1-2-L	1755344.1	1625788.39	shot
1-2-M	1755343.01	1625813.36	shot
1-2-N	1755341.92	1625838.34	shot
1-2-O	1755340.83	1625863.32	shot
1-2-P	1755320.21	1625762.32	shot
1-2-Q	1755319.12	1625787.3	shot
1-2-S	1755316.95	1625837.25	shot
1-2-T	1755315.86	1625862.23	shot
1-2-U	1755295.24	1625761.23	shot
1-2-V	1755294.15	1625786.21	shot
1-2-W	1755293.06	1625811.18	shot
1-2-X	1755291.97	1625836.16	shot
1-2-Y	1755290.88	1625861.14	shot
1-2A-E	1755410.15	1625731.21	shot
1-2A-J	1755385.18	1625730.12	shot
1-2A-O	1755359.2	1625728.99	shot
1-2A-T	1755335.23	1625727.94	shot
1-2A-Y	1755310.25	1625726.85	shot
1-2A-Z	1755284.77	1625725.74	shot
1-2B -A	1755232.03	1625833.55	shot
1-2B-B	1755230.94	1625858.52	shot
1-2B-C	1755229.85	1625883.5	shot
1-2B-H	1755185.21	1625759.44	shot
1-2B-J	1755183.03	1625809.39	shot
1-2B-L	1755180.85	1625859.34	shot
1-2B-T	1755136.91	1625719.29	shot
1-2B-V	1755135.17	1625759.26	shot
1-2B-X	1755132.99	1625809.21	shot
1-2B-Y	1755131.9	1625834.19	shot
1-2B-Z	1755156.98	1625718.17	gas expansion
1-CH-2	1755342.49	1625825.35	core hole 2

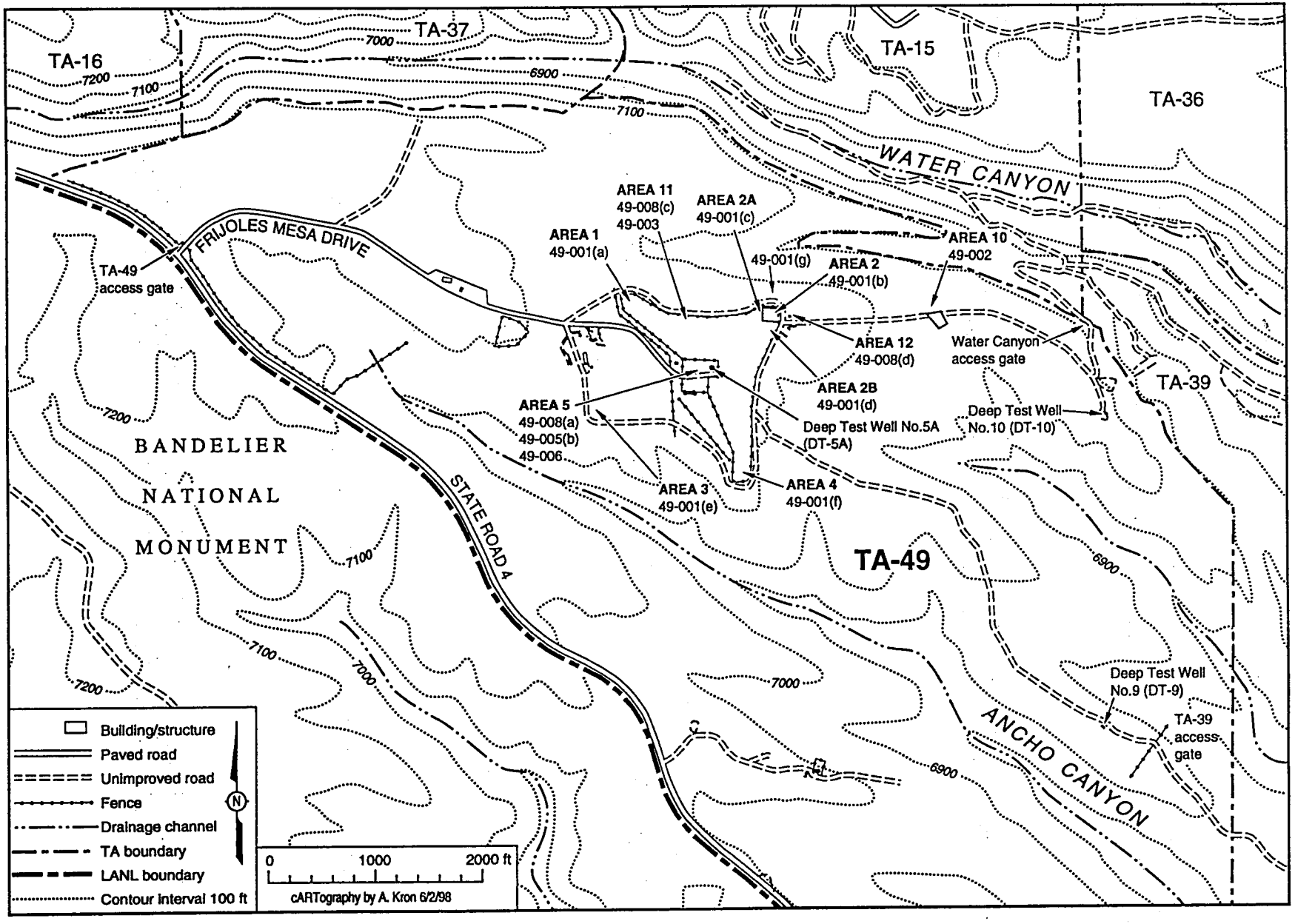

Figure 1-1. Map of TA-49.

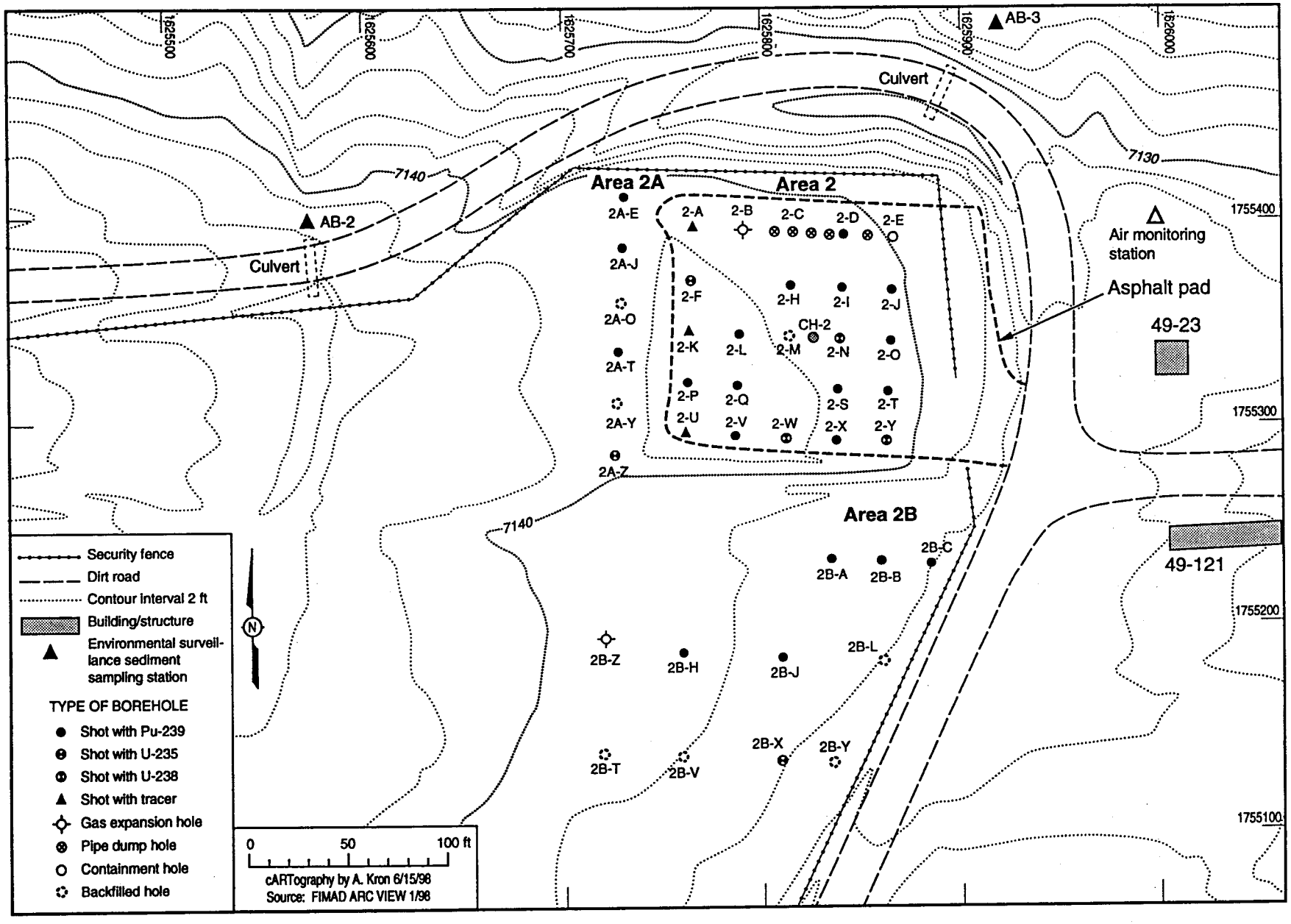

Figure 1-2. Test shafts at Areas 2, 2A, and 2B.

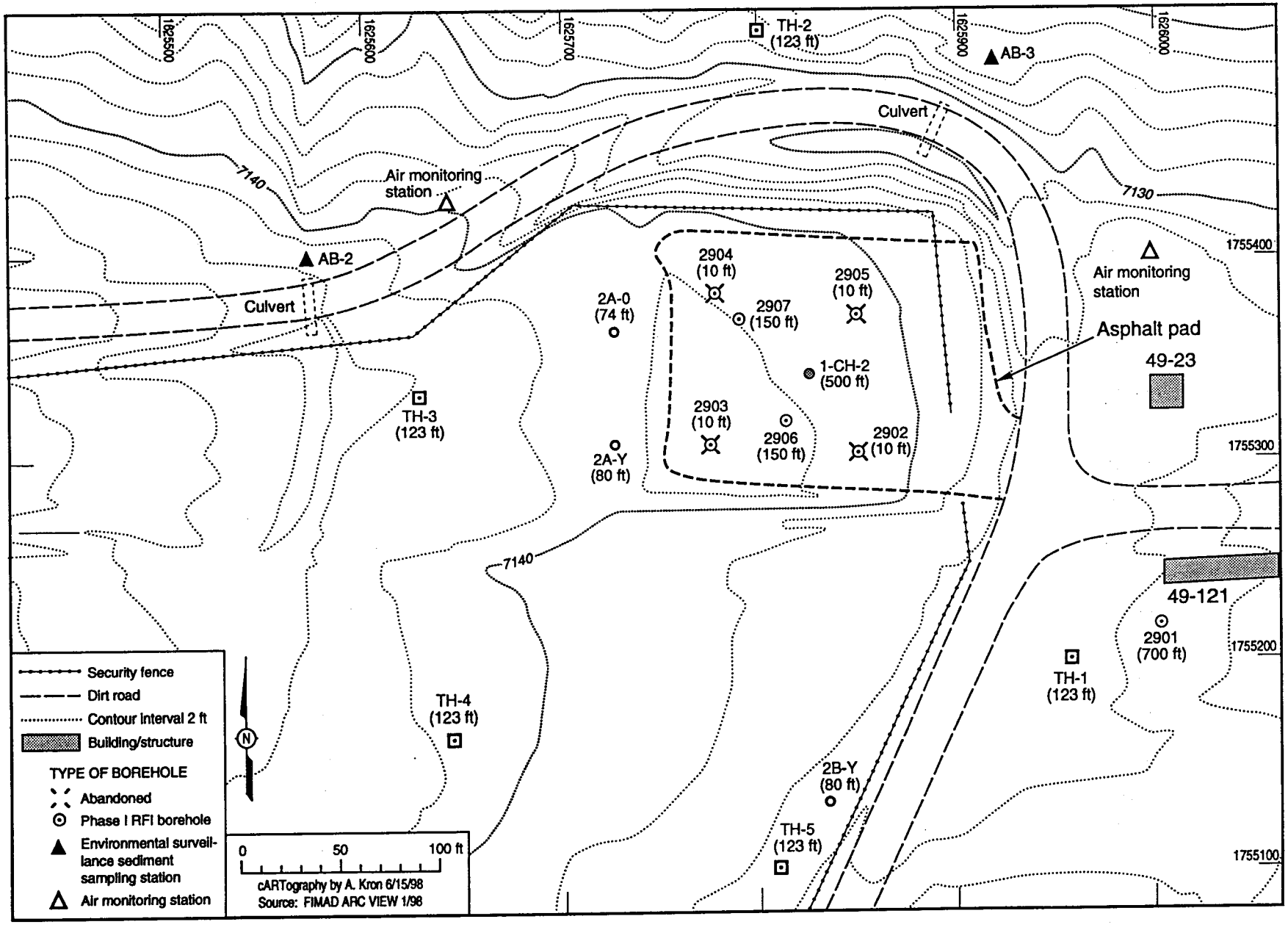

Figure 1-3. Existing sampling hole locations at Area 2.

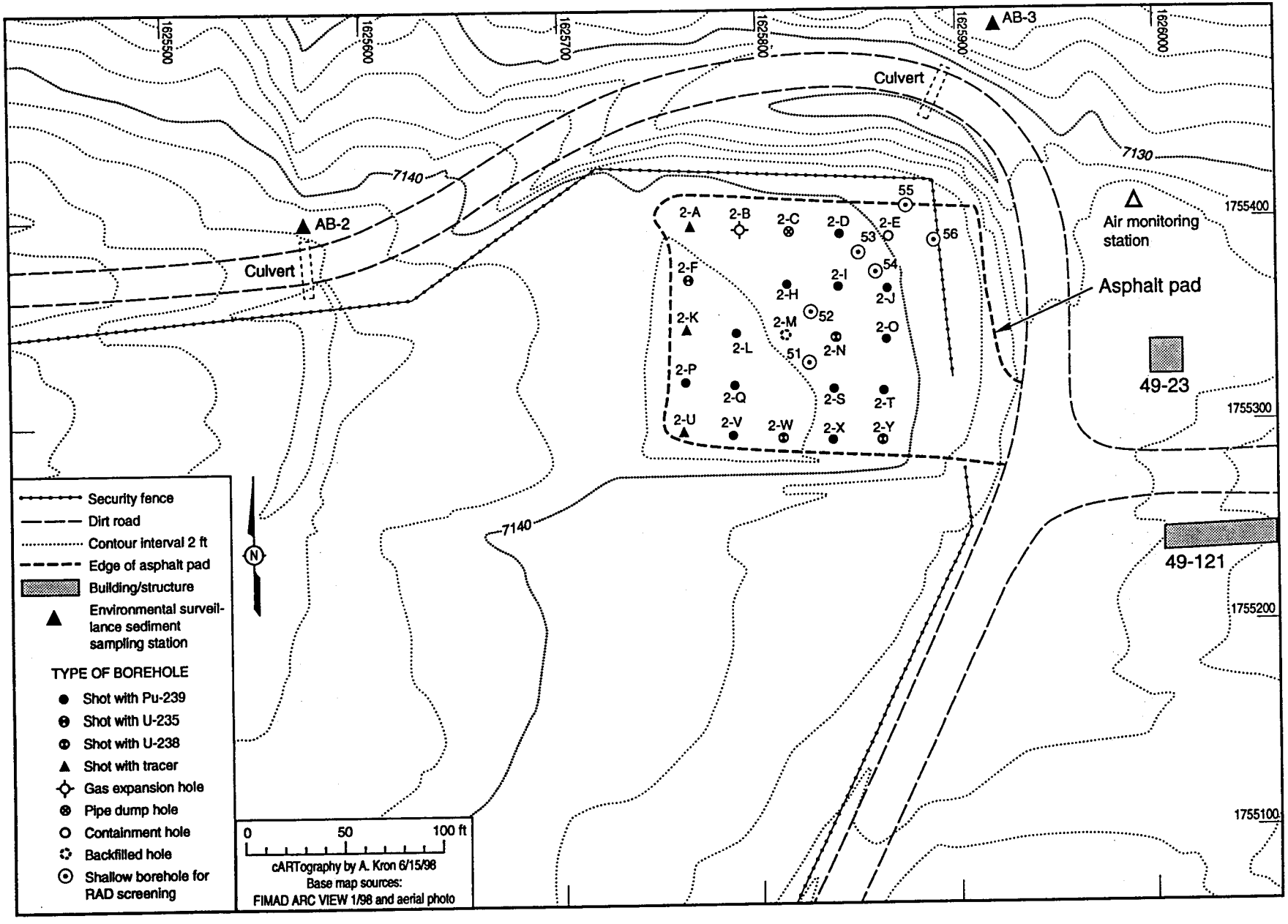

Figure 3-1. Locations of 1998 asphalt shallow borings.

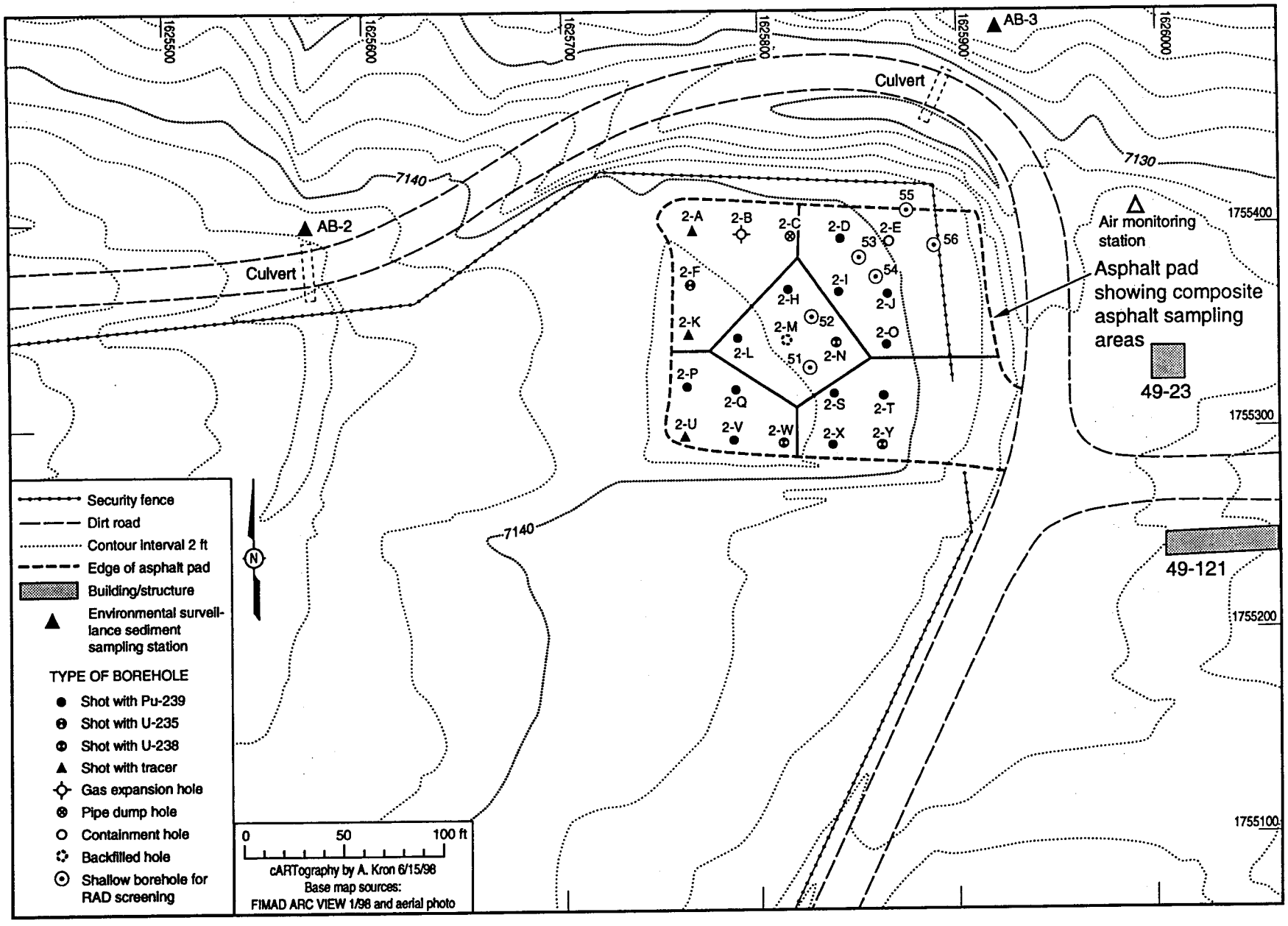

Figure 3-2. Asphalt composite sample locations.

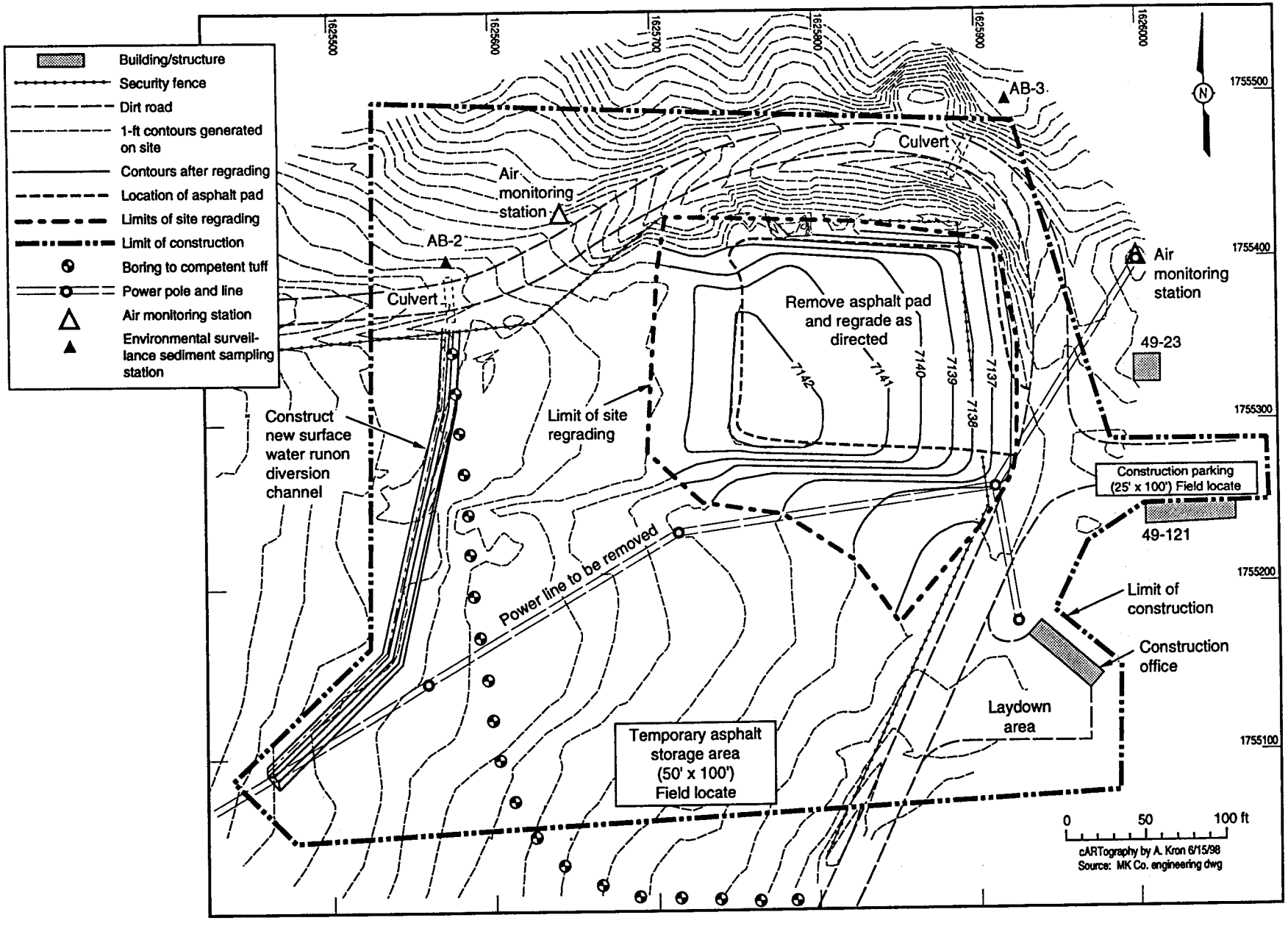

Figure 3-3. Locations of site runon and runoff controls.