CONTACT INFORMATION
Mining Records Curator
Arizona Geological Survey
416 W. Congress St., Suite 100
Tucson, Arizona 85701
602-771-1601
http://www.azgs.az.gov
inquiries@azgs.az.gov

The following file is part of the A. F. Budge Mining Ltd. Mining Collection

IRON KING ASSAY INC.

12-Mar-87

LAB JOB #:	MSC01372	CC:	Carole A. O'Brien and Peter Hahn
Client name:	A. F. Budge (Mining) Ltd.	No. Samples:	6
		Date Received:	03-05-87
Billing address:	7340 E. Shoeman Lane Suite #111-B-E Scottsdale, AZ 85251	Submitted by:	Don White
Phone number:	945-4630 / 778-3140		

INVOICE ATTACHED

ANALYTICAL REPORT

Client ID MSC01372	Lab ID		FA/AA Au oz/ton
VULTURE BATCH #1987-03			
HOLE #C-1			
290-295'	1372-	1	<.0003
295-300'	1372-	2	0.0003
300-305'	1372-	3	0.0006
305-310'	1372-	4	<.0003
310-315'	1372-	5	<.0003
315-320'	1372-	6	0.0006

REGISTERED ASSAYER
CERTIFICATE NO.
ROBERT G. CROOK
Date Signed 3-13-87
ARIZONA, U.S.A.

P.O. Box 56 • Humboldt, Arizona 86329 • Phone (602) 632-7410

IRON KING ASSAY INC.

19-Mar-87

LAB JOB #:	MSC01385	CC:	Carole A. O'Brien, Don White, Peter Hahn
Client name:	A. F. Budge (Mining) Ltd.	No. Samples:	16
		Date Received:	03-11-87
Billing address:	7340 E. Shoeman Lane Suite 111-B-E Scottsdale, AZ 85251	Submitted by:	A.J. Fernandez
Phone number:	945-4630 / 778-3140	INVOICE ATTACHED	

ANALYTICAL REPORT

Client ID MSC01385	Lab ID	FA/AA Au oz/ton
VULTURE BATCH #1987-04		
HOLE #VS-2		
65-70'	1385- 1	<.0003
80-85'	1385- 2	<.0003
95-100'	1385- 3	<.0003
110-115'	1385- 4	<.0003
125-130'	1385- 5	<.0003
140-145'	1385- 6	<.0003
155-160'	1385- 7	<.0003
170-175'	1385- 8	<.0003
185-190'	1385- 9	<.0003
200-205'	1385- 10	0.0044
215-220'	1385- 11	0.0006
230-235'	1385- 12	<.0003
245-250'	1385- 13	<.0003
260-265'	1385- 14	<.0003

REGISTERED ASSAYER CERTIFICATE NO. 14315 ROBERT G. CROOK Date Signed 3-19-87 ARIZONA, U.S.A.

Robert G. Crook

Client ID MSC01385	Lab ID	FA/AA Au oz/ton
275-280'	1385- 15	<.0003
290-295'	1385- 16	<.0003

REGISTERED ASSAYER
CERTIFICATE NO.
34315
ROBERT G.
CROOK
Date Signed 3-19-87
ARIZONA, U.S.A.

Robert G. Crook

IRON KING ASSAY INC.

20-Mar-87

LAB JOB #: MSC01392

Client name: A. F. Budge (Mining) Ltd.

Billing address: 7340 E. Shoeman Lane
Suite 111-B-E
Scottsdale, AZ 85251

Phone number: 945-4630 / 778-3140

CC: Carole A. O'Brien,
Don White, Peter Hahn

No. Samples: 19
Date Received: 03-11-87
Submitted by: A.J. Fernandez

INVOICE ATTACHED

ANALYTICAL REPORT

Client ID MSC01392	Lab ID	FA/AA Au oz/ton
VULTURE BATCH #1987-04		
HOLE #C-1		
5-10'	1392- 1	0.0038
20-25'	1392- 2	0.0020
35-40'	1392- 3	0.0009
50-55'	1392- 4	<.0003
65-70'	1392- 5	<.0003
80-85'	1392- 6	<.0003
95-100'	1392- 7	0.0006
110-115'	1392- 8	0.0015
125-130'	1392- 9	0.0009
140-145'	1392- 10	<.0003
155-160'	1392- 11	<.0003
170-175'	1392- 12	<.0003
185-190'	1392- 13	<.0003
200-205'	1392- 14	<.0003
215-220'	1392- 15	<.0003

REGISTERED ASSAYER
CERTIFICATE NO. 15389
JIM ROY WEATHERBY
Signed 3-20-87
ARIZONA, U.S.A.

P.O. Box 56 • Humboldt, Arizona 86329 • Phone (602) 632-7410

Client ID MSC01392	Lab ID	FA/AA Au oz/ton
230-235'	1392- 16	<.0003
245-250'	1392- 17	<.0003
265-270'	1392- 18	<.0003
280-285'	1392- 19	<.0003

REGISTERED ASSAYER
CERTIFICATE NO.
15583
JIM ROY
WEATHERBY
Date Signed 3-20-86
ARIZONA, U.S.A.

IRON KING ASSAY INC.

20-Mar-87

LAB JOB #: MSC01393

Client name: A. F. Budge (Mining) Ltd.

Billing address: 7340 E. Shoeman Lane
Suite 111-B-E
Scottsdale, AZ 85251

Phone number: 945-4630 / 778-3140

CC: Carole A. O'Brien,
Don White, Peter Hahn

No. Samples: 21
Date Received: 03-11-87
Submitted by: A.J. Fernandez

INVOICE ATTACHED

ANALYTICAL REPORT

Client ID MSC01393	Lab ID	FA/AA Au oz/ton
VULTURE BATCH #1987-04		
HOLE #C-2		
0-5'	1393- 1	0.0050
15-20'	1393- 2	0.0015
20-25'	1393- 3	0.0015
35-40'	1393- 4	<.0003
50-55'	1393- 5	<.0003
65-70'	1393- 6	<.0003
80-85'	1393- 7	<.0003
95-100'	1393- 8	<.0003
110-115'	1393- 9	<.0003
125-130'	1393- 10	<.0003
140-145'	1393- 11	<.0003
155-160'	1393- 12	<.0003
170-175'	1393- 13	<.0003
185-190'	1393- 14	0.0012
200-205'	1393- 15	0.0003

REGISTERED ASSAYER
CERTIFICATE NO.
15583
JIM ROY
WEATHERBY
Date Signed 3-20-87
ARIZONA, U.S.A.

P.O. Box 56 • Humboldt, Arizona 86329 • Phone (602) 632-7410

Client ID MSC01393	Lab ID		FA/AA Au oz/ton
215-220'	1393-	16	0.0009
230-235'	1393-	17	0.0006
245-250'	1393-	18	0.0003
260-265'	1393-	19	0.0012
275-280'	1393-	20	0.0003
290-295'	1393-	21	<.0003

REGISTERED ASSAYER
CERTIFICATE NO.
15586
JIM ROY
WEATHERBY
Signed 3-20-87
ARIZONA, U.S.A.

IRON KING ASSAY INC.

25-Mar-87

LAB JOB #:	MSC01394	CC:	Carole A. O'Brien, Don White, Peter Hahn
Client name:	A. F. Budge (Mining) Ltd.	No. Samples:	20
Billing address:	7340 E. Shoeman Lane Suite 111-B-E Scottsdale, AZ 85251	Date Received:	03-11-87
		Submitted by:	A.J. Fernandez
Phone number:	945-4630 / 778-3140	INVOICE ATTACHED	

ANALYTICAL REPORT

Client ID MSC01394	Lab ID		FA/AA Au oz/ton
VULTURE BATCH #1987-04			
HOLE #C-3			
0-5'	1394-	1	0.0111
15-20'	1394-	2	0.0029
30-35'	1394-	3	0.0006
45-50'	1394-	4	0.0003
60-65'	1394-	5	0.0003
75-80'	1394-	6	0.0009
90-95'	1394-	7	<.0003
105-110'	1394-	8	0.0012
120-125'	1394-	9	<.0003
135-140'	1394-	10	<.0003
150-155'	1394-	11	<.0003
165-170'	1394-	12	<.0003
180-185'	1394-	13	<.0003
195-200'	1394-	14	<.0003
210-215'	1394-	15	<.0003

REGISTERED ASSAYER CERTIFICATE NO. 14316 ROBERT G. CROOK Date Signed 3-26-87 ARIZONA, U.S.A.

Robert G. Crook

Client ID MSC01394	Lab ID		FA/AA Au oz/ton
225-230'	1394-	16	<.0003
240-245'	1394-	17	<.0003
255-260'	1394-	18	<.0003
270-275'	1394-	19	<.0003
285-290'	1394-	20	<.0003

REGISTERED ASSAYER
CERTIFICATE NO.
14316
ROBERT G.
CROOK
Date Signed 3-26-87
ARIZONA, U.S.A.

SERGENT, HAUSKINS & BECKWITH

GR
File

PRELIMINARY SITE CHARACTERIZATION REPORT
Heap Leach Facility Design
Vulture Mine Project
Near Wickenburg, Arizona

Registered Professional Engineer (Civil)
CERTIFICATE NO. 19077
JAMES R. FAHY
James R. Fahy
Date Signed 2/15/84
ARIZONA, U.S.A.

SHB Job No. E87-11

Consulting Geotechnical Engineers
PHOENIX • ALBUQUERQUE • SANTA FE • SALT LAKE CITY • EL PASO • TUCSON

SHB

SERGENT, HAUSKINS & BECKWITH
Geotechnical Engineers, Inc.

3232 West Virginia Avenue
Phoenix, Arizona 85009
(602) 272-6848

TRANSMITTAL

DATE December 2, 1987

TO A. F. Budge (Mining) Limited
7340 East Shoeman Lane, Suite 111 "B" (E)
Scottsdale, Arizona 85251-3335

ATTENTION A.J. Fernandez, Senior Mining Engineer

PROJECT Heap Leach Facility Design, Vulture Mine Project

JOB/PROPOSAL NO. E87-11

WE ARE SENDING YOU:

- [x] Attached
- [ ] Under separate cover the following:
- [ ] Boring Logs
- [ ] Calculations
- [ ] Design Charts
- [ ] Progress Reports
- [x] Laboratory Results
- [ ] Plans
- [ ] Specifications
- [ ] ______

DELIVERY BY:

- [ ] Hand Delivery
- [x] First Class Mail
- [ ] Registered Mail
- [ ] Express Mail
- [ ] Federal Express
- [ ] Other
- [ ] Return Receipt Requested

TRANSMITTED FOR:

- [ ] Review & Comment
- [ ] Approval
- [x] Your Files/Information
- [x] As Requested

DESCRIPTION Moisture-density and permeability test results for Burro Clay.

REMARKS

COPY TO File

SIGNED Nick LaFrony

SERGENT, HAUSKINS & BECKWITH

CONSULTING GEOTECHNICAL ENGINEERS

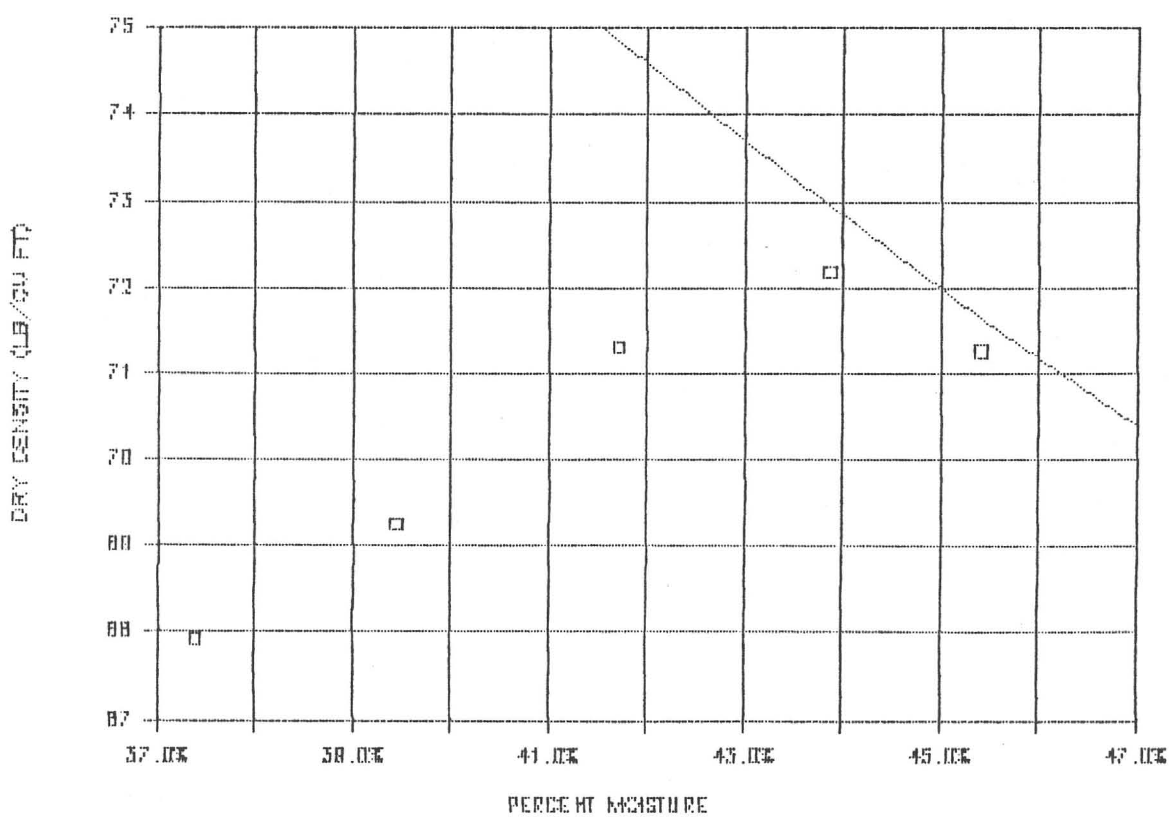
REPORT OF LABORATORY TESTS		DATE	4/1/87
PROJECT: HEAP LEACH-- VULTURE MINE		JOB NO.	E87-11
LOCATION: BURRO CLAY		W.O.NO.	3
		LAB NO.	1

==

TEST DESIGNATION	ASTM D698
METHOD	A
CURVE	

MAXIMUM DRY DENSITY	72.1 LB/CU FT
OPTIMUM MOISTURE CONTENT	43.5%

MOISTURE — DENSITY RELATIONSHIP



SERGENT, HAUSKINS & BECKWITH

CONSULTING GEOTECHNICAL ENGINEERS

REPORT ON LABORATORY TESTS — DATE: 04-22-1987

PROJECT: VULTURE MINE-- HEAP LEACH — JOB NO. E87-11

SAMPLE: BURRO CLAY — LAB NO. 1, SHEET 1

PERMEABILITY TEST — W.O. 3

WEIGHT OF WET SOIL, GMS (BEFORE)	79.67	
WEIGHT OF WET SOIL, GMS (AFTER)	79.67	
WEIGHT OF DRY SOIL, GMS	55.52	
HEIGHT OF SAMPLE, CMS	5.82	
DIAMETER OF SAMPLE, (AVERAGE) CMS	3.33	
WATER CONTENT, % (before and after)	43.50	43.50
SOIL DENSITY, PCF	68.32	
AREA OF SAMPLE, SQ CM	8.71	

HEAD inches (psig) total, in.	Q cc	TIME sec.	K cm/sec	K ft/yr
12.46 5 151.06	6.55	172,800	0.66E-07	0.68E-01

SERGENT, HAUSKINS & BECKWITH CONSULTING GEOTECHNICAL ENGINEERS

APPLIED SOIL MECHANICS • ENGINEERING GEOLOGY • MATERIALS ENGINEERING • HYDROLOGY

February 11, 1987

A. F. Budge (Mining) Limited
7340 East Shoeman Lane
Suite 111 "B" (E)
Scottsdale, Arizona 85251-3335

SHB Job No. E87-11

Attention: A. J. Fernandez
Senior Mining Engineer

Re: Heap Leach Facility Design
Vulture Mine Project
Near Wickenburg, Arizona

Gentlemen:

Our Preliminary Site Characterization Report for the referenced project is herewith submitted. The report includes discussion of the geologic, hydrogeologic and seismotectonic settings at the project site; results of our preliminary subsurface investigations for the proposed stormwater diversion alignment alternatives and leach pad site, and a summary of hydrological and geotechnical engineering analyses conducted for preliminary diversion design and cost estimating.

Should any questions arise concerning this submittal, please do not hesitate to contact us.

Respectfully submitted,

Sergent, Hauskins & Beckwith Engineers

By ______________________
James R. Fahy, P.E.

and ______________________
Paul V. Smith, P.G.

Reviewed by ______________________
Lawrence A. Hansen, Ph.D., P.E.

Registered Professional Engineer (Civil) Certificate No. 19677 James R. Fahy Date Signed Arizona, U.S.A.

Registered Geologist Certificate No. 9111 Paul V. Smith Date Signed 2/11/87 Arizona, U.S.A.

Registered Professional Engineer (Civil) Certificate No. 13872 Lawrence A. Hansen Date Signed 2/11/87 Arizona, U.S.A.

Copies: Addressee (3)

REPLY TO: 3232 W. VIRGINIA, PHOENIX, ARIZONA 85009

PHOENIX (602) 272-6848
TUCSON (602) 792-2779
ALBUQUERQUE (505) 884-0950
SANTA FE (505) 471-7836
SALT LAKE CITY (801) 266-0720
EL PASO (915) 778-3369

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REPORT

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APPENDIX C

SHB Job No. E87-11

Registered Professional Engineer (Civil)
CERTIFICATE NO. 19677
JAMES R. FAHY
Date Signed 2/11/87
ARIZONA, U.S.A.

1. INTRODUCTION

This report summarizes our preliminary site characterization studies for the proposed heap leach facilities at the A. F. Budge (Mining) Limited (AFBL) Vulture Mine Project, located near Wickenburg, Arizona. (See Figure 1, presented in Appendix C.) These studies included a review of existing data and literature on the geologic, hydrogeologic and seismotectonic setting of the site. Concurrently, an abbreviated subsurface investigation and site reconnaissance of the proposed leach pad and diversion areas was completed. In addition, hydrological and geotechnical engineering analyses were performed for preliminary assessment of diversion design options and cost estimates, and for optimal pad location.

The primary objective of this phase of investigation was to characterize the Vulture Mine Project site in sufficient detail to provide a preliminary assessment of diversion and leach pad locations and to identify any potential geotechnical constraints associated with these elements of the facility.

2. PROJECT DESCRIPTION

Preliminary details of the project were provided by A. J. Fernandez, Senior Mining Engineer of AFBL. The project will involve heap leaching gold ore from an on-site open pit and amalgamated tailings from an existing on-site disposal area. The ore will be crushed to a final product having a nominal maximum particle size of about 1/8 inch. Both the tailings and crushed ore will be agglomerated prior to placement on the pad. The tailings will be agglomerated to a nominal 3/8-inch size, compared to an estimated 1/4 to 3/8-inch agglomerated size for the ore. Based on presently known reserves, an estimated total of about 700,000 tons of material, including both ore and tailings, will be leached over an approximate project life of two to three years.

As presently planned, the leach pad will cover an area of about 375,000 square feet (8.6 acres), with ore placed to a total heap height of about 66 feet. The heap will be constructed in five lifts, including two initial 15-foot lifts, followed by three 12-foot lifts. The on-site tailings will be placed in the first lift. Approximately 25,000 SQ FT ~~tons~~ of ore will be under leach at any one time. The solution application rate will be about 0.004 gpm/FT2 ~~ton~~ with a corresponding design solution flow rate of about 100 gpm.

The leach pad will incorporate either a single geomembrane-lined system or a double-lined system. The double liner may include a geomembrane as the primary liner and compacted native soils as the secondary liner, or geomembrane liners for both primary and secondary lining of the pad.

Pregnant solution from the heaps will be transported by a lined solution channel to the pregnant solution pond. The pregnant solution pond will incorporate a double lined system with a seepage detection/collection sump. A conceptual layout of the leach pad, solution channel and ponds is shown on Sheet 1 included in the map pocket.

A major design element of the project is the storm water diversion channel required to divert surface water run-off from the contributing watershed upstream from the facility. A summary of our subsurface investigation of proposed diversion alignment alternatives, and the engineering analyses completed as part of the preliminary design of the alternatives, are summarized in Sections 3 and 5, respectively.

Structures presently on-site would be utilized for mill shops, offices and other ancillary facilities. Additional process and crushing equipment will be skid-mounted.

3. INVESTIGATION

3.1 Review of Existing Data

Prior to and in conjunction with the field investigation, the following data were reviewed:

A. General site plans, aerial photographs, topographic and geologic maps and placer test trench evaluation data provided by AFBL.

B. Geologic and hydrogeologic maps and literature published by government agencies and professional societies.

Mr. A. J. Fernandez, Senior Mining Engineer of AFBL, provided additional background information during conversations on-site and at several meetings during the course of the investigation.

3.2 Site Area Reconnaissance & Geologic Mapping

A brief preliminary reconnaissance of the Vulture Mine area was performed by Lawrence A. Hansen, Ph.D., P.E., James R. Fahy, P.E., and Paul V. Smith, P.G., of this firm in the company of Mr. A. J. Fernandez, on January 15, 1987. The locations of existing and planned facilities were examined and a preliminary evaluation of several potential diversion alignments was performed.

An engineering geologic map of the proposed leach pad area was prepared in the field by Paul V. Smith, P.G. on January 30, 1987. This map is presented on Sheet 1. Bedrock, surficial materials, tailings and fill in the proposed leach pad area were classified according to the Genesis-Lithology-Qualifier (GLQ) system of engineering geology mapping symbols (Keaton, 1984)*. A brief explanation of the system is included in the legend for Sheet 1.

*References are listed at end of report.

3.3 Subsurface Investigation

A total of 16 backhoe test pits were excavated using a subcontracted Case 580 backhoe. Locations of the test pits are shown on Sheet 1. Test pits 1 through 8 (TP-1 through TP-8) were located along the alignments of potential diversion channels. The primary purpose of these pits was to determine excavation conditions and the depth of soil and bedrock along the proposed alignments. TP-9, as originally planned, was not advanced since bedrock was exposed at the ground surface in this area. Surficial materials were sampled from this location, and a test pit designation is retained for purposes of identification. TP-10 through TP-17 were advanced in the proposed leach pad area to determine the depth of tailings, soil and rock. Disturbed bulk samples of all materials encountered in these pits were retained for laboratory analysis.

All soils encountered were classified by the Unified Soil Classification System (ASTM D2487) which is summarized in Appendix A. Appendix A also includes a summary of terminology used to describe the relative density, consistency or firmness of soils, a summary of terminology used for the description of rock and the test pit logs.

All test pits were backfilled with excavated material subsequent to the investigation. Paul V. Smith, P.G., of this firm supervised the field investigation.

3.4 Laboratory Analyses

Grain-size distributions and Atterberg limits were determined for samples of material from three potential clay borrow sources. The samples were provided by Mr. A. J. Fernandez of AFBL. Moisture-density relationship determinations (standard Proctor) and remolded permeability tests of these clays are presently in progress.

4. SITE GEOLOGY & GEOTECHNICAL PROFILE

4.1 Bedrock & Surficial Geology

The Vulture Mountains are composed of a Precambrian metamorphic/igneous core complex intruded by igneous rocks of Late Cretaceous, Tertiary and Quaternary age (Wilson and others, 1957; Wilson and others, 1969). Sedimentary rocks are generally not present in significant amounts. Bedrock is overlain by varying thicknesses of unconsolidated Late Tertiary to Quaternary alluvial fan, channel and basin fill deposits, colluvium and eolian deposits.

The surface geology of the Vulture Mine area was not mapped in detail for this project, but was obtained from an unpublished map (White, 1986) provided by AFBL. Bedrock consists of a schist/amphibolite complex of Precambrian age, intruded by granite, "quartz porphyry," aplite and alaskite of possibly Late Cretaceous age.

These units are overlain by undifferentiated volcanic rocks of Tertiary age, and are cut by several northwest- to north-northwest-trending faults.

Bedrock is overlain by Late Tertiary to Quaternary alluvial fan and channel deposits, plus minor amounts of slope wash, colluvium, and eolian deposits. These surficial materials are generally strongly cemented with secondary calcium carbonate (caliche), forming a hard, low permeability and relatively resistant surface.

Weathering may extend to depths of several tens of feet in bedrock, forming a moderately hard material that may be excavated using standard construction equipment. Certain rock types are more resistant to surface weathering, and shallow excavations may require ripping or light blasting locally.

Portions of the mine area are also overlain by various fill materials, including tailings, mine waste rock, concrete slabs, machine parts, construction materials, sand and gravel, and various deleterious materials.

4.2 Hydrogeology

The site area lies within the upper portion of the Hassayampa River basin, which extends from the Date Creek, Weaver and Bradshaw Mountains north of Wickenburg to the confluence with the Salt River near Phoenix, covering a total area of about 1,300 square miles.

Groundwater conditions in this area are discussed in a report by Sanger and Appel (1978). The report includes data on groundwater depths and water quality from numerous wells in the region, including the well at the Vulture Mine. It also delineates the outlines of several groundwater basins within the Hassayampa River drainage system. The Vulture Mountains are flanked on the south by a deep alluvial basin referred to as the Hassayampa Plain. This area receives recharge, primarily in the form of groundwater, from the southern slopes of the Vulture Mountains, including the site area. Groundwater occurs in saturated alluvial materials at elevations ranging from about 1250 to 1500 feet in the Hassayampa Plain.

The water table at the site is reported by Sanger and Appel (1978) to lie at an elevation of about 1645 feet above sea level, or 435 feet below the ground surface. This is in general agreement with recent observations made at the mine (personal communication from Mr. A. J. Fernandez).

Surface flow in stream channels near the site is intermittent, no surface bodies of water presently exist, and none of the backhoe test pits encountered groundwater in surficial materials. Groundwater evidently only occurs at significant depths in bedrock, generally below about 400 feet. Thus, infiltration of hazardous contaminants to the water table from the proposed leach pad area is not likely to occur, unless such contaminants are introduced via underground mine workings.

Groundwater in the site area is of generally good quality, with the exception of a high fluoride content. Major constituents present include sodium, calcium, magnesium and bicarbonate (Sanger and Appel, 1978).

4.3 Seismotectonic Setting & Seismic Design Parameters

Recent studies by the Arizona Bureau of Geology and Mineral Technology (DuBois and others, 1982; Menges and Pearthree, 1983; Scarborough and others, 1986) indicate that the potential for future seismic activity in the Vulture Mountains is relatively low. The area lies within seismic zone 010 of Algermissen and others (1982). The preliminary map of horizontal acceleration in rock (with 90 percent probability of not being exceeded in ten years) prepared by Algermissen and others (1982) recommends a value of 0.04g for the site area.

4.4 Geotechnical Profile Along Proposed Diversion Channel Alternatives

4.4.1 Diversion Alternatives 1 & 2

A total of eight backhoe test pits were advanced along proposed diversion channel alternatives 1 and 2. The depth of soil and bedrock encountered is indicated on the test pit logs in Appendix A and is also shown on Sheet 1. Backhoe refusal was encountered at depths ranging from 4.5 to 10 feet. Refusal occurred on either hard, cemented alluvium or shallow bedrock. It was generally possible to advance the backhoe up to a few feet into the upper weathered surface of the bedrock, indicating that excavation of this material may be possible using conventional excavation equipment.

Alluvial materials encountered in the test pits include sand and gravel with lesser amounts of cobbles, silt and clay. These materials are generally stratified, bedded and moderately to strongly cemented. The depth of alluvium varied from a maximum of 8 feet in TP-1 to a minimum of 4 feet in TP-5. Refusal did not occur in alluvium except in TP-6. The alluvial materials encountered in these pits can be excavated using conventional excavation equipment.

Bedrock was encountered in all test pits except TP-6, at depths ranging from the surface in TP-9 to 8 feet in TP-1. Various rock types were encountered, including schist, amphibolite, gabbro, diorite, and various fine grained intrusives. These materials are moderately to highly weathered and may be rippable to depths of at least 10 to 12 feet in most places. However, at the locations of TP-7 and TP-9, a relatively fresh and hard layered gneiss and schist was encountered, which may require blasting.

4.4.2 Diversion Alternative 3

A brief geological reconnaissance of diversion alternative 3 was performed on January 30, 1987. Alluvial materials, typically composed of hard, cemented sand and gravel, occur at the surface. Bedrock is exposed nearby and would probably be encountered at depths of 10 feet or less. The depth of weathering of this rock was not determined. However, it may be possible to excavate this material to the required depth using conventional excavation equipment. Light blasting or ripping may be required if the rock is less weathered and more intact.

4.5 Geotechnical Profile of Proposed Leach Pad Area

The engineering geologic map of the proposed leach pad area is presented on Sheet 1. A total of eight backhoe test pits were advanced in this area to depths ranging from 3.5 to 16 feet. As shown on Sheet 1, tailings are distributed over this area across an artificial alluvial fan that spreads outward toward the southwest from the former mill area. The tailings are thickest at the apex of the fan, where backhoe pit TP-13 was advanced to a depth of 16 feet without encountering native materials. Based on visual estimates, there may be 25 or 30 feet of tailings at this location. The thickness appears to vary in an irregular fashion across the pile area, filling in irregularities in the former ground surface.

The tailings primarily consist of uniform, thinly bedded to laminated silt and very fine to fine grained sand. These deposits appear to be loose in relative density and are estimated to be moderately moisture sensitive. The tailings will require some densification and recompaction of near-surface layers as part of the pad construction.

The tailings are underlain by alluvium, generally composed of hard cemented sand and gravel. This material is of unknown thickness. It is exposed at the surface in several drainage channels traversing the northwest side of the proposed pad area (TP-17) and in a small area near the southeast corner (TP-11). The profile of the tailings and alluvium is well exposed in a recently incised drainage channel at the northwest corner of the proposed pad area; the thickness of the tailings at several points along this channel is listed on Sheet 1.

Bedrock underlies the alluvium at unknown depth. It is not exposed in the proposed pad area, except along the northeast side, nor was it exposed by the test pits. Some rock may have been removed from the area adjacent to the former spiggot to facilitate mill construction. Bedrock may be relatively shallow in this area, and may dip away toward the west. The existence of northwest- to north-northwest-trending faults cannot be ruled out, although none were shown by White (1986). The depth to bedrock within the pad area will be determined from our Phase II exploratory drilling program.

4.6 Erosion Potential of Proposed Leach Pad Area

Existing drainages in the site area display a braided stream morphology. A similar pattern probably underlies the tailings. The natural drainage patterns have been modified in the past by construction of several berms near the west end of the pile. The effect of these has been to direct intermittent flows toward the tailings. As a result, active erosion of the tailings pile area is presently occurring.

A site grading and drainage plan will be developed as part of Phase II which will address the existing erosion channels. Perimeter berms and diversion dikes will be provided along the perimeter of the leach facility for erosion protection and conveyance of incident runoff away from the site.

5. SURFACE WATER HYDROLOGY

5.1 General

A detailed analysis of surface water hydrology was performed for various storm events within the contributing watershed located north of the Vulture Mine open pit. Mill Wash, which is the major drainage channel of the watershed, crosses a portion of the proposed open pit area. The purpose of the hydrologic calculations was to establish peak design flows and runoff volumes for use in determining the minimum channel dimensions and channel capacity required to divert the design storm around the open pit and away from the mine site. A summary of the methodology used and analysis results are presented in the following sections.

5.2 Hydrologic Analyses

Peak design storm flows for the contributing watershed area were calculated using the Hydrologic Engineering Center (HEC-1) Flood Hydrograph Package developed by the U.S. Army Corps of Engineers (1981). The HEC-1 model simulates surface runoff response of a basin to precipitation by representing the basin as an interconnected system of hydrologic and hydraulic components. In this analysis, the components used were subbasins and channels for runoff entities. The flood flow analysis followed the Soil Conservation Service (SCS) curve number (CN) method available in the HEC-1 model. Calculations were performed for the 100 and 500-year, 24-hour precipitation events and the six-hour general storm probable maximum precipitation (PMP) event.

5.2.1 Subbasins

The watershed upstream from the Vulture Mine open pit was divided into four subbasins to facilitate modeling. The boundaries of the subbasins are shown in Figure 2 in Appendix C.

5.2.2 Curve Numbers

An important parameter in determining flood flows from the watershed is the CN. Factors considered in determining the CN of each subbasin are soil types and depths, vegetation types and percent of cover, and antecedent moisture conditions of the watershed at commencement of the storm. CN estimates were made utilizing soils information from the U.S. Department of Agriculture Soil Conservation Service (SCS) for Maricopa County (1973), field inspection of the main channel deposits and surficial soils in the watershed, and representative CN's for various soil groups presented by SCS.

Variations in assigned CN for the subbasins within the watershed were principally due to the associated variations in subbasin drainage channel conditions and contributing area of each channel to the total subbasin area. Assigned CN values for each subbasin are presented below:

Subbasin	Curve No.
Red Wash 1	80
Red Wash 2	80
Mill Wash	75
Vulture	85

5.2.3 Lag Time & Time of Concentration

Lag time is defined as the time for water to flow from the center of mass of rainfall excess to the point of peak discharge. Estimates of lag times for each subbasin were made utilizing the Lag Method developed by SCS, which relates the lag time (L) to the slope (Y) in percent, the hydraulic length (l) in feet, and the maximum retention (s).

The time of concentration (t_c), which is a measure of the time for a particle of water to travel from the hydrologically most distant point in the watershed to the design point, was estimated using the empirical relationships $t_c = 1.67L$. Table 1 in Appendix C summarizes input parameters for each subbasin.

5.2.4 Precipitation

Estimated precipitation for the 100-year, 24-hour rainfall event was obtained from the NOAA Atlas (1973). Rainfall from the 500-year, 24-hour event was interpolated using a semi-log plot of lesser storm events. Total rainfall of 4.1 and 5.1 inches, respectively, was determined for the 100 and 500-year storms.

The six-hour general storm PMP was developed following guidelines presented by the U.S. Department of Commerce (1977). Computations for development of the general storm PMP are presented in Table 2 in Appendix C. A total rainfall of 9.2 inches was utilized for the PMP calculations.

5.2.5 Peak Discharge & Runoff Volume

Peak discharges and runoff volumes calculated for the design storms are as follows:

Return Period (years)	Peak Discharge (cfs)	Volume of Runoff (acre-feet)
100	877	319
500	1,251	452
PMP	4,043	1,345

Computer summary sheets for the HEC-1 analyses are included in Appendix C.

6. DISCUSSION & RECOMMENDATIONS

6.1 Diversion Channel

Four diversion alignment alternatives, as shown on Sheet 1, were considered for control of storm runoff from the contributing watershed. Alternatives 1 and 2 intercept the watershed at Mill Wash approximately 1,000 feet north of the open pit, diverting runoff to the east of the pit and then to an existing drainage south of the mine site. Preliminary estimates of earthwork quantities indicate a total of between 20,000 and 25,000 cubic yards of cut and fill would be required to construct either of these alternatives.

Costs for construction of either Alternative 1 or 2 are estimated at about $52,000. This includes earthwork costs for excavation, subgrade preparation and construction of the diversion channel perimeter berms. Channel protection for scour would be included at the diversion entrance only. For a short-term project such as the Vulture Mine Project, it appears to be advantageous on a cost-benefit comparison to accept the risk of occasional repair of sections of the channel after a significant storm than to fully armor the channel.

Alternative 3 has the watershed runoff remaining in Mill Wash through the open pit area followed by a short diversion to an existing drainage on the southwest side of the pit. Alternative 3 would require a staged mining operation to maintain the wash for the majority of time spent mining the open pit. The wash would be disrupted for a 6 to 8-month period during which time the runoff in Mill Wash would be diverted to a previously mined portion of the pit. Any significant accumulation of runoff would be pumped to nearby drainages.

Estimated earthwork quantities required to reconstruct the Mill Wash channel across the open pit after completion of mining eliminates this alternative as a viable option. Approximately 137,000 cubic yards of material would be required to reconstruct the channel in its present position, or in excess of five times that required for either of Alternatives 1 or 2.

Alternative 4 includes diversion of all storm flows during mining directly into the open pit. This alternative appears to be the most economical option, but future costs may arise during mining that are difficult to quantify presently. Initial earthwork quantities and costs to facilitate this alternative would be minimal, but future costs may be incurred due to temporary pit shutdown during storms, for pit pumpout afterwards, and for pit slope modifications required after temporary impoundment of water.

Considering that open pit mining will intercept existing abandoned underground stopes which would probably serve as conduits for rapid drawdown of runoff in the pit, and that the duration of pit excavation is estimated to be less than two years, the risk of excessive shutdown and remedial costs during pit mining appear minimal. In addition, runoff into the pit would provide recharge to the local groundwater regime.

Diversion alternatives for the project were discussed with the Arizona Department of Health Services (ADHS), specifically regarding the possibility of diverting runoff directly into the open pit. ADHS indicated two criteria will control diversion siting or pad location. First, the diversion should be sited to avoid potential impact of runoff on the integrity of the heap leach pile or solution ponds. Second, should storm runoff be diverted into the open pit, the water quality of the surface runoff must be acceptable for recharge to the groundwater.

The diversion alternatives were also discussed with the Arizona Department of Water Resources (ADWR). Though this agency had a favorable reaction to Alternative 4, this procedure would require a groundwater recharge permit, which will require a hydrological characterization of the region. ADWR also indicated a permit could only be granted for water for which Vulture Mine has legal rights. We are presently pursuing the issues of water appropriation.

6.2 Leach Pad & Ponds

Locating the leach pad and solution ponds generally within the boundaries of the existing on-site tailings, as shown on Sheet 1, appears to be the most viable alternative, considering required grading and subgrade preparation. In general, the tailings deposit gently slopes to the southwest, which is advantageous for pad runoff and solution transport to the pregnant pond. The tailings consist primarily of fine grained sands and silts and would provide a very smooth finished subgrade for liner placement. Alternative leach pad locations on native soils or rock would require extensive grading and site preparation, including the import of finer grained material.

The tailings are loosely deposited and will require densification and recompaction of the near-surface materials prior to finish grading and liner placement. Estimates of compressibility of these materials and required subgrade preparation procedures will be developed as part of our Phase II program.

Preliminary siting plans for the leach pad and pregnant pond on the existing tailings were discussed with ADHS. Results of these discussions were very positive. Provided our design philosophy is adequately supported by the results of our subsurface exploration and engineering analyses, ADHS will consider permitting of these facilities on the existing tailings. A double-lined facility with leakage detection is not a mandatory requirement of the ADHS provided a single-lined facility can be supported as an adequate containment system for environmental protection.

Decisions as to the incorporation of an extreme storm surge pond in addition to the pregnant pond or providing storm storage fully within the pregnant pond have not been made as yet. An economic analysis of these options will be conducted in Phase II to determine the most cost effective system.

6.3 Waste Rock Pile

The proposed waste rock area is about 1,200 feet north of the open pit on a gently sloping terrain (1 to 3 percent). An estimated 1,200,000 tons of waste rock will be included in the dump site. The pile will be constructed by end dumping at the angle of repose of the waste material. It is anticipated that the pile will be a single lift of about 50 to 60 feet. Relatively shallow bedrock underlies this area and will provide a relatively high degree of stability for the pile. Periodic sloughing of the near-surface materials should be considered when determining its final location, and the toe of the pile should be sufficiently removed from any stream flow. It appears these criteria can be accommodated in the general area proposed.

6.4 Clay Borrow

Materials from the three potential clay borrow sources near Congress, Arizona are similar in grain size distribution and plasticity. Each is highly plastic and is anticipated to possess recompacted coefficient of permeability of less than $1x10^{-7}$ cm/s. Due to the highly plastic nature of these materials, achieving near optimum moisture content during compaction and the potential desiccation and cracking after placement need to be evaluated when considering their use. The borrow materials include a significant amount of coarse grained fraction which may be advantageous in achieving required compaction, and which may reduce the potential for desiccation cracking prior to covering the clays.

Moisture-density determinations and compacted permeability tests are being performed on samples of the clay borrow materials. A final determination as to the suitability of the clays for use as a low permeability lining for the pad and/or solution ponds will be made upon review of these laboratory tests. As part of our Phase II program, cost comparisons will be made for alternatives utilizing the clay soils and placing a geomembrane as an underliner.

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APPENDIX A

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TEST DRILLING EQUIPMENT & PROCEDURES

Drilling Equipment Truck-mounted CME-55 drill rigs powered with 4 or 6 cylinder Ford industrial engines are used in advancing test borings. The 4 cylinder and 6 cylinder engines are capable of delivering about 4,350 and 6,500 foot/pounds torque to the drill spindle, respectively. The spindle is advanced with twin hydraulic rams capable of exerting 12,000 pounds downward force. Drilling through soil or softer rock is performed with 6 1/2 O.D., 3 1/4 I.D. hollow stem auger or 4 1/2 inch continuous flight auger. Carbide insert teeth are normally used on the auger bits so they can often penetrate rock or very strongly cemented soils which require blasting or very heavy equipment for excavation. Where refusal is experienced in auger drilling, the holes are sometimes advanced with tricone gear bits and NX rods using water or air as a drilling fluid. Where auger and tricone gear bits cannot be used to advance the hole due to cobbles or caving conditions, the ODEX (overburden drilling with the eccentric method) is used. A percussion down-the-hole hammer underreams the hole and 5 inch steel casing is introduced into the hole during drilling. The drill bit is eccentric and can be removed from the center of the casing to allow sampling of the material below the bit penetration depth.

Sampling Procedures Dynamically driven tube samples are usually obtained at selected intervals in the borings by the ASTM D1586 procedure. In many cases, 2" O.D., 1 3/8" I.D. samplers are used to obtain the standard penetration resistance. "Undisturbed" samples of firmer soils are often obtained with 3" O.D. samplers lined with 2.42" I.D. brass rings. The driving energy is generally recorded as the number of blows of a 140 pound 30 inch free fall drop hammer required to advance the samplers in 6 inch increments. However, in stratified soils, driving resistance is sometimes recorded in 2 or 3 inch increments so that soil changes and the presence of scattered gravel or cemented layers can be readily detected and the realistic penetration values obtained for consideration in design. These values are expressed in blows per foot on the logs. "Undisturbed" sampling of softer soils is sometimes performed with thin walled Shelby tubes (ASTM D1587). Where samples of rock are required, they are obtained by NX diamond core drilling (ASTM D2113). Tube samples are labeled and placed in watertight containers to maintain field moisture contents for testing. When necessary for testing, larger bulk samples are taken from auger cuttings.

Continuous Penetration Tests Continuous penetration tests are performed by driving a 2" O.D. blunt nosed penetrometer adjacent to or in the bottom of borings. The penetrometer is attached to 1 5/8" O.D. drill rods to provide clearance to minimize side friction so that penetration values are as nearly as possible a measure of end resistance. Penetration values are recorded as the number of blows of a 140 pound 30 inch free fall drop hammer required to advance the penetrometer in one foot increments or less.

Boring Records Drilling operations are directed by our field engineer or geologist who examines soil recovery and prepares boring logs. Soils are visually classified in accordance with the Unified Soil Classification System (ASTM D2487) with appropriate group symbols being shown on the logs.

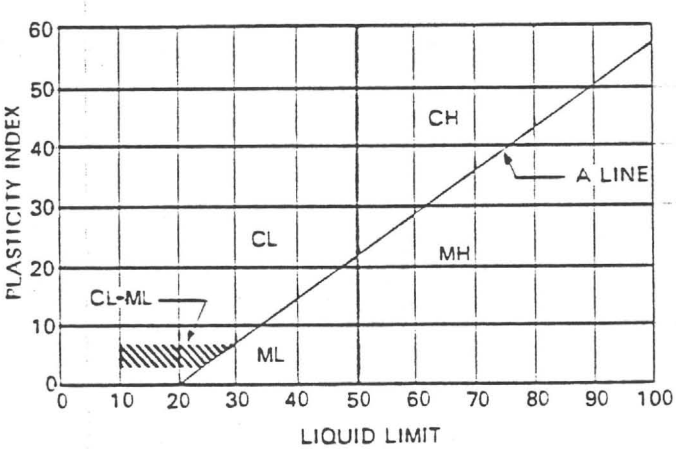
UNIFIED SOIL CLASSIFICATION SYSTEM

Soils are visually classified by the Unified Soil Classification system on the boring logs presented in this report. Grain-size analysis and Atterberg Limits Tests are often performed on selected samples to aid in classification. The classification system is briefly outlined on this chart. For a more detailed description of the system, see "The Unified Soil Classification System" Corp of Engineers, US Army Technical Memorandum No. 3-357 (Revised April 1960) or ASTM Designation: D2487-66T.

MAJOR DIVISIONS				GRAPHIC SYMBOL	GROUP SYMBOL	TYPICAL NAMES
COARSE-GRAINED SOILS (Less than 50% passes No. 200 sieve)	GRAVELS (50% or less of coarse fraction passes No. 4 sieve)	CLEAN GRAVELS (Less than 5% passes No. 200 sieve)			GW	Well graded gravels, gravel-sand mixtures, or sand-gravel-cobble mixtures.
					GP	Poorly graded gravels, gravel-sand mixtures, or sand-gravel-cobble mixtures.
		GRAVELS WITH FINES (More than 12% passes No. 200 sieve)	Limits plot below "A" line & hatched zone on plasticity chart		GM	Silty gravels, gravel-sand-silt mixtures.
			Limits plot above "A" line & hatched zone on plasticity chart		GC	Clayey gravels, gravel-sand-clay mixtures.
	SANDS (More than 50% of coarse fraction passes No. 4 sieve)	CLEAN SANDS (Less than 5% passes No. 200 seive)			SW	Well graded sands, gravelly sands.
					SP	Poorly graded sands, gravelly sands.
		SANDS WITH FINES (More than 12% passes No. 200 sieve)	Limits plot below "A" line & hatched zone on plasticity chart		SM	Silty sands, sand-silt mixtures.
			Limits plot above "A" line & hatched zone on plasticity chart		SC	Clayey sands, sand-clay mixtures.
FINE-GRAINED SOILS (50% or more passes No. 200 sieve)	SILTS (Limits plot below "A" line & hatched zone on plasticity chart)	SILTS OF LOW PLASTICITY (Liquid Limit Less Than 50)			ML	Inorganic silts, clayey silts with slight plasticity.
		SILTS OF HIGH PLASTICITY (Liquid Limit More Than 50)			MH	Inorganic silts, micaceous or diatomaceous silty soils, elastic silts.
	CLAYS (Limits plot above "A" line & hatched zone on plasticity chart)	CLAYS OF LOW PLASTICITY (Liquid Limit Less Than 50)			CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays.
		CLAYS OF HIGH PLASTICITY (Liquid Limit More Than 50)			CH	Inorganic clays of high plasticity, fat clays, sandy clays of high plasticity.

NOTE: Coarse grained soils with between 5% & 12% passing the No. 200 sieve and fine grained soils with limits plotting in the hatched zone on the plasticity chart to have double symbol.

PLASTICITY CHART



DEFINITIONS OF SOIL FRACTIONS

SOIL COMPONENT	PARTICLE SIZE RANGE
Cobbies	Above 3 in.
Gravel	3 in. to No. 4 sieve
Coarse gravel	3 in. to ¾ in.
Fine gravel	¾ in. to No. 4 sieve
Sand	No. 4 to No. 200
Coarse	No. 4 to No. 10
Medium	No. 10 to No. 40
Fine	No. 40 to No. 200
Fines (silt or clay)	Below No. 200 sieve

TERMINOLOGY USED TO DESCRIBE THE RELATIVE DENSITY, CONSISTENCY OR FIRMNESS OF SOILS

The terminology used on the boring logs to describe the relative density, consistency or firmness of soils relative to the standard penetration resistance is presented below. The standard penetration resistance (N) in blows per foot is obtained by the ASTM D1586 procedure using 2" O.D., 1 3/8" I.D. samplers.

1. Relative Density. Terms for description of relative density of cohesionless, uncemented sands and sand-gravel mixtures.

N	Relative Density
0-4	Very loose
5-10	Loose
11-30	Medium dense
31-50	Dense
50+	Very dense

2. Relative Consistency. Terms for description of clays which are saturated or near saturation.

N	Relative Consistency	Remarks
0-2	Very soft	Easily penetrated several inches with fist.
3-4	Soft	Easily penetrated several inches with thumb.
5-8	Medium stiff	Can be penetrated several inches with thumb with moderate effort.
9-15	Stiff	Readily indented with thumb, but penetrated only with great effort.
16-30	Very stiff	Readily indented with thumbnail.
30+	Hard	Indented only with dificulty by thumbnail.

3. Relative Firmness. Terms for description of partially saturated and/or cemented soils which commonly occur in the Southwest including clays, cemented granular materials, silts and silty and clayey granular soils.

N	Relative Firmness
0-4	Very soft
5-8	Soft
9-15	Moderately firm
16-30	Firm
31-50	Very firm
50+	Hard

EXPLANATION OF CORE LOG PRESENTATION
& TERMINOLOGY FOR THE DESCRIPTION OF ROCK

I. ROCK QUALITY DESIGNATION (RQD). Percentage of rock core per core run which is relatively sound and unfractured and which is longer than 0.33 feet in length. Rock which is soft or weathered, closely jointed, or rock from which the core recovery is low, will have poor to fair RQD.

II. DISCONTINUITIES

A. Spacing of Joints

Code	Spacing of Joints	Descriptive Term
1	Greater than 10 ft.	Very wide
2	3 ft. - 10 ft.	Wide
3	1 ft. - 3 ft.	Moderately close
4	0.2 ft. - 1 ft.	Close
5	Less than 0.2 ft.	Very close

B. Orientation of Joints

Measurements presented represent dip angles from horizontal.

Symbol	Description
Rdm	Random - preferred orientation cannot be determined.

C. Condition of Joints

1. Roughness

Symbol	Descriptive Term	Properties
Smth	Smooth	Appears smooth and is essentially smooth to the touch. May be slickensided.
SRgh	Slightly rough	Asperities on the fracture surfaces are visible and can be distinctly felt.
MRgh	Medium rough	Asperities are clearly visible and fracture surface feels abrasive.
Rgh	Rough	Large angular asperities can be seen. Some ridge and high side angle steps evident.

Symbol	Descriptive Term	Properties
VRgh	Very rough	Near vertical steps and ridges occur on the fracture surface.

2. Presence or Absence of Fracture Filling Material

Symbol	Descriptive Term	Definition
Cln	Clean	No fracture filling material.
Stn	Stained	Coloration of rock only. No recognizable filling material.
Fld	Filled	Fracture filled with recognizable filling material.

III. BEDDING

Symbol	Descriptive Term	Definition
TL	Thinly laminated	Less than 0.01 ft.
L	Laminated	0.01 ft. to 0.04 ft.
ThB	Thinly bedded	0.04 ft. to 0.20 ft.
MB	Medium bedded	0.20 ft. to 2.00 ft.
TkB	Thickly bedded	More than 2.00 ft.

IV. DEGREE OF WEATHERING

Symbol	Descriptive Term	Properties
Dec	Decomposed, generally soil-like, can be crumbled by hand pressure.	
HiW	Highly weathered, generally rock-like, can be broken easily, but crumbles with difficulty by hand.	
MdW	Moderately weathered, fabric stained rusty brown, can be indented by steel nail, breaks only with difficulty.	
SlW	Slightly weathered, open discontinuities are weathered, coated, but only slight weathering of rock mass, generally not indented by steel nail.	
UnW Ex Jts	Unweathered except joints, weathering limited to the surface of discontinuities; fabric is fresh throughout but most joints show rusty stain and/or soil filling material.	
UnW Inc Jts	Unweathered including joints, rock mass and discontinuities are unweathered; only occasional joints show rusty stain, practically no soil filling.	

V. HARDNESS

Descriptive Term	Properties
Very hard	Cannot be scratched with knife or sharp pick. Breaking of hand specimens requires several hard blows of geologist's pick.
Hard	Can be scratched with knife or pick only with difficulty. Hard blow of hammer required to detach hand specimen.
Moderately hard	Can be scratched with knife or pick. Gouges or grooves to ¼ inch deep can be excavated by hard blow of point of a geologist's pick. Hand specimens can be detached by moderate blow.
Moderately soft	Can be grooved or gouged 1/16 inch deep by firm pressure on knife or pick point. Can be excavated in small chips to pieces about 1 inch maximum size by hard blows of the point of a geologist's pick.
Soft	Can be gouged or grooved readily with knife or pick point. Can be excavated in chips to pieces several inches in size by moderate blows of a pick point. Small thin pieces can be broken by finger pressure.
Very soft	Can be carved with knife. Can be excavated readily with point of pick. Pieces 1 inch or more in thickness can be broken with finger pressure. Can be scratched readily by fingernail.

VI. MISCELLANEOUS ABBREVIATIONS

Symbol	Description	Symbol	Description
Bkn	Broken	Incl	Inclusions
Brc	Brecciated	Qtz	Quartz
Calc	Calcite	Slicks	Slickensides
Cem	Cemented	SZ	Shear Zone
Frct	Fractured		
Gog	Gouge		

PROJECT Heap Leach Facility Design Vulture Mine Project

JOB NO. E87-11 DATE 1-23-87

LOG OF TEST PIT NO. TP-1

Backhoe Type Case 580

Location E 221,130; N 1,027,530

Elevation 2063'

Datum *VMP

GROUND WATER

DEPTH	HOUR	DATE
	none	

Depth in Feet	Graphical Log	Sample	Sample Type	Moisture Content Per Cent of Dry Wt.	Unified Soil Classification	REMARKS	VISUAL CLASSIFICATION
0–10			D, D		SP & GP	moist	SAND, predominantly medium to coarse grained, interbedded with occasional fine grained sand, fine grained gravel & gravelly sand, subrounded to subangular, no trace of lime cementation, nonplastic, brown note: well bedded, beds from 1" to 1' thick note: increasing amounts of gravel to sandy gravel below 3'
10						moist	BEDROCK, undifferentiated Precambrian schist and amphibolite cut by Tertiary (?) Feldspathic intrusive (Alaskite ?), moderately to strongly weathered, moderately soft to moderately hard, dark green, gray to black, weathering to dark reddish brown note: hardness increasing gradually with depth note: may be rippable to 15'

Backhoe refused at 10'
Backfill hole with cuttings

*Vulture Mine Project Composite Surface Map

SAMPLE TYPE
B — Undisturbed Block Sample
D — Disturbed Bulk Sample

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JOB NO. E87-11 DATE 1-23-87

LOG OF TEST PIT NO. TP-2

Backhoe Type Case 580
Location E 221,300; N 1,027,420
Elevation 2073'
Datum *VMP

GROUND WATER

DEPTH	HOUR	DATE
	none	

Depth in Feet	Sample Type	Unified Soil Classification	REMARKS	VISUAL CLASSIFICATION
0–7	D	SP & GP	slightly moist to moist	Interbedded fine to medium grained SAND & GRAVEL, SANDY GRAVEL & GRAVELLY SAND, occasional cobbles, especially from 5' to 7', subrounded to angular, moderately to strongly lime cemented, nonplastic, reddish brown note: well bedded, beds vary from 2" to 2'
7–9	D		moist	BEDROCK, undifferentiated Precambrian schist and amphibolite cut by Tertiary (?) Feldspathic intrusive (Alaskite ?), moderately to strongly weathered, moderately soft to moderately hard, dark green, gray to black, weathering to dark reddish brown note: hardness increasing gradually with depth note: may be rippable to 15'

Backhoe refused at 9'
Backfilled hole with cuttings

*Vulture Mine Project Composite Surface Map

SAMPLE TYPE
B — Undisturbed Block Sample
D — Disturbed Bulk Sample

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JOB NO. E87-11 DATE 1-23-87

LOG OF TEST PIT NO. TP-3

Backhoe Type Case 580

Location E 221,460; N 1,027,310

Elevation 2070'

Datum *VMP

GROUND WATER

DEPTH	HOUR	DATE
	none	

Depth in Feet	Graphical Log	Sample	Sample Type	Moisture Content Per Cent of Dry Wt.	Unified Soil Classification	REMARKS	VISUAL CLASSIFICATION
0–8		X	D (0–5), D (5–8)		SP & GP	slightly moist	Interbedded SANDY GRAVEL & GRAVELLY SAND, occasional cobbles, predominantly fine to medium grained, massive to thickly bedded, angular, weakly to moderately lime cemented, nonplastic, reddish brown note: beds vary from 6" to 3'
8–						slightly moist	BEDROCK, undifferentiated Precambrian Schist, strongly weathered, moderately soft to moderately hard, green to brown note: very high caliche content note: may be rippable to at least 15' to 20'

Backhoe refused at 8'
Backfilled hole with cuttings

*Vulture Mine Project Composite Surface Map

SAMPLE TYPE
B — Undisturbed Block Sample
D — Disturbed Bulk Sample

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PROJECT Heap Leach Facility Design Vulture Mine Project

JOB NO. E87-11 DATE 1-23-87

LOG OF TEST PIT NO. TP-4

Backhoe Type Case 580

Location E 221,880; N 1,026,945

Elevation 2055'

Datum *VMP

GROUND WATER

DEPTH	HOUR	DATE
	none	

Depth in Feet	Graphical Log	Sample	Sample Type	Moisture Content Per Cent of Dry Wt.	Unified Soil Classification	REMARKS	VISUAL CLASSIFICATION
0		X	D		SP & ML	moist	SAND, fine to medium grained with occasional coarse grained sand interbedded with silt with some fine grained sand & clay, well rounded to angular, considerable lime cementation increasing with depth, nonplastic to low plasticity, brown note: some organic material, especially roots note: layering typically 6" to 1' thick
		X	D		GP	slightly moist to moist	SANDY GRAVEL, occasionally varying to gravelly sand, angular, strongly lime cemented, nonplastic, brown
5		X	D			slightly moist to moist	BEDROCK, Gabbro-diorite, fine grained with conspicuous salt & pepper texture, strongly fractured, well developed cleavage, moderately weathered to strongly weathered, soft to moderately hard, dark greenish gray to black note: hardness increasing with depth; may be rippable to 6' to 8'
10							

Backhoe refused at 5'6"
Backfilled hole with cuttings

*Vulture Mine Project Composite Surface Map

SAMPLE TYPE
B — Undisturbed Block Sample
D — Disturbed Bulk Sample

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PROJECT Heap Leach Facility Design Vulture Mine Project

JOB NO. E87-11 DATE 1-23-87

LOG OF TEST PIT NO. TP-5

Backhoe Type Case 580

Location E 222,345; N 1,026,150

Elevation 2038'

Datum *VMP

GROUND WATER

DEPTH	HOUR	DATE
	none	

Depth in Feet	Graphical Log	Sample	Sample Type	Moisture Content Per Cent of Dry Wt.	Unified Soil Classification	REMARKS	VISUAL CLASSIFICATION
0		X	D		ML & SP	slightly moist to moist	Interbedded SILT varying to SANDY SILT & CLAYEY SILT & thin (1" to 3") layers of fine to medium grained sand, silt beds ~ 1' thick, moderately to strongly lime cemented, nonplastic to low plasticity, brown note: some roots present note: varying to sandy gravel, predominantly fine to medium grained, angular, medium to high lime content below 3', nonplastic, brown
5		X	D			slightly moist	BEDROCK, undifferentiated Precambrian schist, highly weathered, highly fractured, well developed cleavage, moderately soft to moderately hard, green to reddish brown note: very strongly calichified note: may be rippable to 8' to 10'
10							

Backhoe refused at 6'
Backfilled hole with cuttings

*Vulture Mine Project Composite Surface Map

SAMPLE TYPE
B — Undisturbed Block Sample
D — Disturbed Bulk Sample

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Vulture Mine Project

JOB NO. E87-11 DATE 1-23-87

LOG OF TEST PIT NO. TP-6

Backhoe Type Case 580
Location E 222,545; N 1,026,060
Elevation 2046'
Datum *VMP

GROUND WATER

DEPTH	HOUR	DATE
	none	

Depth in Feet	Graphical Log	Sample	Sample Type	Moisture Content Per Cent of Dry Wt.	Unified Soil Classification	REMARKS	VISUAL CLASSIFICATION
0		X	D		ML	slightly moist	SANDY SILT occasionally varying to silty sand, weakly to moderately lime cemented, nonplastic, brown
		X	D		SP & GP	slightly moist to moist	GRAVELLY SAND varying to sandy gravel, predominantly medium to coarse grained, subangular to angular, very strongly lime cemented, nonplastic, light brown to brown, caliche-mottled note: rippable note: bedrock not encountered
5							

Backhoe refused at 4'6"
Backfilled hole with cuttings

*Vulture Mine Project Composite Surface Map

SAMPLE TYPE
B — Undisturbed Block Sample
D — Disturbed Bulk Sample

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PROJECT Heap Leach Facility Design Vulture Mine Project

JOB NO. E87-11 DATE 1-23-87

LOG OF TEST PIT NO. TP-7

Backhoe Type Case 580

Location E 220,680; N 1,025,660

Elevation 2043'

Datum *VMP

GROUND WATER

DEPTH	HOUR	DATE
	none	

Depth in Feet	Graphical Log	Sample	Sample Type	Moisture Content Per Cent of Dry Wt.	Unified Soil Classification	REMARKS	VISUAL CLASSIFICATION
0		X	D		SP & GP	slightly moist to moist	Interbedded SAND, SILTY SAND & GRAVELLY SAND, predominantly fine to medium grained, angular to subrounded, moderately to strongly lime cemented, increasing with depth, nonplastic, brown note: beds from 1' to 2' thick
5		X	D			slightly moist	BEDROCK, Diorite-gabbro, fine grained, slightly to moderately weathered, hard, green note: may not be rippable below 6' to 8'
10							

Backhoe refused at 6'
Backfilled hole with cuttings

*Vulture Mine Project Composite Surface Map

SAMPLE TYPE
B — Undisturbed Block Sample
D — Disturbed Bulk Sample

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PROJECT Heap Leach Facility Design
Vulture Mine Project

JOB NO. E87-11 DATE 1-23-87

LOG OF TEST PIT NO. TP-8

Backhoe Type Case 580
Location E 222,035; N 1,025,420
Elevation 2033'
Datum *VMP

GROUND WATER

DEPTH	HOUR	DATE
	none	

Depth in Feet	Graphical Log	Sample	Sample Type	Moisture Content Per Cent of Dry Wt.	Unified Soil Classification	REMARKS	VISUAL CLASSIFICATION
0 – 5		X	D		ML	slightly moist to moist	TAILINGS SILT, light brown to yellowish brown
10		X	D			slightly moist to moist	BEDROCK, interbedded schist & gneiss, very fine to fine grained, moderately weathered from 7' to 9', slightly weathered to unweathered below 9' dark greenish gray, reddish brown to black note: may be rippable to 12' to 15'
							Backhoe refused at 9' Backfilled hole with cuttings *Vulture Mine Project Composite Surface Map

SAMPLE TYPE
B — Undisturbed Block Sample
D — Disturbed Bulk Sample

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PROJECT Heap Leach Facility Design
Vulture Mine Project

JOB NO. E87-11 DATE 1-30-87

LOG OF TEST PIT NO. TP-10

Backhoe Type Case 580

Location E 221, 600; N 1,025,130

Elevation 2046'

Datum Zortman Mining Company

GROUND WATER

DEPTH	HOUR	DATE
	none	

Depth in Feet	Graphical Log	Sample	Sample Type	Moisture Content Per Cent of Dry Wt.	Unified Soil Classification	REMARKS	VISUAL CLASSIFICATION
0		X	D		ML& SP	slightly moist to moist	TAILINGS SANDY SILT varying to SILTY SAND, thinly bedded to laminated, moderately to strongly lime cemented, nonplastic to low plasticity, light brown, tan varying to yellow note: 6" conspicuous yellow layer at base of tailings
5		X	D		GP	slightly moist to moist	SANDY GRAVEL, some coarse grained sand to medium grained gravel, occasional cobbles, predominantly fine to medium grained, angular, massive to thickly bedded, strongly lime cemented, nonplastic, reddish brown
10							Backhoe refused at 6'6" Backfilled hole with cuttings

SAMPLE TYPE
B — Undisturbed Block Sample
D — Disturbed Bulk Sample

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PROJECT Heap Leach Facility Design Vulture Mine Project

JOB NO. E87-11 DATE 1-30-87

LOG OF TEST PIT NO. TP-11

Backhoe Type Case 580

Location E 221,840; N 1,024,820

Elevation 2031'

Datum Zortman Mining Company

GROUND WATER

DEPTH	HOUR	DATE
	none	

Depth in Feet	Graphical Log	Sample	Sample Type	Moisture Content Per Cent of Dry Wt.	Unified Soil Classification	REMARKS	VISUAL CLASSIFICATION
0		X	D		SP	slightly moist to moist	SAND varying to CLAYEY or SILTY SAND, occasional coarse grained sand to fine grained gravel, predominantly fine grained sand, weakly to moderately lime cemented, nonplastic to low plasticity, light brown to reddish brown note: some windblown tails on surface note: some roots and other organic matter present
5		X	D		SP & GP	slightly moist to moist	Interbedded SAND & GRAVEL, occasional cobbles, predominantly fine to medium grained sand, predominantly medium grained gravel, angular, strongly lime cemented, nonplastic, reddish brown
10							Backhoe refused at 5'6" Backfilled hole with cuttings

SAMPLE TYPE
B — Undisturbed Block Sample
D — Disturbed Bulk Sample

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Vulture Mine Project

JOB NO. E87-11 DATE 1-30-87

LOG OF TEST PIT NO. TP-12

Backhoe Type Case 580

Location E 220,780; N 1,025,140

Elevation 2052'

Datum Zortman Mining Company

GROUND WATER

DEPTH	HOUR	DATE
	none	

Depth in Feet	Graphical Log	Sample	Sample Type	Moisture Content Per Cent of Dry Wt.	Unified Soil Classification	REMARKS	VISUAL CLASSIFICATION
0							
							TAILINGS
						slightly moist	SANDY SILT, predominantly very fine grained sand, thinly bedded, moderately lime cemented, nonplastic to low plasticity, tan to light reddish brown
5							
			D		ML		note: base of tailings not contacted
10							note: possible collapsing soil conditions
15							Stopped backhoe at 14' Backfilled hole with cuttings

SAMPLE TYPE
B — Undisturbed Block Sample
D — Disturbed Bulk Sample

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JOB NO. E87-11 DATE 1-30-87

LOG OF TEST PIT NO. TP-13

Backhoe Type Case 580

Location E 220,160; N 1,025,345

Elevation 2063'

Datum Zortman Mining Company

GROUND WATER

DEPTH	HOUR	DATE
	none	

Depth in Feet	Graphical Log	Sample	Sample Type	Moisture Content Per Cent of Dry Wt.	Unified Soil Classification	REMARKS	VISUAL CLASSIFICATION
0							
						slightly moist	TAILINGS SANDY SILT varying to SILTY SAND, predominantly very fine to fine grained sand, thinly bedded to laminated, moderately lime cemented, nonplastic to low plasticity, tan, occasionally varying to brownish red or reddish brown
5							
			D		ML		
10							note: base of tailings not contacted
			D				note: possible collapsing soil conditions
15							
							Stopped backhoe at 16' Backfilled hole with cuttings
20							

SAMPLE TYPE
B — Undisturbed Block Sample
D — Disturbed Bulk Sample

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PROJECT Heap Leach Facility Design Vulture Mine Project

JOB NO. E87-11 DATE 1-30-87

LOG OF TEST PIT NO. TP-14

Backhoe Type Case 580

Location E 220, 565; N 1,025,015

Elevation 2038'

Datum Zortman Mining Company

GROUND WATER

DEPTH	HOUR	DATE
	none	

Depth in Feet	Graphical Log	Sample	Sample Type	Moisture Content Per Cent of Dry Wt.	Unified Soil Classification	REMARKS	VISUAL CLASSIFICATION
0–5					ML	slightly moist	TAILINGS SANDY SILT varying to SILTY SAND, predominantly very fine to fine grained sand, thinly bedded to laminated, moderately lime cemented, nonplastic to low plasticity, tan to light reddish brown note: possible collapsing soil conditions
5–10					GP	slightly moist	SANDY GRAVEL, some silt, occasional cobbles, predominantly fine to medium grained, angular, massive, moderately to strongly lime cemented, nonplastic, yellowish brown to brown
							Backhoe refused at 9' Backfilled hole with cuttings

SAMPLE TYPE
B — Undisturbed Block Sample
D — Disturbed Bulk Sample

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JOB NO. E87-11 DATE 1-30-87

LOG OF TEST PIT NO. TP-15

Backhoe Type Case 580

Location E 220,050; N 1,025,320

Elevation 2047'

Datum Zortman Mining Company

GROUND WATER

DEPTH	HOUR	DATE
	none	

Depth in Feet	Graphical Log	Sample	Sample Type	Moisture Content Per Cent of Dry Wt.	Unified Soil Classification	REMARKS	VISUAL CLASSIFICATION
0							TAILINGS
						slightly moist	SANDY SILT varying to SILTY SAND, predominantly very fine grained sand, thinly bedded, moderately lime cemented, nonplastic to low plasticity, tan varying to dark brown, reddish brown or dark gray
5					ML		
			D				note: possible collapsing soil conditions
10							
			D				note: base of tailings not contacted
15							Stopped backhoe at 14'6" Backfilled hole with cuttings

SAMPLE TYPE
B — Undisturbed Block Sample
D — Disturbed Bulk Sample

PROJECT Heap Leach Facility Design Vulture Mine Project

JOB NO. E87-11 DATE 1-30-87

LOG OF TEST PIT NO. TP-16

Backhoe Type Case 580

Location E 220,170; N 1,025,650

Elevation 2048'

Datum Zortman Mining Company

GROUND WATER

DEPTH	HOUR	DATE
	none	

Depth in Feet	Graphical Log	Sample	Sample Type	Moisture Content Per Cent of Dry Wt.	Unified Soil Classification	REMARKS	VISUAL CLASSIFICATION
0							TAILINGS
			D		SP & ML	slightly moist to moist	SILTY SAND varying to SANDY SILT, predominantly very fine to fine grained, thinly bedded to laminated, moderately lime cemented, nonplastic to low plasticity, tan note: possible collapsing soil conditions note: hardness & cementation gradually increasing below 2'
5			D		SP	slightly moist to moist	SAND, occasional lenses of gravel & clay, predominantly fine to medium grained, angular, weakly to moderately lime cemented, nonplastic to low plasticity, reddish brown to tan
10							

Backhoe refused at 7'
Backfilled hole with cuttings

SAMPLE TYPE
B — Undisturbed Block Sample
D — Disturbed Bulk Sample

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Vulture Mine Project

JOB NO. E87-11 DATE 1-30-87

LOG OF TEST PIT NO. TP-17

Backhoe Type Case 580
Location E 220,480; N 1,025,585
Elevation 2045'
Datum Zortman Mining Company

GROUND WATER

DEPTH	HOUR	DATE
	none	

Depth in Feet	Graphical Log	Sample	Sample Type	Moisture Content Per Cent of Dry Wt.	Unified Soil Classification	REMARKS	VISUAL CLASSIFICATION
0		X	D		SP	slightly moist	SAND varying to GRAVELLY SAND, predominantly fine to medium grained, angular, massive, very strongly lime cemented, nonplastic, light brown to light reddish brown note: thick lenses & pods of caliche note: weakly to moderately lime cemented zone, 0 to 6"; some roots & other organic matter
5							Backhoe refused at 3'6" Backfilled hole with cuttings

SAMPLE TYPE
B — Undisturbed Block Sample
D — Disturbed Bulk Sample

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APPENDIX B

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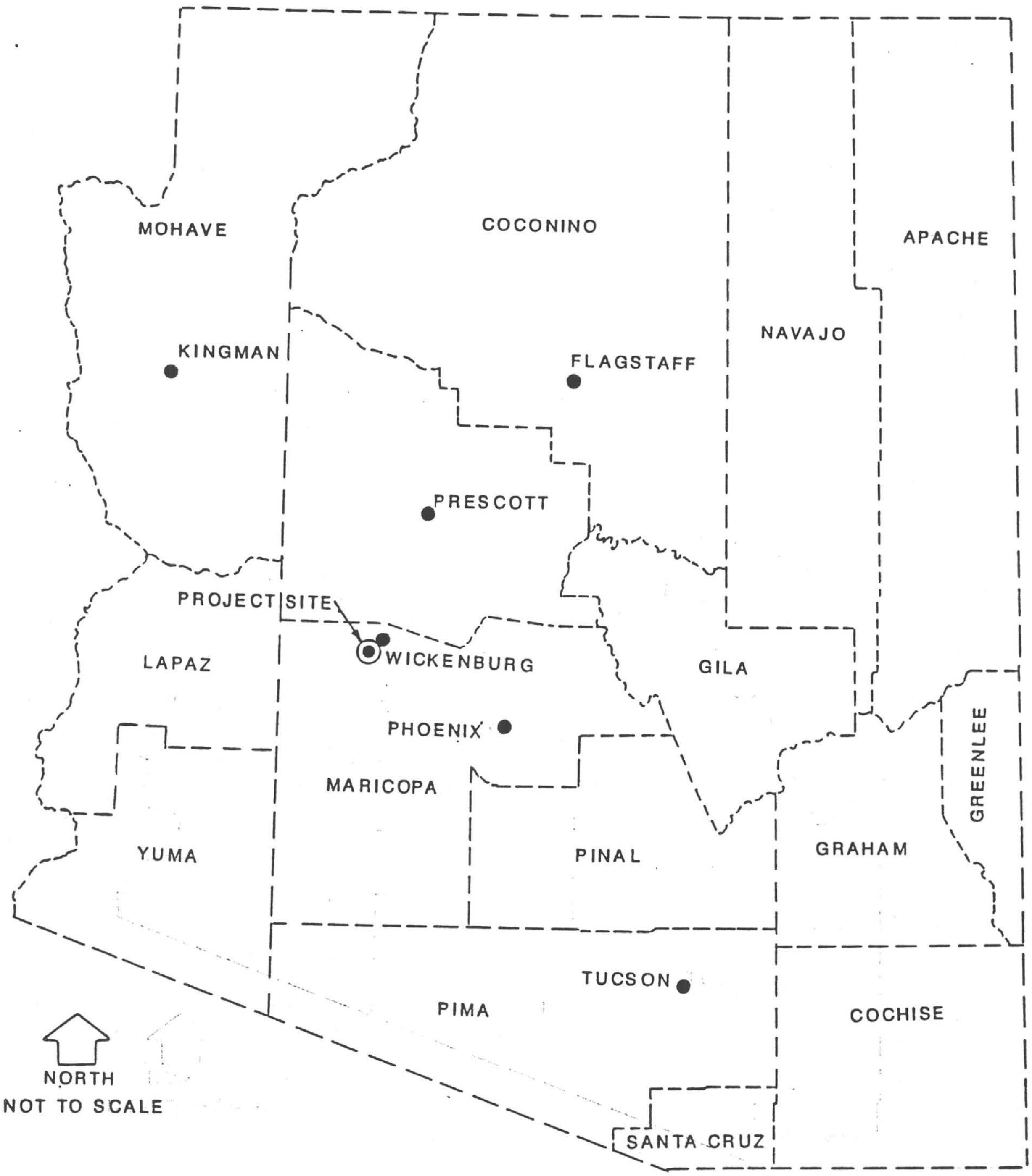
TABULATION OF TEST RESULTS

Job No. E87-11
W/O 1

HOLE NO	DEPTH	UNIFIED CLASS	L.L.	P.I.	SIEVE ANALYSIS-ACCUM % PASSING #200 .75"	#100 1"	#50 1.5"	#40 2"	#30 2.5"	#16 3"	#10 3.5"	#8 4"	#4 6"	.25" 8"	.375" 10"	.5" 12"	LAB NO
BURRO CLAY	---	SM	96	52	36	41	53	66	78	93	97	98	100				7-11-1
LYLES UPPER GREEN CLAY	---	SC	94	60	19	27	40	50	62	89	98	99	100				7-11-2
BC-1 CLAY	---	MH	%102	59	52	60	72	82	91	99							7-11-3

APPENDIX C

FIGURE 1
PROJECT LOCATION MAP



Heap Leach Facility Design
Vulture Mine Project
Near Wickenburg, Arizona
SHB Job No. E87-11

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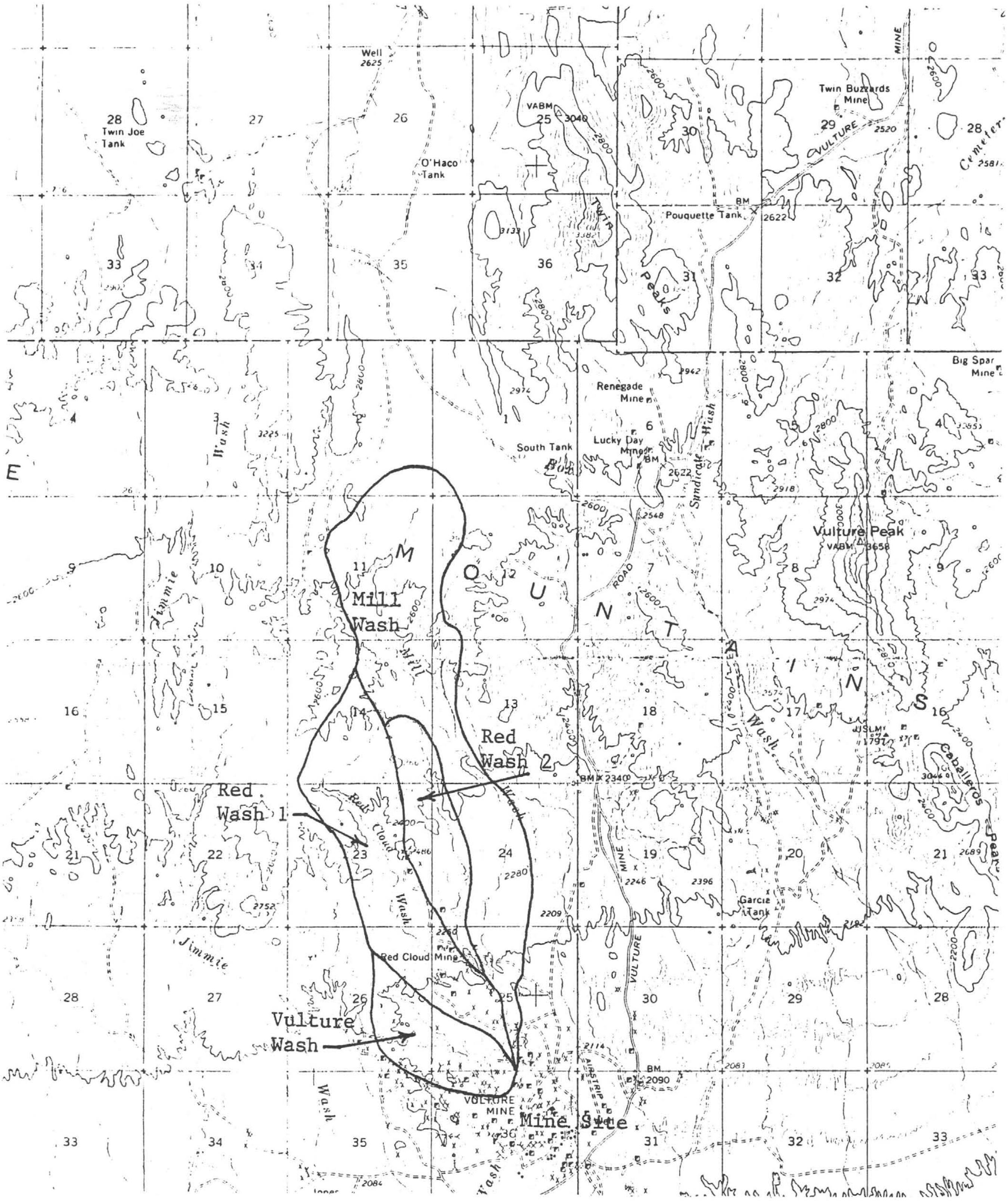
FIGURE 2

Watershed Subbasins for Vulture Mine Site



Heap Leach Facility Design
Vulture Mine Project
Near Wickenburg, Arizona
SHB Job No. E87-11

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Heap Leach Facility Design
Vulture Mine Project
Near Wickenburg, Arizona
SHB Job No. E87-11

TABLE 1

Subbasin Design Criteria for HEC-1 Analyses

	Subbasin			
	Vulture Wash	Red Wash 1	Red Wash 2	Mill Wash
Surface Area (square miles)	0.47	1.24	0.55	2.11
Hydraulic Length (feet)	5,200	9,050	9,880	14,900
Average Slope (percent)	1.9	2.21	3.04	2.68
Lag Time (hours)	0.76	1.24	1.14	1.21
Time of Concentration (hours)	1.21	2.08	1.9	3.26
Curve Number	85	80	80	75

TABLE 2

General Storm PMP Computations

Drainage Vulture   Area 4.37 mi^2 (km^2)

Latitude 34, Longitude 113 of basin center

Month August

Step		Duration (hrs)					
		6	12	18	24	48	72

A. Convergence PMP

1. Drainage average value from one of figures 2.5 to 2.16 13.41 in. (mm)
2. Reduction for barrier-elevation [fig. 2.18] 79 %
3. Barrier-elevation reduced PMP [step 1 X step 2] 10.59 in. (mm)
4. Durational variation [figs. 2.25 to 2.27 and table 2.7]. 74 89 95 100 112 117 %
5. Convergence PMP for indicated durations [steps 3 X 4] 7.84, 9.43, 10.06, 10.59, 11.86, 12.39 in. (mm)
6. Incremental 10 mi^2 (26 km^2) PMP [successive subtraction in step 5] 7.84, 1.59, 0.63, 0.53, 1.27, 0.53 in. (mm)
7. Areal reduction [select from figs. 2.28 and 2.29] 100 100 100 100 100 100 %
8. Areally reduced PMP [step 6 X step 7] 7.84, 1.59, 0.63, 0.53, 1.27, 0.53 in. (mm)
9. Drainage average PMP [accumulated values of step 8] 7.84, 9.43, 10.06 10.59, 11.86, 12.39 in. (mm)

B. Orographic PMP

1. Drainage average orographic index from figure 3.11a to d. 4 in. (mm)
2. Areal reduction [figure 3.20] 100%
3. Adjustment for month [one of figs. 3.12 to 3.17] 100%
4. Areally and seasonally adjusted PMP [steps 1 X 2 X 3] 4 in. (mm)
5. Durational variation [table 3.9] 35 62 83 100 143 162 %
6. Orographic PMP for given durations [steps 4 X 5] 1.4, 2.48, 3.32 4.00, 5.72, 6.48 in. (mm)

C. Total PMP 9.24, 11.91, 13.38, 14.59, 17.58, 18.87 in. (mm)

1. Add steps A9 and B6
2. PMP for other durations from smooth curve fitted to plot of computed data.
3. Comparison with local-storm PMP (see sec. 6.3).

Heap Leach Facility Design
Vulture Mine Project
Near Wickenburg, Arizona
SHB Job No. E87-11

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Computer Summary Sheets for HEC-1 Analyses

```
1                                              ****
                         FLOOD HYDROGRAPH PACKAGE HEC-1 (IBM XT 512K VERSION) -FEB 1.1995
          U.S. ARMY CORPS OF ENGINEERS, THE HYDROLOGIC ENGINEERING CENTER, 609 SECOND STREET, DAVIS, CA. 95616
                                               ****



         THIS HEC-1 VERSION CONTAINS ALL OPTIONS EXCEPT ECONOMICS, AND THE NUMBER OF PLANS ARE REDUCED TO 3


1                                        HEC-1 INPUT                                          PAGE  1

         LINE        ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

           1         ID  SHB JOB NO. E87-11                          SCS HYDROGRAPH METHOD
           2         ID  100 YEAR, 24 HOURS STORM
           3         ID  FOR VOLTURE MINE WATERSHED
                     *DIAGRAM
*** FREE ***
           4         IT      15 01JUL87    0000     300
           5         IO       3
           6         IN      60 01JUL87

           7         KK    MILL
           8         KM  MILL WASH
           9         BA    2.11
          10         PI    0.05    0.05    0.05    0.05    0.06    0.07    0.07    0.10    0.11    0.14
          11         PI    0.22    1.78    0.40    0.22    0.14    0.11    0.09    0.09    0.07    0.06
          12         PI    0.05    0.06    0.06    0.02
          13         LS       0      75       0
          14         UD    3.26

          15         KK    RED1
          16         KM  WEST RED CLOUD WASH
          17         BA    1.24
          18         LS       0      80       0
          19         UD   2.075

          20         KK    RED2
          21         KM  EAST RED CLOUD WASH
          22         BA    0.55
          23         LS       0      80       0
          24         UD    1.90

          25         KK     RED
          26         KM  COMBINE FLOW FOR RED1 AND RED2
          27         HC       2

          28         KK    MRED
          29         KM  COMBINE MILL WASH AND RED CLOUD WASH
          30         HC       2

          31         KK    VOLT
          32         KM  VOLTURE WASH
          33         BA    0.47
          34         LS       0      85       0
```

```
          36          KK    ENDS
          37          KM   COMBINE MILL WASH AND VOLTURE MILL WASH
          38          HC      2
          39          ZZ
1
              SCHEMATIC DIAGRAM OF STREAM NETWORK
INPUT
 LINE     (V) ROUTING          (--->) DIVERSION OR PUMP FLOW

  NO.     (.) CONNECTOR        (<---) RETURN OF DIVERTED OR PUMPED FLOW

   7       MILL
            .
            .
  15        .        RED1
            .          .
            .          .
  20        .          .         RED2
            .          .           .
            .          .           .
  25        .         RED...........
            .          .
            .          .
  28       MRED...........
            .
            .
  31        .        VOLT
            .          .
            .          .
  36       ENDS...........

(***) RUNOFF ALSO COMPUTED AT THIS LOCATION
1                                                          ****
                          FLOOD HYDROGRAPH PACKAGE HEC-1 (IBM XT 512K VERSION) -FEB 1,1985
          U.S. ARMY CORPS OF ENGINEERS, THE HYDROLOGIC ENGINEERING CENTER, 609 SECOND STREET, DAVIS, CA. 95616
                                                           ****



                   SHB JOB NO. E87-11                    SCS HYDROGRAPH METHOD
                   100 YEAR, 24 HOURS STORM
                   FOR VOLTURE MINE WATERSHED

   5 IO        OUTPUT CONTROL VARIABLES
                    IPRNT          3  PRINT CONTROL
                    IPLOT          0  PLOT CONTROL
                    QSCAL         0.  HYDROGRAPH PLOT SCALE

     IT        HYDROGRAPH TIME DATA
                     NMIN         15  MINUTES IN COMPUTATION INTERVAL
                    IDATE     1JUL87  STARTING DATE
                    ITIME       0000  STARTING TIME
                       NQ        300  NUMBER OF HYDROGRAPH ORDINATES
                   NDDATE     4JUL87  ENDING DATE
                   NDTIME       0245  ENDING TIME

                COMPUTATION INTERVAL    .25 HOURS
                     TOTAL TIME BASE  74.75 HOURS

        ENGLISH UNITS
```

```
             *************
             *           *
   7 KK      *   MILL    *
             *           *
             *************
                          MILL WASH

   6 IN          TIME DATA FOR INPUT TIME SERIES
                      JXMIN          60  TIME INTERVAL IN MINUTES
                      JXDATE     1JUL87  STARTING DATE
                      JXTIME          0  STARTING TIME

              SUBBASIN RUNOFF DATA

   9 BA          SUBBASIN CHARACTERISTICS
                      TAREA        2.11  SUBBASIN AREA

                 PRECIPITATION DATA

   8 PB               STORM        4.12  BASIN TOTAL PRECIPITATION

   8 PI           INCREMENTAL PRECIPITATION PATTERN
```

.01	.01	.01	.01	.01	.01	.01	.01	.01	.01
.01	.01	.01	.01	.01	.01	.02	.02	.01	.02
.02	.02	.02	.02	.02	.02	.02	.02	.03	.03
.02	.03	.03	.03	.03	.03	.04	.03	.04	.03
.06	.06	.05	.06	.45	.45	.45	.44	.10	.10
.10	.10	.06	.06	.05	.06	.04	.04	.03	.04
.03	.03	.03	.03	.02	.02	.02	.02	.02	.02
.02	.02	.02	.02	.02	.02	.02	.01	.02	.01
.01	.01	.01	.01	.02	.01	.02	.01	.01	.02
.01	.01	.01	.01	.00	.01				

```
  13 LS          SCS LOSS RATE
                    STRTL          .67  INITIAL ABSTRACTION
                    CRVNBR       75.00  CURVE NUMBER
                    RTIMP          .00  PERCENT IMPERVIOUS AREA

  14 UD          SCS DIMENSIONLESS UNITGRAPH
                    TLAG          3.26  LAG

                                                  ***

                                           UNIT HYDROGRAPH
                                        67 END-OF-PERIOD ORDINATES
```

7.	19.	36.	56.	82.	114.	151.	193.	230.	260.
282.	296.	300.	300.	297.	283.	268.	252.	234.	212.
186.	161.	139.	123.	109.	96.	85.	77.	69.	61.
54.	48.	42.	38.	33.	30.	26.	23.	21.	18.
16.	14.	13.	11.	10.	9.	8.	7.	6.	5.
5.	4.	4.	3.	3.	3.	3.	2.	2.	2.
1.	1.	1.	1.	1.	0.	0.			

```
  ***        ***        ***        ***        ***

                 HYDROGRAPH AT STATION      MILL

 TOTAL RAINFALL =    4.12, TOTAL LOSS =    2.36, TOTAL EXCESS =    1.76

  PEAK FLOW    TIME                      MAXIMUM AVERAGE FLOW
                                 6-HR      24-HR      72-HR    74.75-HR
+   (CFS)      (HR)
                       (CFS)
```

```
          (AC-FT)    128.       198.       198.       198.

          CUMULATIVE AREA =    2.11 SQ MI



*** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** ***


           *************
           *           *
  15 KK    *    RED1   *
           *           *
           *************
                 WEST RED CLOUD WASH

            SUBBASIN RUNOFF DATA

  17 BA      SUBBASIN CHARACTERISTICS
                  TAREA        1.24  SUBBASIN AREA

             PRECIPITATION DATA

   8 PB           STORM        4.12  BASIN TOTAL PRECIPITATION

   8 PI         INCREMENTAL PRECIPITATION PATTERN
                  .01     .01     .01     .01     .01     .01     .01     .01     .01     .01
                  .01     .01     .01     .01     .01     .01     .02     .02     .01     .02
                  .02     .02     .02     .02     .02     .02     .02     .02     .03     .03
                  .02     .03     .03     .03     .03     .03     .04     .03     .04     .03
                  .06     .06     .05     .06     .45     .45     .45     .44     .10     .10
                  .10     .10     .06     .06     .05     .06     .04     .04     .03     .04
                  .03     .03     .03     .03     .02     .02     .02     .02     .02     .02
                  .02     .02     .02     .02     .02     .02     .02     .01     .02     .01
                  .01     .01     .01     .01     .02     .01     .02     .01     .01     .02
                  .01     .01     .01     .01     .00     .01

  18 LS       SCS LOSS RATE
                 STRTL          .50  INITIAL ABSTRACTION
                 CRVNBR       80.00  CURVE NUMBER
                 RTIMP          .00  PERCENT IMPERVIOUS AREA

  19 UD       SCS DIMENSIONLESS UNITGRAPH
                 TLAG          2.08  LAG

                                              ***

                                        UNIT HYDROGRAPH
                                   44 END-OF-PERIOD ORDINATES
          11.      34.      65.     108.     163.     215.     252.     270.     272.     264.
         244.     220.     191.     155.     124.     103.      86.      72.      60.      50.
          41.      35.      29.      24.      20.      16.      14.      11.       9.       8.
           7.       5.       4.       4.       3.       3.       2.       2.       2.       1.
           1.       1.       0.       0.

     ***           ***           ***           ***           ***

                    HYDROGRAPH AT STATION     RED1

  TOTAL RAINFALL =    4.12, TOTAL LOSS =    1.98, TOTAL EXCESS =    2.14

 PEAK FLOW     TIME                         MAXIMUM AVERAGE FLOW
                               6-HR       24-HR       72-HR     74.75-HR
```

```
+     337.     14.00              211.        71.        24.        23.
                      (INCHES)   1.581      2.141      2.141      2.141
                       (AC-FT)    105.       142.       142.       142.

                      CUMULATIVE AREA =     1.24 SQ MI



*** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** ***


             **************
             *            *
  20 KK      *     RED2   *
             *            *
             **************
                          EAST RED CLOUD WASH

              SUBBASIN RUNOFF DATA

  22 BA        SUBBASIN CHARACTERISTICS
                    TAREA         .55  SUBBASIN AREA

               PRECIPITATION DATA

   8 PB             STORM        4.12  BASIN TOTAL PRECIPITATION

   8 PI          INCREMENTAL PRECIPITATION PATTERN
                      .01      .01      .01      .01      .01      .01      .01      .01      .01      .01
                      .01      .01      .01      .01      .01      .01      .02      .02      .01      .02
                      .02      .02      .02      .02      .02      .02      .02      .02      .03      .03
                      .02      .03      .03      .03      .03      .03      .04      .03      .04      .03
                      .06      .06      .05      .06      .45      .45      .45      .44      .10      .10
                      .10      .10      .06      .06      .05      .05      .04      .04      .03      .04
                      .03      .03      .03      .03      .02      .02      .02      .02      .02      .02
                      .02      .02      .02      .02      .02      .02      .02      .01      .02      .01
                      .01      .01      .01      .01      .02      .01      .02      .01      .01      .02
                      .01      .01      .01      .01      .00      .01

  23 LS        SCS LOSS RATE
                   STRTL          .50  INITIAL ABSTRACTION
                  CRVNBR        80.00  CURVE NUMBER
                   RTIMP          .00  PERCENT IMPERVIOUS AREA

  24 UD        SCS DIMENSIONLESS UNITGRAPH
                    TLAG         1.90  LAG


                                                  ***


                                               UNIT HYDROGRAPH
                                          40 END-OF-PERIOD ORDINATES
             6.       19.       36.       60.       90.      114.      127.      131.      129.      119.
           107.       92.       73.       58.       47.       38.       32.       26.       21.       17.
            14.       12.       10.        8.        6.        5.        4.        4.        3.        2.
             2.        2.        1.        1.        1.        1.        1.        0.        0.        0.

   ***           ***           ***           ***           ***


                        HYDROGRAPH AT STATION     RED2

   TOTAL RAINFALL =     4.12, TOTAL LOSS =     1.98, TOTAL EXCESS =     2.14

 PEAK FLOW     TIME                        MAXIMUM AVERAGE FLOW
```

```
                    (CFS)
 +    158.    13.75              95.      32.      11.      10.
                    (INCHES)   1.604    2.141    2.141    2.141
                    (AC-FT)      47.      63.      63.      63.

                    CUMULATIVE AREA =    .55 SQ MI




*** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** ***


            *************
            *           *
  25 KK     *     RED   *
            *           *
            *************
                   COMBINE FLOW FOR RED1 AND RED2

  27 HC        HYDROGRAPH COMBINATION
                   ICOMP          2  NUMBER OF HYDROGRAPHS TO COMBINE

                                                   ***

      ***         ***         ***         ***         ***

                    HYDROGRAPH AT STATION      RED

 PEAK FLOW     TIME                   MAXIMUM AVERAGE FLOW
                               6-HR     24-HR     72-HR    74.75-HR
 +   (CFS)     (HR)
                    (CFS)
 +    493.    14.00             306.     103.       34.       33.
                   (INCHES)   1.587    2.141    2.141    2.141
                   (AC-FT)     152.      204.      204.      204.

                   CUMULATIVE AREA =    1.79 SQ MI




*** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** ***


            *************
            *           *
  28 KK     *    MRED   *
            *           *
            *************
                   COMBINE MILL WASH AND RED CLOUD WASH

  30 HC        HYDROGRAPH COMBINATION
                   ICOMP          2  NUMBER OF HYDROGRAPHS TO COMBINE

                                                   ***

      ***         ***         ***         ***         ***

                    HYDROGRAPH AT STATION      MRED

 PEAK FLOW     TIME                   MAXIMUM AVERAGE FLOW
                               6-HR     24-HR     72-HR    74.75-HR
 +   (CFS)     (HR)
                    (CFS)
```

	(INCHES)	1.315	1.932	1.933	1.933
	(AC-FT)	273.	402.	402.	402.

CUMULATIVE AREA = 3.90 SQ MI

*** ***

```
          **************
          *            *
31 KK     *    VOLT    *
          *            *
          **************
               VOLTURE WASH
```

SUBBASIN RUNOFF DATA

33 BA SUBBASIN CHARACTERISTICS

TAREA .47 SUBBASIN AREA

PRECIPITATION DATA

8 PB STORM 4.12 BASIN TOTAL PRECIPITATION

8 PI INCREMENTAL PRECIPITATION PATTERN

.01	.01	.01	.01	.01	.01	.01	.01	.01	.01
.01	.01	.01	.01	.01	.01	.02	.02	.01	.02
.02	.02	.02	.02	.02	.02	.02	.02	.03	.03
.02	.03	.03	.03	.03	.03	.04	.03	.04	.03
.06	.06	.05	.06	.45	.45	.45	.44	.10	.10
.10	.10	.06	.06	.05	.06	.04	.04	.03	.04
.03	.03	.03	.03	.02	.02	.02	.02	.02	.02
.02	.02	.02	.02	.02	.02	.02	.01	.02	.01
.01	.01	.01	.01	.02	.01	.02	.01	.01	.02
.01	.01	.01	.01	.00	.01				

34 LS SCS LOSS RATE

STRTL .35 INITIAL ABSTRACTION

CRVNBR 85.00 CURVE NUMBER

RTIMP .00 PERCENT IMPERVIOUS AREA

35 UD SCS DIMENSIONLESS UNITGRAPH

TLAG 1.21 LAG

***

UNIT HYDROGRAPH

26 END-OF-PERIOD ORDINATES

15.	48.	100.	149.	169.	166.	145.	116.	81.	59.
44.	33.	24.	18.	13.	9.	7.	5.	4.	3.
2.	2.	1.	1.	1.	0.				

*** *** *** *** ***

HYDROGRAPH AT STATION VOLT

TOTAL RAINFALL = 4.12, TOTAL LOSS = 1.55, TOTAL EXCESS = 2.57

PEAK FLOW	TIME	MAXIMUM AVERAGE FLOW			
		6-HR	24-HR	72-HR	74.75-HR
+ (CFS)	(HR)				

(INCHES)	2.009	2.565	2.565	2.565
(AC-FT)	50.	64.	64.	64.

CUMULATIVE AREA = .47 SQ MI

*** ***

```
          **************
          *            *
 36 KK    *    ENDS    *
          *            *
          **************
```

COMBINE MILL WASH AND VOLTURE MILL WASH

38 HC HYDROGRAPH COMBINATION

ICOMP 2 NUMBER OF HYDROGRAPHS TO COMBINE

***

*** *** *** *** ***

HYDROGRAPH AT STATION ENDS

	PEAK FLOW	TIME		MAXIMUM AVERAGE FLOW			
				6-HR	24-HR	72-HR	74.75-HR
+	(CFS)	(HR)					
			(CFS)				
+	877.	14.00		643.	235.	78.	76.
			(INCHES)	1.367	1.999	2.001	2.001
			(AC-FT)	319.	466.	466.	466.

CUMULATIVE AREA = 4.37 SQ MI

1

RUNOFF SUMMARY
FLOW IN CUBIC FEET PER SECOND
TIME IN HOURS, AREA IN SQUARE MILES

	OPERATION	STATION	PEAK FLOW	TIME OF PEAK	AVERAGE FLOW FOR MAXIMUM PERIOD			BASIN AREA	MAXIMUM STAGE	TIME OF MAX STAGE
+					6-HOUR	24-HOUR	72-HOUR			
	HYDROGRAPH AT									
+		MILL	337.	15.50	258.	100.	33.	2.11		
	HYDROGRAPH AT									
+		RED1	337.	14.00	211.	71.	24.	1.24		
	HYDROGRAPH AT									
+		RED2	158.	13.75	95.	32.	11.	.55		
	2 COMBINED AT									
+		RED	493.	14.00	306.	103.	34.	1.79		
	2 COMBINED AT									
+		MRED	757.	14.25	552.	203.	68.	3.90		
	HYDROGRAPH AT									
+		VOLT	217.	13.00	102.	32.	11.	.47		

2 COMBINED AT

*** NORMAL END OF HEC-1 ***

1 ****

FLOOD HYDROGRAPH PACKAGE HEC-1 (IBM XT 512K VERSION) -FEB 1.1985
U.S. ARMY CORPS OF ENGINEERS, THE HYDROLOGIC ENGINEERING CENTER, 609 SECOND STREET, DAVIS, CA. 95616
****

THIS HEC-1 VERSION CONTAINS ALL OPTIONS EXCEPT ECONOMICS, AND THE NUMBER OF PLANS ARE REDUCED TO 3


```
LINE        ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

  1         ID  SHB JOB NO. E87-11                        SCS HYDROGRAPH METHOD
  2         ID  500 YEAR, 24 HOURS STORM
  3         ID  FOR VOLTURE MINE WATERSHED
            *DIAGRAM
*** FREE ***
  4         IT      15 01JUL87    0000     300
  5         IO       3
  6         IN      60 01JUL87

  7         KK    MILL
  8         KM  MILL WASH
  9         BA    2.11
 10         PI    0.06    0.06    0.06    0.06    0.08    0.09    0.09    0.12    0.13    0.18
 11         PI    0.27    2.21    0.49    0.27    0.18    0.13    0.11    0.11    0.09    0.08
 12         PI    0.06    0.07    0.08    0.03
 13         LS       0      75       0
 14         UD    3.26

 15         KK    RED1
 16         KM  WEST RED CLOUD WASH
 17         BA    1.24
 18         LS       0      80       0
 19         UD   2.075

 20         KK    RED2
 21         KM  EAST RED CLOUD WASH
 22         BA    0.55
 23         LS       0      80       0
 24         UD    1.90

 25         KK     RED
 26         KM  COMBINE FLOW FOR RED1 AND RED2
 27         HC       2

 28         KK    MRED
 29         KM  COMBINE MILL WASH AND RED CLOUD WASH
 30         HC       2

 31         KK    VOLT
 32         KM  VOLTURE WASH
 33         BA    0.47
 34         LS       0      85       0
```

```
              36          KK    ENDS
              37          KM   COMBINE MILL WASH AND VOLTURE MILL WASH
              38          HC        2
              39          ZZ
1
                   SCHEMATIC DIAGRAM OF STREAM NETWORK
 INPUT
  LINE      (V) ROUTING          (--->) DIVERSION OR PUMP FLOW

  NO.       (.) CONNECTOR        (<---) RETURN OF DIVERTED OR PUMPED FLOW

    7        MILL
              .
              .
   15         .         RED1
              .           .
              .           .
   20         .           .        RED2
              .           .          .
              .           .          .
   25         .          RED...........
              .           .
              .           .
   28        MRED...........
              .
              .
   31         .         VOLT
              .           .
              .           .
   36        ENDS...........

(***) RUNOFF ALSO COMPUTED AT THIS LOCATION
1                                                   ****
                      FLOOD HYDROGRAPH PACKAGE HEC-1 (IBM XT 512K VERSION) -FEB 1,1985
         U.S. ARMY CORPS OF ENGINEERS, THE HYDROLOGIC ENGINEERING CENTER, 609 SECOND STREET, DAVIS, CA. 95616
                                                    ****



                     SHB JOB NO. E87-11                     SCS HYDROGRAPH METHOD
                     500 YEAR, 24 HOURS STORM
                     FOR VOLTURE MINE WATERSHED

   5 IO        OUTPUT CONTROL VARIABLES
                    IPRNT          3  PRINT CONTROL
                    IPLOT          0  PLOT CONTROL
                    QSCAL         0.  HYDROGRAPH PLOT SCALE

    IT         HYDROGRAPH TIME DATA
                     NMIN         15  MINUTES IN COMPUTATION INTERVAL
                    IDATE     1JUL87  STARTING DATE
                    ITIME       0000  STARTING TIME
                       NQ        300  NUMBER OF HYDROGRAPH ORDINATES
                   NDDATE     4JUL87  ENDING DATE
                   NDTIME       0245  ENDING TIME

               COMPUTATION INTERVAL     .25 HOURS
                    TOTAL TIME BASE   74.75 HOURS

         ENGLISH UNITS
```

```
*************
*           *
7 KK   *    MILL   *
*           *
*************
```

MILL WASH

6 IN TIME DATA FOR INPUT TIME SERIES

JXMIN 60 TIME INTERVAL IN MINUTES

JXDATE 1JUL87 STARTING DATE

JXTIME 0 STARTING TIME

SUBBASIN RUNOFF DATA

9 BA SUBBASIN CHARACTERISTICS

TAREA 2.11 SUBBASIN AREA

PRECIPITATION DATA

8 PB STORM 5.11 BASIN TOTAL PRECIPITATION

8 PI INCREMENTAL PRECIPITATION PATTERN

.02	.02	.02	.01	.01	.02	.02	.02	.01	.02
.02	.02	.02	.02	.02	.02	.02	.02	.02	.02
.02	.02	.02	.02	.02	.02	.02	.02	.03	.03
.03	.03	.03	.03	.03	.03	.05	.05	.04	.05
.07	.07	.07	.07	.55	.55	.55	.55	.12	.12
.12	.12	.07	.07	.07	.07	.05	.05	.04	.05
.03	.03	.03	.03	.03	.03	.03	.03	.03	.03
.03	.03	.02	.02	.02	.02	.02	.02	.02	.02
.01	.02	.01	.01	.02	.02	.02	.02	.02	.02
.02	.02	.01	.01	.01	.01				

13 LS SCS LOSS RATE

STRTL .67 INITIAL ABSTRACTION

CRVNBR 75.00 CURVE NUMBER

RTIMP .00 PERCENT IMPERVIOUS AREA

14 UD SCS DIMENSIONLESS UNITGRAPH

TLAG 3.26 LAG

***

UNIT HYDROGRAPH

67 END-OF-PERIOD ORDINATES

7.	19.	36.	56.	82.	114.	151.	193.	230.	260.
282.	296.	300.	300.	297.	283.	268.	252.	234.	212.
186.	161.	139.	123.	109.	96.	85.	77.	69.	61.
54.	48.	42.	38.	33.	30.	26.	23.	21.	18.
16.	14.	13.	11.	10.	9.	8.	7.	6.	5.
5.	4.	4.	3.	3.	3.	3.	2.	2.	2.
1.	1.	1.	1.	1.	0.	0.			

*** *** *** *** ***

HYDROGRAPH AT STATION MILL

TOTAL RAINFALL = 5.11, TOTAL LOSS = 2.57, TOTAL EXCESS = 2.54

PEAK FLOW	TIME	MAXIMUM AVERAGE FLOW			
		6-HR	24-HR	72-HR	74.75-HR
+ (CFS)	(HR)				
		(CFS)			

(AC-FT) 187. 285. 286. 286.

CUMULATIVE AREA = 2.11 SQ MI

*** ***

```
             *************
             *           *
15 KK        *   RED1    *
             *           *
             *************
                      WEST RED CLOUD WASH
```

SUBBASIN RUNOFF DATA

17 BA SUBBASIN CHARACTERISTICS
TAREA 1.24 SUBBASIN AREA

PRECIPITATION DATA

8 PB STORM 5.11 BASIN TOTAL PRECIPITATION

8 PI INCREMENTAL PRECIPITATION PATTERN

.02	.02	.02	.01	.01	.02	.02	.02	.01	.02
.02	.02	.02	.02	.02	.02	.02	.02	.02	.02
.02	.02	.02	.02	.02	.02	.02	.02	.03	.03
.03	.03	.03	.03	.03	.03	.05	.05	.04	.05
.07	.07	.07	.07	.55	.55	.55	.55	.12	.12
.12	.12	.07	.07	.07	.07	.05	.05	.04	.05
.03	.03	.03	.03	.03	.03	.03	.03	.03	.03
.03	.03	.02	.02	.02	.02	.02	.02	.02	.02
.01	.02	.01	.01	.02	.02	.02	.02	.02	.02
.02	.02	.01	.01	.01	.01				

18 LS SCS LOSS RATE
STRTL .50 INITIAL ABSTRACTION
CRVNBR 80.00 CURVE NUMBER
RTIMP .00 PERCENT IMPERVIOUS AREA

19 UD SCS DIMENSIONLESS UNITGRAPH
TLAG 2.08 LAG

***

UNIT HYDROGRAPH
44 END-OF-PERIOD ORDINATES

11.	34.	65.	108.	163.	215.	252.	270.	272.	264.
244.	220.	191.	155.	124.	103.	86.	72.	60.	50.
41.	35.	29.	24.	20.	16.	14.	11.	9.	8.
7.	5.	4.	4.	3.	3.	2.	2.	2.	1.
1.	1.	0.	0.						

*** *** *** *** ***

HYDROGRAPH AT STATION RED1

TOTAL RAINFALL = 5.11, TOTAL LOSS = 2.12, TOTAL EXCESS = 2.99

PEAK FLOW	TIME		MAXIMUM AVERAGE FLOW		
		6-HR	24-HR	72-HR	74.75-HR

(CFS)

+	475.	14.00		295.	100.	33.	32.
			(INCHES)	2.211	2.989	2.989	2.989
			(AC-FT)	146.	198.	198.	198.

CUMULATIVE AREA = 1.24 SQ MI

*** ***

```
           *************
           *           *
 20 KK     *    RED2   *
           *           *
           *************
```

EAST RED CLOUD WASH

SUBBASIN RUNOFF DATA

22 BA SUBBASIN CHARACTERISTICS
TAREA .55 SUBBASIN AREA

PRECIPITATION DATA

8 PB STORM 5.11 BASIN TOTAL PRECIPITATION

8 PI INCREMENTAL PRECIPITATION PATTERN

.02	.02	.02	.01	.01	.02	.02	.02	.01	.02
.02	.02	.02	.02	.02	.02	.02	.02	.02	.02
.02	.02	.02	.02	.02	.02	.02	.02	.03	.03
.03	.03	.03	.03	.03	.03	.05	.05	.04	.05
.07	.07	.07	.07	.55	.55	.55	.55	.12	.12
.12	.12	.07	.07	.07	.07	.05	.05	.04	.05
.03	.03	.03	.03	.03	.03	.03	.03	.03	.03
.03	.03	.02	.02	.02	.02	.02	.02	.02	.02
.01	.02	.01	.01	.02	.02	.02	.02	.02	.02
.02	.02	.01	.01	.01	.01				

23 LS SCS LOSS RATE
STRTL .50 INITIAL ABSTRACTION
CRVNBR 80.00 CURVE NUMBER
RTIMP .00 PERCENT IMPERVIOUS AREA

24 UD SCS DIMENSIONLESS UNITGRAPH
TLAG 1.90 LAG

***

UNIT HYDROGRAPH
40 END-OF-PERIOD ORDINATES

6.	19.	36.	60.	90.	114.	127.	131.	129.	119.
107.	92.	73.	58.	47.	38.	32.	26.	21.	17.
14.	12.	10.	8.	6.	5.	4.	4.	3.	2.
2.	2.	1.	1.	1.	1.	1.	0.	0.	0.

*** *** *** *** ***

HYDROGRAPH AT STATION RED2

TOTAL RAINFALL = 5.11, TOTAL LOSS = 2.12, TOTAL EXCESS = 2.99

PEAK FLOW TIME MAXIMUM AVERAGE FLOW

6-HR 24-HR 72-HR 74.75-HR

```
                          (CFS)
   +    223.    13.75             133.       44.       15.        14.
                        (INCHES)  2.242     2.989     2.989      2.989
                        (AC-FT)    66.       88.       88.        88.

                        CUMULATIVE AREA =     .55 SQ MI



*** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** ***

              **************
              *            *
   25 KK      *     RED    *
              *            *
              **************
                         COMBINE FLOW FOR RED1 AND RED2

   27 HC          HYDROGRAPH COMBINATION
                        ICOMP           2  NUMBER OF HYDROGRAPHS TO COMBINE

                                                    ***

        ***           ***           ***           ***           ***

                        HYDROGRAPH AT STATION       RED

   PEAK FLOW     TIME                      MAXIMUM AVERAGE FLOW
                                  6-HR       24-HR      72-HR     74.75-HR
   +   (CFS)      (HR)
                          (CFS)
   +    695.    13.75             427.       144.       48.        46.
                        (INCHES)  2.220     2.989     2.989      2.989
                        (AC-FT)    212.      285.      285.       285.

                        CUMULATIVE AREA =    1.79 SQ MI



*** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** ***

              **************
              *            *
   28 KK      *    MRED    *
              *            *
              **************
                         COMBINE MILL WASH AND RED CLOUD WASH

   30 HC          HYDROGRAPH COMBINATION
                        ICOMP           2  NUMBER OF HYDROGRAPHS TO COMBINE

                                                    ***

        ***           ***           ***           ***           ***

                        HYDROGRAPH AT STATION      MRED

   PEAK FLOW     TIME                      MAXIMUM AVERAGE FLOW
                                  6-HR       24-HR      72-HR     74.75-HR
   +   (CFS)      (HR)
```

```
                    (INCHES)    1.878      2.743      2.745      2.745
                    (AC-FT)      391.       571.       571.       571.

                    CUMULATIVE AREA =    3.90 SQ MI
```

*** ***

```
            *************
            *           *
   31 KK    *    VOLT   *
            *           *
            *************
                      VOLTURE WASH

             SUBBASIN RUNOFF DATA

   33 BA      SUBBASIN CHARACTERISTICS
                  TAREA        .47  SUBBASIN AREA

              PRECIPITATION DATA

    8 PB          STORM       5.11  BASIN TOTAL PRECIPITATION

    8 PI        INCREMENTAL PRECIPITATION PATTERN
                 .02     .02     .02     .01     .01     .02     .02     .02     .01     .02
                 .02     .02     .02     .02     .02     .02     .02     .02     .02     .02
                 .02     .02     .02     .02     .02     .02     .02     .02     .03     .03
                 .03     .03     .03     .03     .03     .03     .05     .05     .04     .05
                 .07     .07     .07     .07     .55     .55     .55     .55     .12     .12
                 .12     .12     .07     .07     .07     .07     .05     .05     .04     .05
                 .03     .03     .03     .03     .03     .03     .03     .03     .03     .03
                 .03     .03     .02     .02     .02     .02     .02     .02     .02     .02
                 .01     .02     .01     .01     .02     .02     .02     .02     .02     .02
                 .02     .02     .01     .01     .01     .01

   34 LS        SCS LOSS RATE
                  STRTL        .35  INITIAL ABSTRACTION
                  CRVNBR     85.00  CURVE NUMBER
                  RTIMP        .00  PERCENT IMPERVIOUS AREA

   35 UD        SCS DIMENSIONLESS UNITGRAPH
                  TLAG        1.21  LAG

                                           ***

                                      UNIT HYDROGRAPH
                                  26 END-OF-PERIOD ORDINATES
          15.      48.     100.     149.     169.     166.     145.     116.      81.      59.
          44.      33.      24.      18.      13.       9.       7.       5.       4.       3.
           2.       2.       1.       1.       1.       0.

     ***         ***         ***         ***         ***

                  HYDROGRAPH AT STATION     VOLT

   TOTAL RAINFALL =    5.11, TOTAL LOSS =    1.64, TOTAL EXCESS =    3.47

  PEAK FLOW    TIME                   MAXIMUM AVERAGE FLOW
                                6-HR      24-HR      72-HR    74.75-HR
+  (CFS)       (HR)
```

(INCHES)	2.699	3.470	3.470	3.470
(AC-FT)	68.	87.	87.	37.

CUMULATIVE AREA = .47 SQ MI

*** ***

```
             *************
             *           *
  36 KK      *    ENDS   *
             *           *
             *************
```

COMBINE MILL WASH AND VOLTURE MILL WASH

38 HC HYDROGRAPH COMBINATION
ICOMP 2 NUMBER OF HYDROGRAPHS TO COMBINE

***

*** *** *** *** ***

HYDROGRAPH AT STATION ENDS

PEAK FLOW	TIME		MAXIMUM AVERAGE FLOW			
			6-HR	24-HR	72-HR	74.75-HR
+ (CFS)	(HR)					
		(CFS)				
+ 1251.	14.00		911.	331.	111.	107.
		(INCHES)	1.937	2.820	2.823	2.323
		(AC-FT)	452.	657.	658.	658.

CUMULATIVE AREA = 4.37 SQ MI

1

RUNOFF SUMMARY
FLOW IN CUBIC FEET PER SECOND
TIME IN HOURS, AREA IN SQUARE MILES

	OPERATION	STATION	PEAK FLOW	TIME OF PEAK	AVERAGE FLOW FOR MAXIMUM PERIOD			BASIN AREA	MAXIMUM STAGE	TIME OF MAX STAGE
+					6-HOUR	24-HOUR	72-HOUR			
+	HYDROGRAPH AT	MILL	495.	15.50	377.	144.	48.	2.11		
+	HYDROGRAPH AT	RED1	475.	14.00	295.	100.	33.	1.24		
+	HYDROGRAPH AT	RED2	223.	13.75	133.	44.	15.	.55		
+	2 COMBINED AT	RED	695.	13.75	427.	144.	48.	1.79		
+	2 COMBINED AT	MRED	1091.	14.25	788.	288.	96.	3.90		
+	HYDROGRAPH AT	VOLT	294.	13.00	136.	44.	15.	.47		

*** NORMAL END OF HEC-1 ***

```
1                                          ****
                    FLOOD HYDROGRAPH PACKAGE HEC-1 (IBM XT 512K VERSION) -FEB 1,1985
          U.S. ARMY CORPS OF ENGINEERS, THE HYDROLOGIC ENGINEERING CENTER, 609 SECOND STREET, DAVIS, CA. 95616
                                          ****




          THIS HEC-1 VERSION CONTAINS ALL OPTIONS EXCEPT ECONOMICS, AND THE NUMBER OF PLANS ARE REDUCED TO 3


1                                     HEC-1 INPUT                                        PAGE  1

     LINE        ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

       1         ID   SHB JOB NO. E87-11                        SCS HYDROGRAPH METHOD
       2         ID   6 HOUR PMP STORM
       3         ID   FOR VOLTURE MINE WATERSHED
                 *DIAGRAM
*** FREE ***
       4         IT      15 01JUL87    0000      300
       5         IO       3
       6         IN      15 01JUL87

       7         KK    MILL
       8         KM   MILL WASH
       9         BA    2.11
      10         PI    0.10    0.11    0.11    0.11    0.14    0.15    0.17    0.22    0.24    0.32
      11         PI    0.49    4.00    0.90    0.49    0.32    0.24    0.19    0.19    0.15    0.14
      12         PI    0.11    0.13    0.14    0.06
      13         LS       0      75       0
      14         UD    3.26

      15         KK    RED1
      16         KM   WEST RED CLOUD WASH
      17         BA    1.24
      18         LS       0      80       0
      19         UD   2.075

      20         KK    RED2
      21         KM   EAST RED CLOUD WASH
      22         BA    0.55
      23         LS       0      80       0
      24         UD    1.90

      25         KK     RED
      26         KM   COMBINE FLOW FOR RED1 AND RED2
      27         HC       2

      28         KK    MRED
      29         KM   COMBINE MILL WASH AND RED CLOUD WASH
      30         HC       2

      31         KK    VOLT
      32         KM   VOLTURE WASH
      33         BA    0.47
      34         LS       0      85       0
```

```
            36          KK   ENDS
            37          KM   COMBINE MILL WASH AND VOLTURE MILL WASH
            38          HC      2
            39          ZZ
1
                SCHEMATIC DIAGRAM OF STREAM NETWORK
INPUT
 LINE      (V) ROUTING          (--->) DIVERSION OR PUMP FLOW

  NO.      (.) CONNECTOR        (<---) RETURN OF DIVERTED OR PUMPED FLOW

    7       MILL
              .
              .
   15         .        RED1
              .          .
              .          .
   20         .          .         RED2
              .          .           .
              .          .           .
   25         .         RED............
              .          .
              .          .
   28       MRED............
              .
              .
   31         .        VOLT
              .          .
              .          .
   36       ENDS............

(***) RUNOFF ALSO COMPUTED AT THIS LOCATION
1                                                   ****
                     FLOOD HYDROGRAPH PACKAGE HEC-1 (IBM XT 512K VERSION) -FEB 1,1985
       U.S. ARMY CORPS OF ENGINEERS, THE HYDROLOGIC ENGINEERING CENTER, 609 SECOND STREET, DAVIS, CA. 95616
                                                    ****



                   SHB JOB NO. E87-11                    SCS HYDROGRAPH METHOD
                   6 HOUR PMP STORM
                   FOR VOLTURE MINE WATERSHED

   5 IO         OUTPUT CONTROL VARIABLES
                    IPRNT          3  PRINT CONTROL
                    IPLOT          0  PLOT CONTROL
                    QSCAL         0.  HYDROGRAPH PLOT SCALE

     IT         HYDROGRAPH TIME DATA
                     NMIN         15  MINUTES IN COMPUTATION INTERVAL
                    IDATE     1JUL87  STARTING DATE
                    ITIME       0000  STARTING TIME
                       NQ        300  NUMBER OF HYDROGRAPH ORDINATES
                   NDDATE     4JUL87  ENDING DATE
                   NDTIME       0245  ENDING TIME

              COMPUTATION INTERVAL    .25 HOURS
                   TOTAL TIME BASE  74.75 HOURS

        ENGLISH UNITS
```

```
            *************
            *           *
 7 KK       *    MILL   *
            *           *
            *************
                       MILL WASH

 6 IN         TIME DATA FOR INPUT TIME SERIES
                   JXMIN         15  TIME INTERVAL IN MINUTES
                  JXDATE     1JUL87  STARTING DATE
                  JXTIME          0  STARTING TIME

             SUBBASIN RUNOFF DATA

 9 BA         SUBBASIN CHARACTERISTICS
                   TAREA       2.11  SUBBASIN AREA

              PRECIPITATION DATA

 8 PP              STORM       9.24  BASIN TOTAL PRECIPITATION

 8 PI           INCREMENTAL PRECIPITATION PATTERN
                  .10      .11      .11      .11      .14      .16      .17      .22      .24      .32
                  .49     4.00      .90      .49      .32      .24      .19      .19      .16      .14
                  .11      .13      .14      .06

13 LS         SCS LOSS RATE
                   STRTL        .67  INITIAL ABSTRACTION
                  CRVNBR      75.00  CURVE NUMBER
                   RTIMP        .00  PERCENT IMPERVIOUS AREA

14 UD         SCS DIMENSIONLESS UNITGRAPH
                    TLAG       3.26  LAG

                                           ***

                                        UNIT HYDROGRAPH
                                    67 END-OF-PERIOD ORDINATES
              7.       19.       36.       56.       82.      114.      151.      193.      230.      260.
            282.      296.      300.      300.      297.      283.      268.      252.      234.      212.
            186.      161.      139.      123.      109.       96.       85.       77.       67.       61.
             54.       48.       42.       38.       33.       30.       26.       23.       21.       18.
             16.       14.       13.       11.       10.        9.        8.        7.        6.        5.
              5.        4.        4.        3.        3.        3.        3.        2.        2.        2.
              1.        1.        1.        1.        1.        0.        0.

      ***        ***        ***        ***        ***

                    HYDROGRAPH AT STATION     MILL

   TOTAL RAINFALL =    9.24, TOTAL LOSS =    3.07, TOTAL EXCESS =    6.17

  PEAK FLOW     TIME                   MAXIMUM AVERAGE FLOW
                               6-HR       24-HR       72-HR     74.75-HR
+   (CFS)       (HR)
                        (CFS)
+   1678.       6.50           1178.        350.        117.        112.
                      (INCHES) 5.191       6.173       6.173       6.173
                      (AC-FT)   584.        695.        695.        695.

                   CUMULATIVE AREA =    2.11 SQ MI
```

```
*** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** ***

            *************
            *           *
 15 KK      *   RED1    *
            *           *
            *************
                   WEST RED CLOUD WASH

              SUBBASIN RUNOFF DATA

 17 BA          SUBBASIN CHARACTERISTICS
                     TAREA        1.24  SUBBASIN AREA

                PRECIPITATION DATA

  8 PB               STORM        9.24  BASIN TOTAL PRECIPITATION

  8 PI            INCREMENTAL PRECIPITATION PATTERN
                      .10      .11      .11      .11      .14      .16      .17      .22      .24      [illegible]
                      .49     4.00      .90      .49      .32      .24      .19      .19      .16      .14
                      .11      .13      .14      .06

 18 LS          SCS LOSS RATE
                     STRTL         .50  INITIAL ABSTRACTION
                    CRVNBR       80.00  CURVE NUMBER
                     RTIMP         .00  PERCENT IMPERVIOUS AREA

 19 UD          SCS DIMENSIONLESS UNITGRAPH
                      TLAG        2.08  LAG

                                                         ***

                                                    UNIT HYDROGRAPH
                                                44 END-OF-PERIOD ORDINATES
               11.       34.       65.      108.      163.      215.      252.      270.      272.      264.
              244.      220.      191.      155.      124.      103.       86.       72.       60.       50.
               41.       35.       29.       24.       20.       16.       14.       11.        9.        8.
                7.        5.        4.        4.        3.        3.        2.        2.        2.        1.
                1.        1.        0.        0.

     ***            ***            ***            ***            ***

                        HYDROGRAPH AT STATION     RED1

     TOTAL RAINFALL =     9.24, TOTAL LOSS =     2.44, TOTAL EXCESS =     6.80

   PEAK FLOW     TIME                           MAXIMUM AVERAGE FLOW
                                     6-HR        24-HR        72-HR      74.75-HR
 +   (CFS)       (HR)
                           (CFS)
 +    1536.      5.25                 855.        227.          76.          73.
                         (INCHES)    6.409       6.796        6.796        6.796
                          (AC-FT)     424.        449.         449.         449.

                        CUMULATIVE AREA =     1.24 SQ MI


*** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** ***
```

```
             *           *
 20 KK       *   RED2    *
             *           *
             *************
                        EAST RED CLOUD WASH

                SUBBASIN RUNOFF DATA

 22 BA            SUBBASIN CHARACTERISTICS
                       TAREA        .55  SUBBASIN AREA

                  PRECIPITATION DATA

  8 PB                 STORM       9.24  BASIN TOTAL PRECIPITATION

  8 PI              INCREMENTAL PRECIPITATION PATTERN
                       .10      .11      .11      .11      .14      .16      .17      .22      .24      .32
                       .49     4.00      .90      .49      .32      .24      .19      .19      .15      .14
                       .11      .13      .14      .06

 23 LS            SCS LOSS RATE
                       STRTL        .50  INITIAL ABSTRACTION
                      CRVNBR      80.00  CURVE NUMBER
                       RTIMP        .00  PERCENT IMPERVIOUS AREA

 24 UD            SCS DIMENSIONLESS UNITGRAPH
                       TLAG        1.90  LAG

                                                        ***

                                                     UNIT HYDROGRAPH
                                                 40 END-OF-PERIOD ORDINATES
                6.       19.       36.       60.       90.      114.      127.      131.      129.      119.
              107.       92.       73.       58.       47.       38.       32.       26.       21.       17.
               14.       12.       10.        8.        6.        5.        4.        4.        3.        2.
                2.        2.        1.        1.        1.        1.        1.        0.        0.        0.

     ***           ***           ***           ***           ***

                      HYDROGRAPH AT STATION     RED2

   TOTAL RAINFALL =     9.24, TOTAL LOSS =     2.44, TOTAL EXCESS =     6.80

  PEAK FLOW     TIME                           MAXIMUM AVERAGE FLOW
                                       6-HR        24-HR       72-HR     74.75-HR
+   (CFS)       (HR)
                            (CFS)
+     731.      5.00                   384.        101.         34.         32.
                          (INCHES)     6.488       6.796       6.796       6.796
                           (AC-FT)     190.        199.        199.        199.

                       CUMULATIVE AREA =     .55 SQ MI


*** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** ***

             *************
             *           *
 25 KK       *   RED     *
             *           *
             *************
                        COMBINE FLOW FOR RED1 AND RED2
```

29 HC HYDROGRAPH COMBINATION
ICOMP 2 NUMBER OF HYDROGRAPHS TO COMBINE

***

*** *** *** *** ***

HYDROGRAPH AT STATION RED

PEAK FLOW	TIME		MAXIMUM AVERAGE FLOW			
			6-HR	24-HR	72-HR	74.75-HR
+ (CFS)	(HR)					
		(CFS)				
+ 2251.	5.00		1238.	327.	109.	105.
		(INCHES)	6.432	6.796	6.796	6.796
		(AC-FT)	614.	649.	649.	649.

CUMULATIVE AREA = 1.79 SQ MI

*** ***

```
          **************
          *            *
  28 KK   *    MRED    *
          *            *
          **************
```

COMBINE MILL WASH AND RED CLOUD WASH

30 HC HYDROGRAPH COMBINATION
ICOMP 2 NUMBER OF HYDROGRAPHS TO COMBINE

***

*** *** *** *** ***

HYDROGRAPH AT STATION MRED

PEAK FLOW	TIME		MAXIMUM AVERAGE FLOW			
			6-HR	24-HR	72-HR	74.75-HR
+ (CFS)	(HR)					
		(CFS)				
+ 3565.	5.50		2374.	677.	226.	217.
		(INCHES)	5.659	6.459	6.459	6.459
		(AC-FT)	1177.	1343.	1343.	1343.

CUMULATIVE AREA = 3.90 SQ MI

*** ***

```
          **************
          *            *
  31 KK   *    VOLT    *
          *            *
          **************
```

VOLTURE WASH

SUBBASIN RUNOFF DATA

```
                TAREA        .47  SUBBASIN AREA

           PRECIPITATION DATA

 8 PB           STORM       9.24  BASIN TOTAL PRECIPITATION

 8 PI            INCREMENTAL PRECIPITATION PATTERN
                  .10      .11      .11      .11      .14      .16      .17      .22      .24      .22
                  .49     4.00      .90      .49      .32      .24      .19      .19      .16      .14
                  .11      .13      .14      .06

34 LS           SCS LOSS RATE
                STRTL        .35  INITIAL ABSTRACTION
                CRVNBR     85.00  CURVE NUMBER
                RTIMP        .00  PERCENT IMPERVIOUS AREA

35 UD           SCS DIMENSIONLESS UNITGRAPH
                TLAG        1.21  LAG

                                                      ***

                                                 UNIT HYDROGRAPH
                                             26 END-OF-PERIOD ORDINATES
             15.      48.     100.     149.     169.     166.     145.     116.      81.      59.
             44.      33.      24.      18.      13.       9.       7.       5.       4.       3.
              2.       2.       1.       1.       1.       0.

     ***          ***          ***          ***          ***

                 HYDROGRAPH AT STATION     VOLT

   TOTAL RAINFALL =    9.24, TOTAL LOSS =    1.83, TOTAL EXCESS =    7.41

   PEAK FLOW     TIME                       MAXIMUM AVERAGE FLOW
                                   6-HR        24-HR       72-HR     74.75-HR
 +   (CFS)       (HR)
                          (CFS)
 +    943.       4.25              369.         94.         31.         30.
                        (INCHES)   7.301       7.415       7.415       7.415
                        (AC-FT)    183.        186.        186.        186.

                  CUMULATIVE AREA =     .47 SQ MI



*** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** ***


         **************
         *            *
 36 KK   *     ENDS   *
         *            *
         **************
                     COMBINE MILL WASH AND VOLTURE MILL WASH

 38 HC          HYDROGRAPH COMBINATION
                ICOMP          2  NUMBER OF HYDROGRAPHS TO COMBINE

                                                      ***

     ***          ***          ***          ***          ***

                 HYDROGRAPH AT STATION     ENDS
```

				6-HR	24-HR	72-HR	74.75-HR
+	(CFS)	(HR)					
			(CFS)				
+	4043.	5.25		2712.	771.	257.	248.
			(INCHES)	5.769	6.562	6.562	6.562
			(AC-FT)	1345.	1529.	1529.	1529.

CUMULATIVE AREA = 4.37 SQ MI

1

RUNOFF SUMMARY
FLOW IN CUBIC FEET PER SECOND
TIME IN HOURS, AREA IN SQUARE MILES

+	OPERATION	STATION	PEAK FLOW	TIME OF PEAK	AVERAGE FLOW FOR MAXIMUM PERIOD 6-HOUR	24-HOUR	72-HOUR	BASIN AREA	MAXIMUM STAGE	TIME OF MAX STAGE
	HYDROGRAPH AT									
+		MILL	1678.	6.50	1178.	350.	117.	2.11		
	HYDROGRAPH AT									
+		RED1	1536.	5.25	855.	227.	76.	1.24		
	HYDROGRAPH AT									
+		RED2	731.	5.00	384.	101.	34.	.55		
	2 COMBINED AT									
+		RED	2251.	5.00	1238.	327.	109.	1.79		
	2 COMBINED AT									
+		MRED	3585.	5.50	2374.	677.	226.	3.90		
	HYDROGRAPH AT									
+		VOLT	943.	4.25	369.	94.	31.	.47		
	2 COMBINED AT									
+		END5	4043.	5.25	2712.	771.	257.	4.37		

*** NORMAL END OF HEC-1 ***

Not Scanned

January 5, 1990

Ms. Carol O'Brien
A.F. Budge (Mining) Limited
4301 North 75th Street
Scottsdale, AZ 85251-3504

RE: TECHNICAL INFORMATION - VULTURE PROPERTY

Dear Carol;

I have prepared for your appraisal and attention, a list of the documentation that has not yet being delivered to us with respect to the Vulture agreement. This was compiled after a discussion with Don White concerning what information exists at the current time. Don is of the opinion that Budge does have most of the data that he has in his files.

1. All of the underground geological maps, sections, assay plans, assay sections, longitudinals and other and sundry drawings relating to the underground workings. We understand from White that there are a great number of these available. Sufficient for him to construct a mine model. During 1971 Noranda Mines carried out a great deal of geophysical and airborne work contracted by GEODATA Inc. The IP survey that was carried out during the later part of this year on which the recent drilling program was based. We understand that this is on file.

2. All of the drill logs with descriptions, assay and other related data pertaining to the above program of drilling carried out the later part of 1989.

3. Hans Matthews has been in communication with Chuck Elliot (Tucson) and has very good cooperation. We have received a great amount of data from him pertaining to the earlier geophysical surveys and other material.

I have been asked by the syndicate members as to the contract being drafted by Lacey. Please comment.

We'd appreciate your cooperation on obtaining the above material. It is most important as we are currently putting together the overall picture of the area including all the airborne, ground, underground and other related data.

Sincerely,

ARIZONA EXPLORATIONS, INC.
Stanley W. Holmes,
President

SWH/bjg

Carole/
Could you please obtain all pertinent data from Don White, etc. - ASAP.
Thanks.
Harris

BUDGE

A.F. Budge (Mining) Limited

4301 North 75th Street
Suite 101
Scottsdale, AZ 85251-3504

(602) 945-4630
FAX (602) 949-1737

January 29, 1990

Arizona Explorations Inc.
8433 N. Black Canyon Highway
Suite 158
Phoenix, AZ 85021

via FAX: 864-6116

Dear Stan:

I am in dire need of some information in the files on the Vulture which you received from our office.

In March of 1987, we drilled several holes in the vicinity of our leach pads. These were condemnation holes, and numbered C-1, C-2, etc.

Would you please fax the logs of these holes, which were prepared by Peter H. Hahn. I promised the Department of Environmental Quality I would send them the information as soon as possible.

Your assistance in this request would be greatly appreciated.

Sincerely,

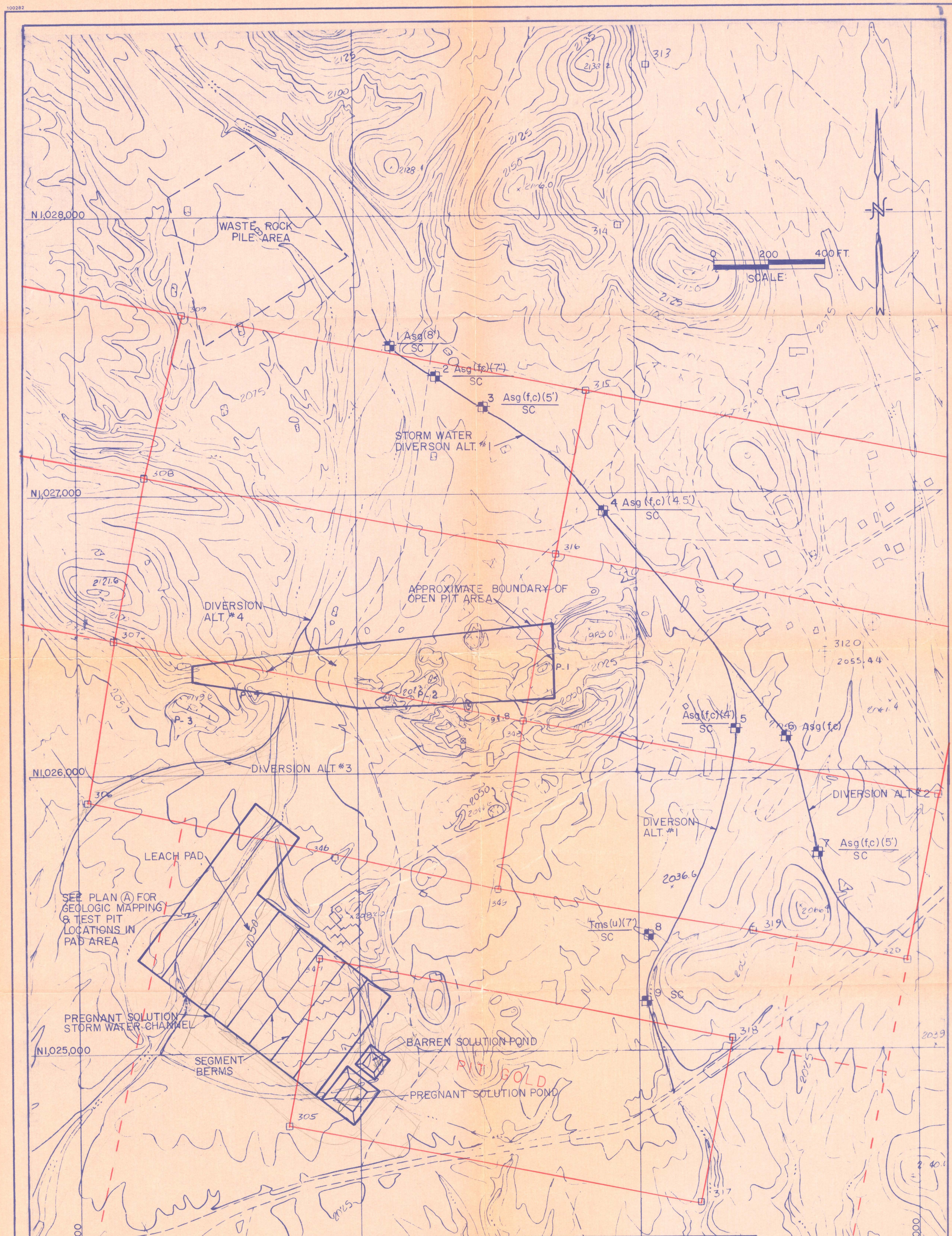
Carole.

Carole A. O'Brien

Carole

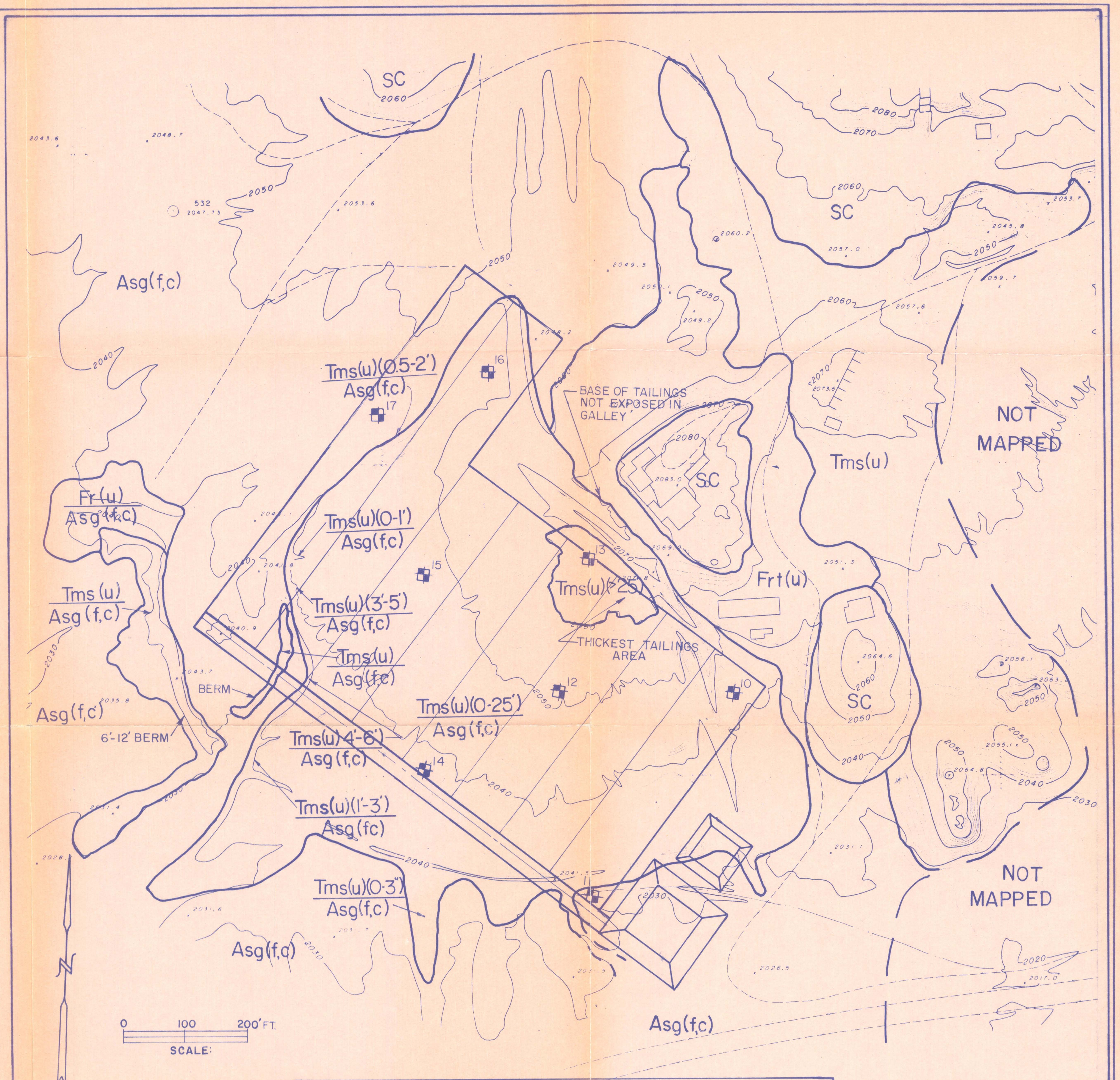
Please find enclosed C-# Logs and a 1987 report on the Leach operation. If you should require additional info please call!

Hans



CONCEPTUAL LAY-OUT OF HEAP LEACH FACILITIES

Showing Diversion Alt. 1 & 2 Test Pit Locations



ENGINEERING GEOLOGY OF LEACH PAD & POND AREAS

PLAN (A)

EXPLANATION

UNCONSOLIDATED MATERIALS

General Symbol Ab (c)(t)

- A - Genetic Symbol
- b - Lithologic Symbol
- (c) - Qualifier Symbol
- (t) - Approximate Thickness
- Ab/Ab(c) - Sequential Units

BEDROCK MATERIALS

SC - Precambrian schist. May include other metamorphic and igneous rock types. Generally moderately to strongly weathered to depths of at least 10 to 15 feet.

Symbols

- Contact
- Backhoe test pit location and no.

Genetic Symbols

- T - Tailings
- A - Alluvium
- F - Fill

Lithologic Symbols

- m - silt
- s - sand
- g - gravel

Qualifier Symbols

- u - uncompacted
- f - fan deposit
- c - caliche-cemented

SURFICIAL UNITS

- Tms(u) - Tailings: silt/sand (uncompacted)
- Frt(u) - Fill: rock rubble, and other deleterious material (uncompacted)
- Asg(f,c) - Alluvium: sand/gravel (fan morphology, caliche-cemented)

Note: Base map prepared by Aerial Mapping, Inc. for Zortman Mining Co.

NO.	DESCRIPTION	DATE

REVISIONS

SERGENT, HAUSKINS & BECKWITH
CONSULTING GEOTECHNICAL ENGINEERS

PLATE 1 SITE PLAN AND ENGINEERING GEOLOLGIC MAP OF PROPOSED LEACH PAD AREA

JOB NO.	DATE	DESIGNED BY	DRAWN BY	CHECKED BY	SHEET NO
E87-11	2-87	PVS	CAW	JRF	1

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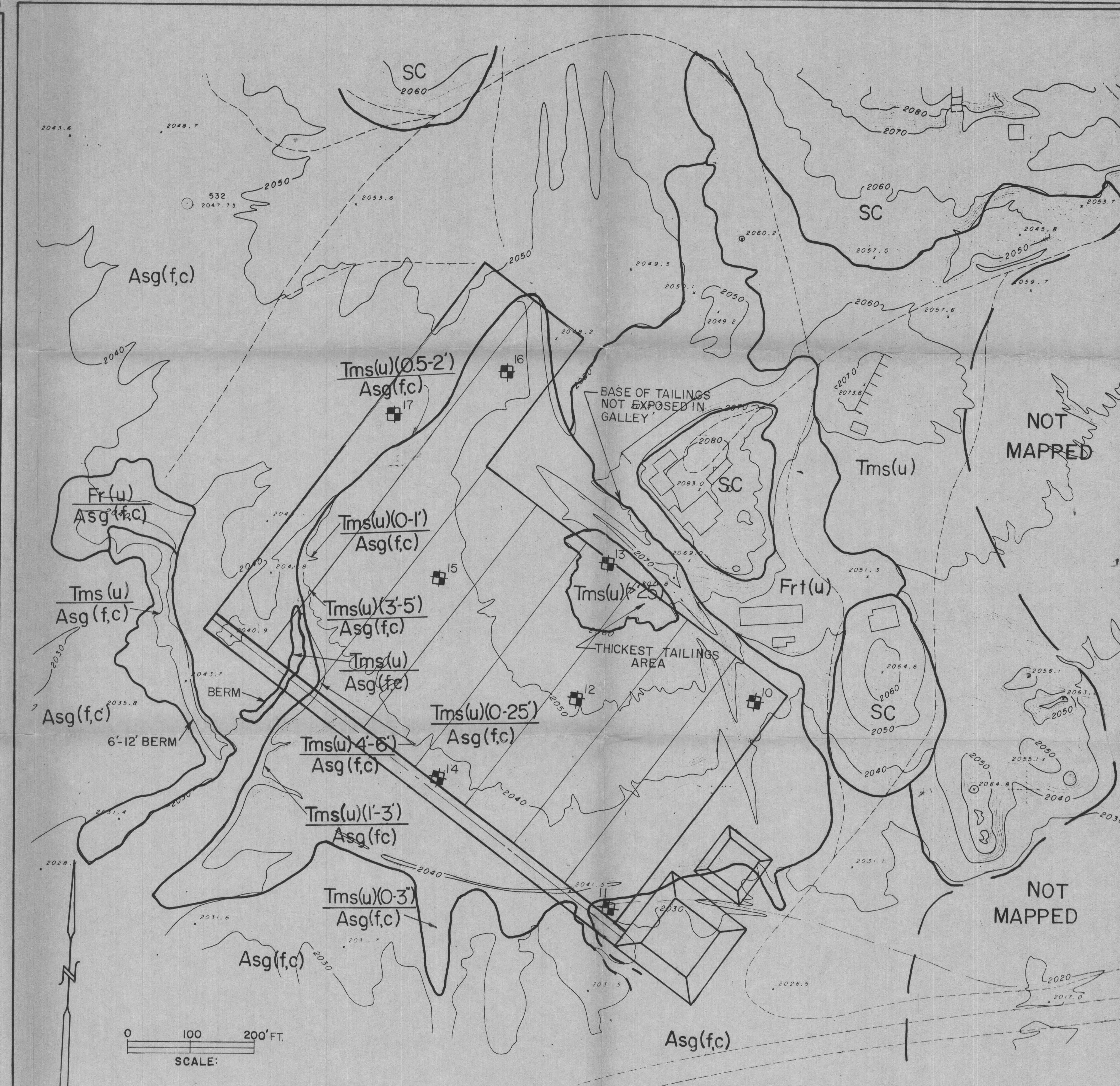
7/18/11
MO

CONCEPTUAL LAY-OUT OF HEAP LEACH FACILITIES

Showing Diversion Alt. 1 & 2 Test Pit Locations



ENGINEERING GEOLOGY OF LEACH PAD & POND AREAS

PLAN (A)

EXPLANATION

UNCONSOLIDATED MATERIALS

General Symbol Ab (c)(t)

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- b - Lithologic Symbol
- (c) - Qualifier Symbol
- (t) - Approximate Thickness
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Symbols

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- Backhoe test pit location and no.

Genetic Symbols

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Note: Base map prepared by Aerial Mapping, Inc. for Zortman Mining Co.

NO.	DESCRIPTION	DATE
	REVISIONS	

SERGENT, HAUSKINS & BECKWITH

CONSULTING GEOTECHNICAL ENGINEERS

PLATE 1 SITE PLAN AND ENGINEERING GEOLOLGIC MAP OF PROPOSED LEACH PAD AREA

JOB NO.	DATE	DESIGNED BY	DRAWN BY	CHECKED BY	SHEET NO
E87-11	2-87	PVS	CAW	JRF	1

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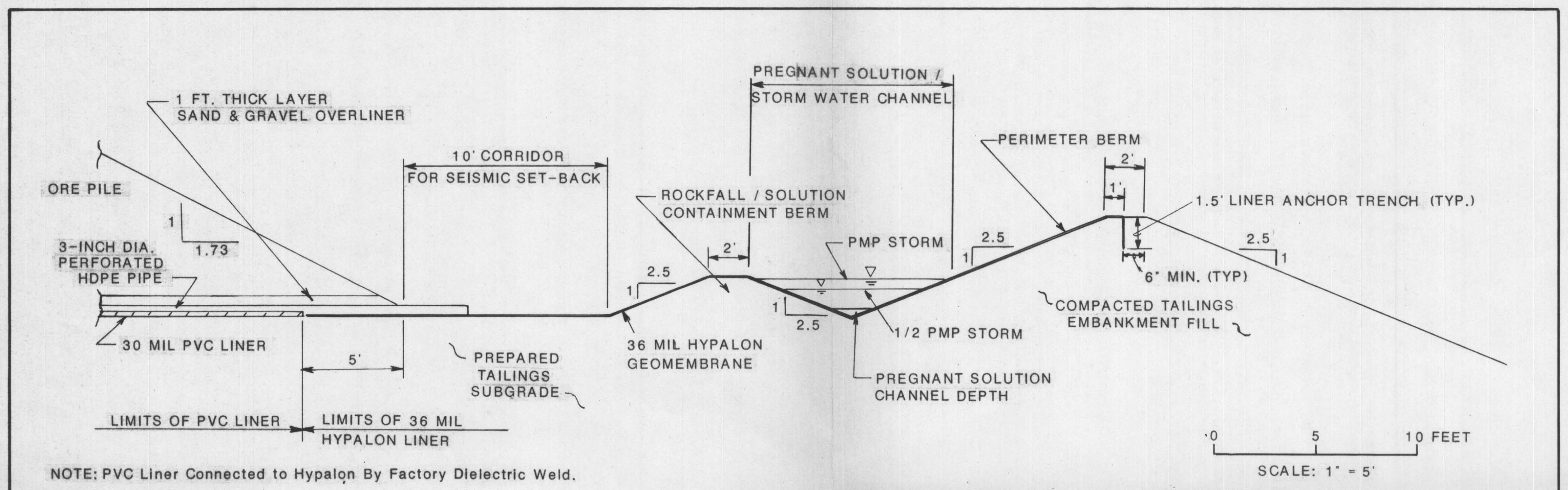
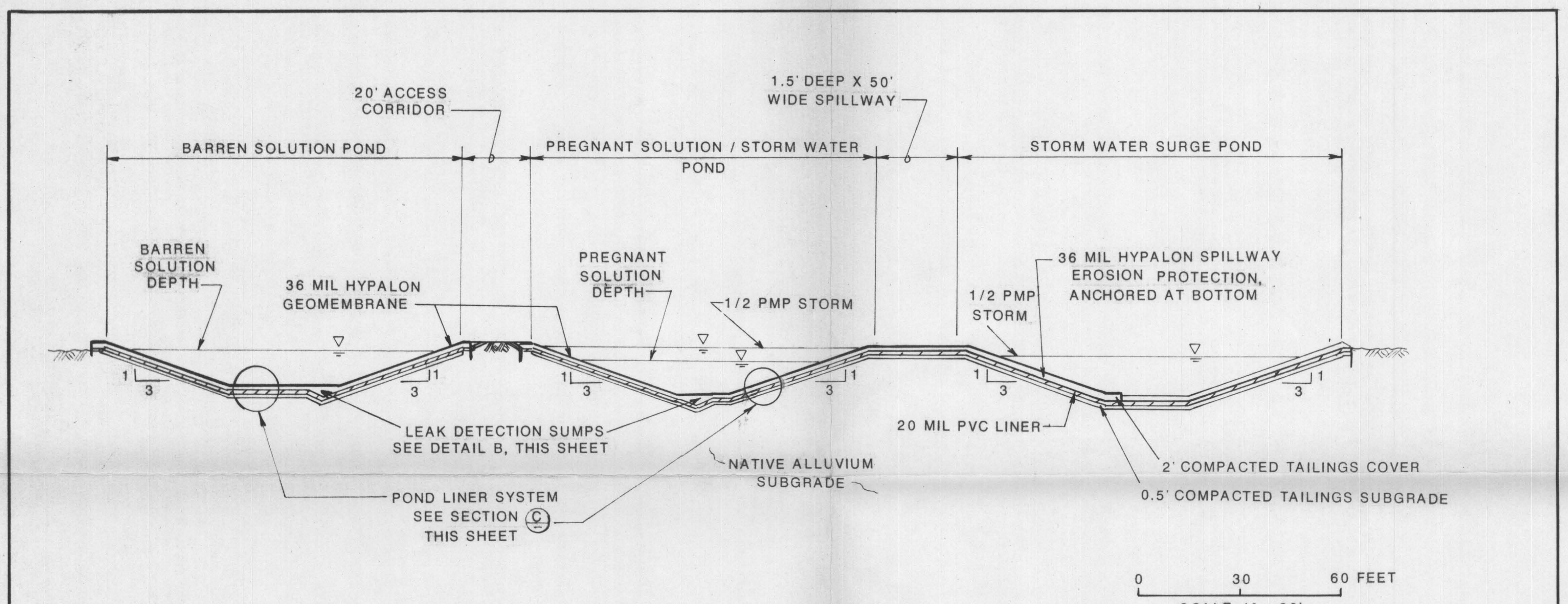
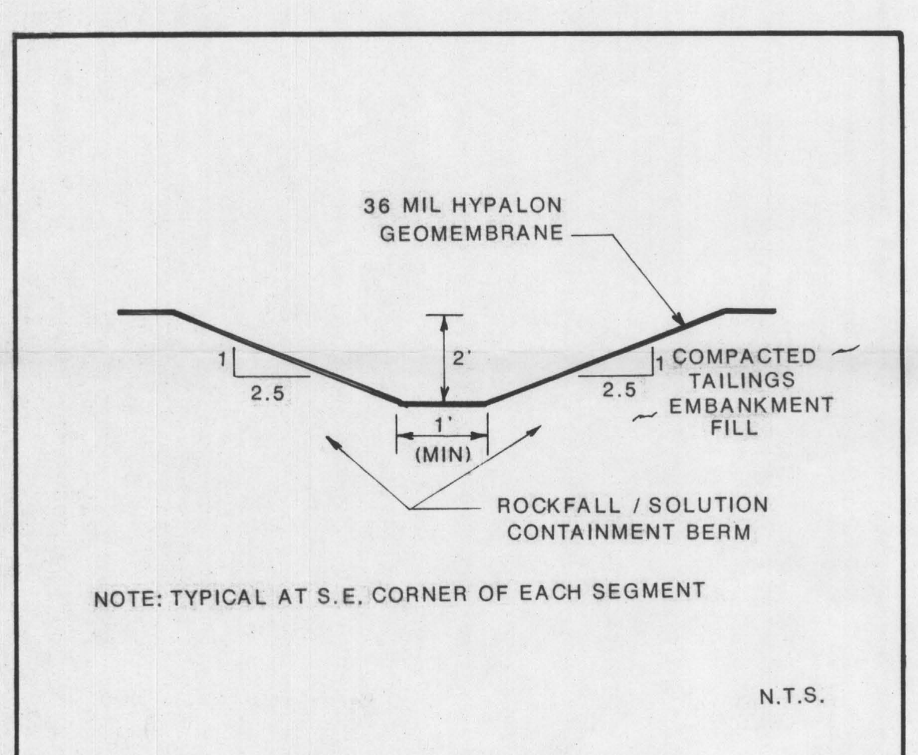


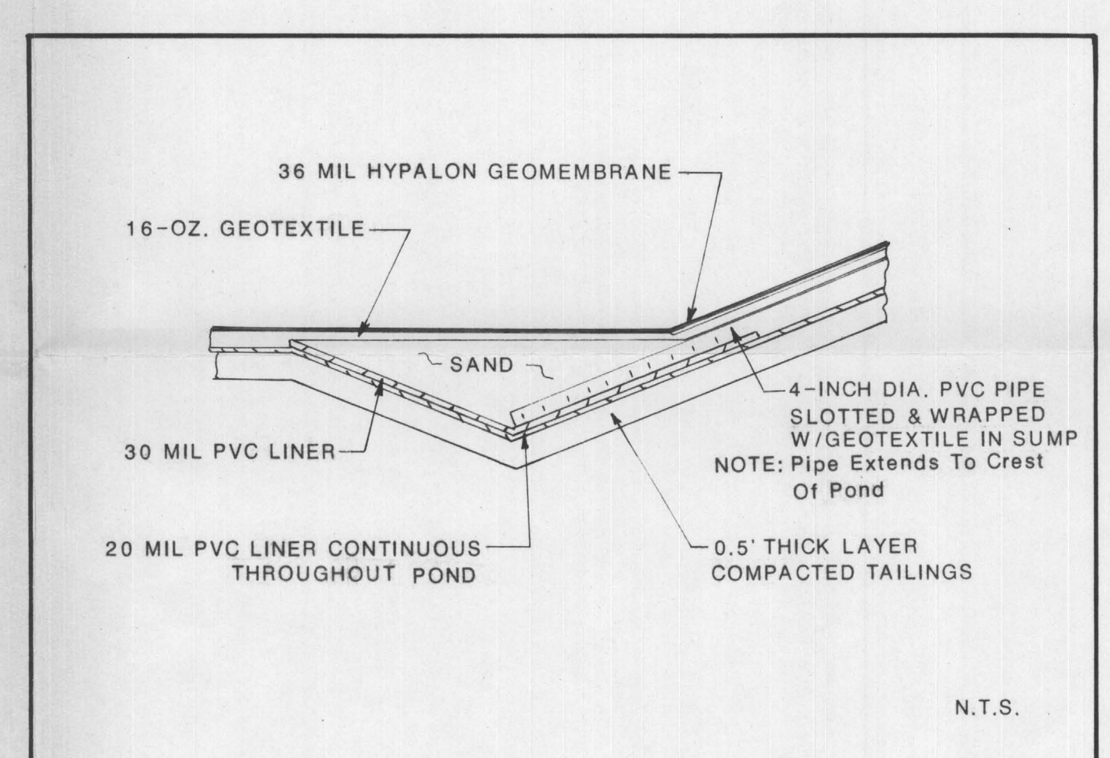
SECTION A



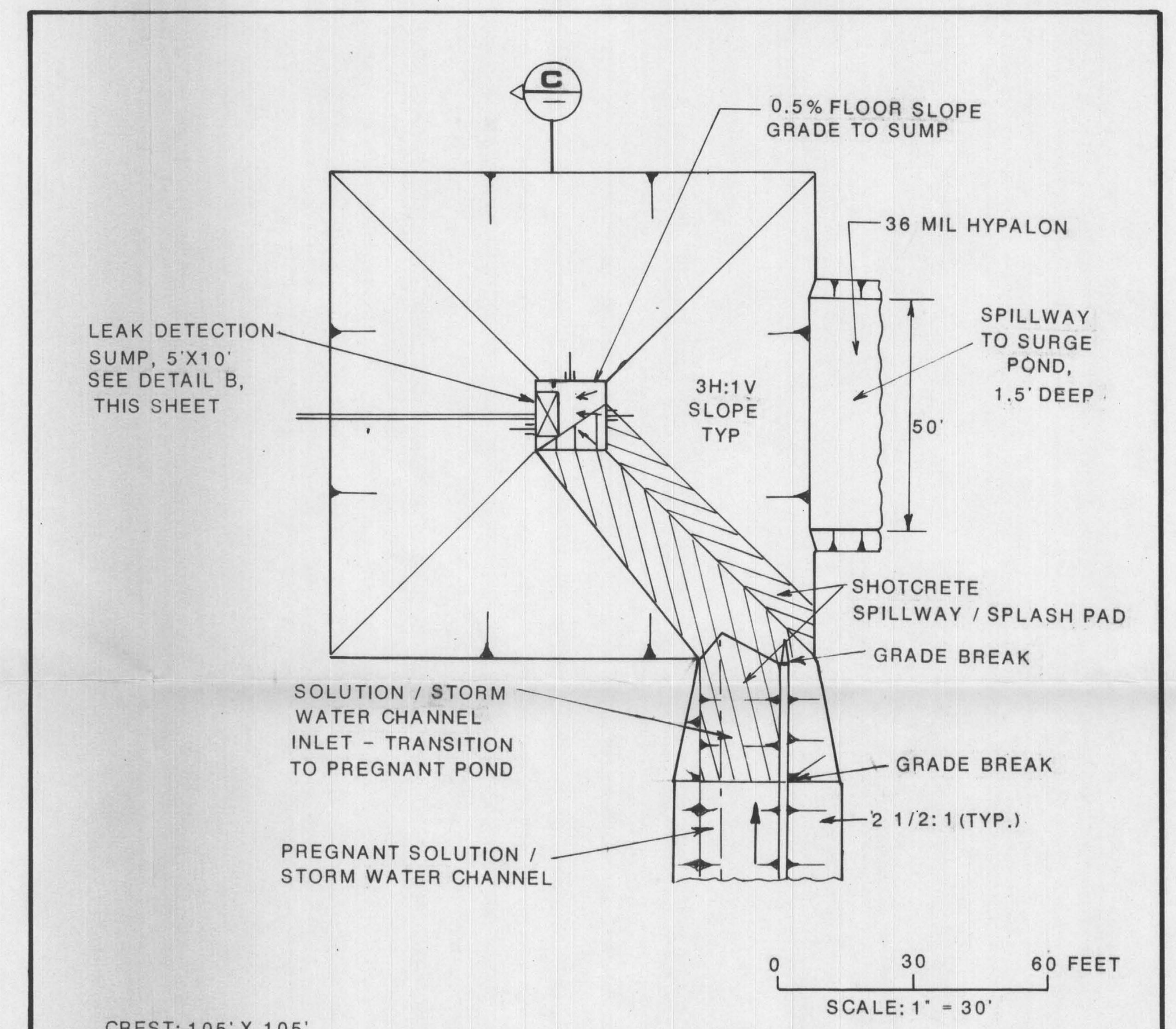
SECTION B



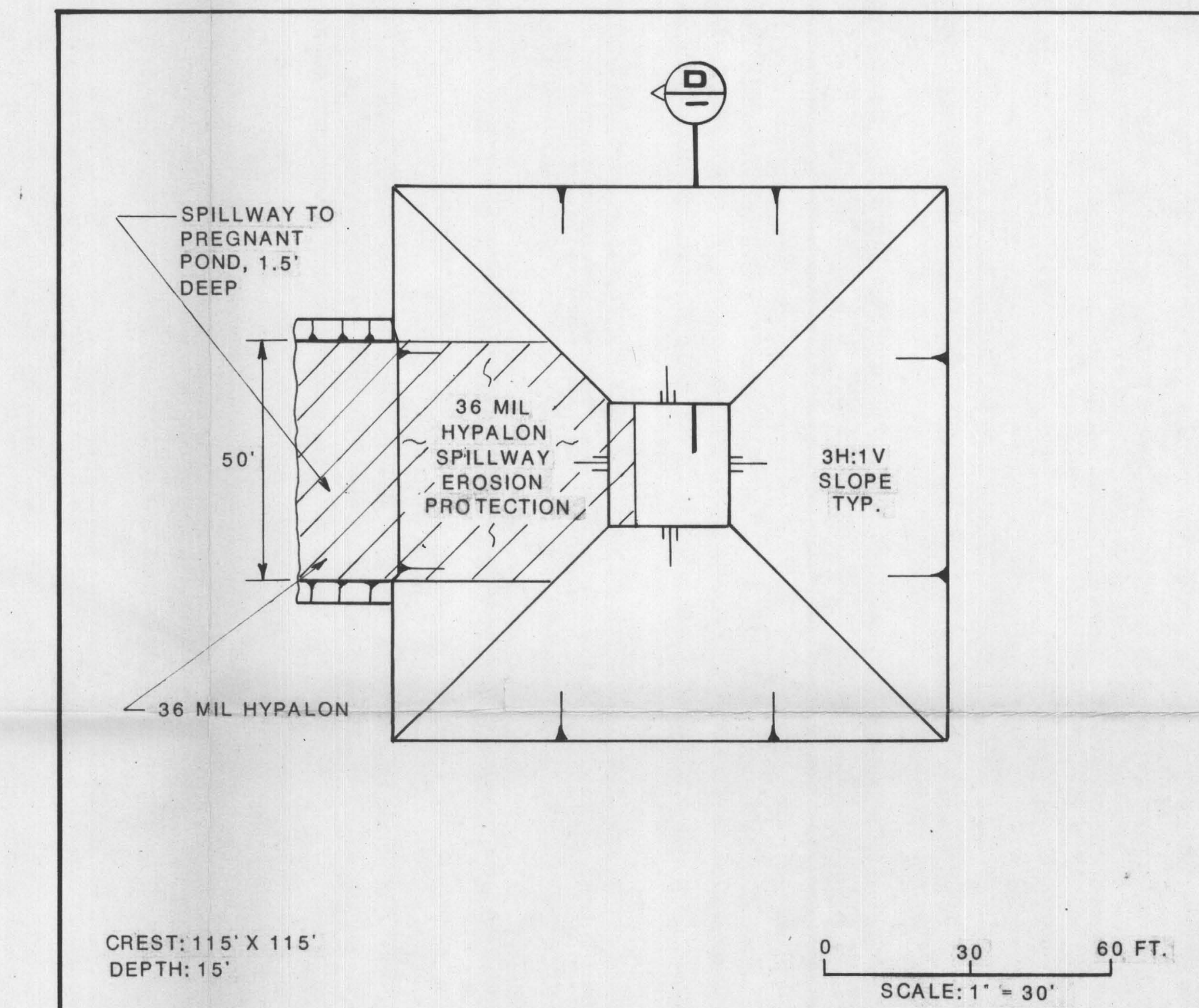
LEACH PAD SEGMENT OUTLET DETAIL A



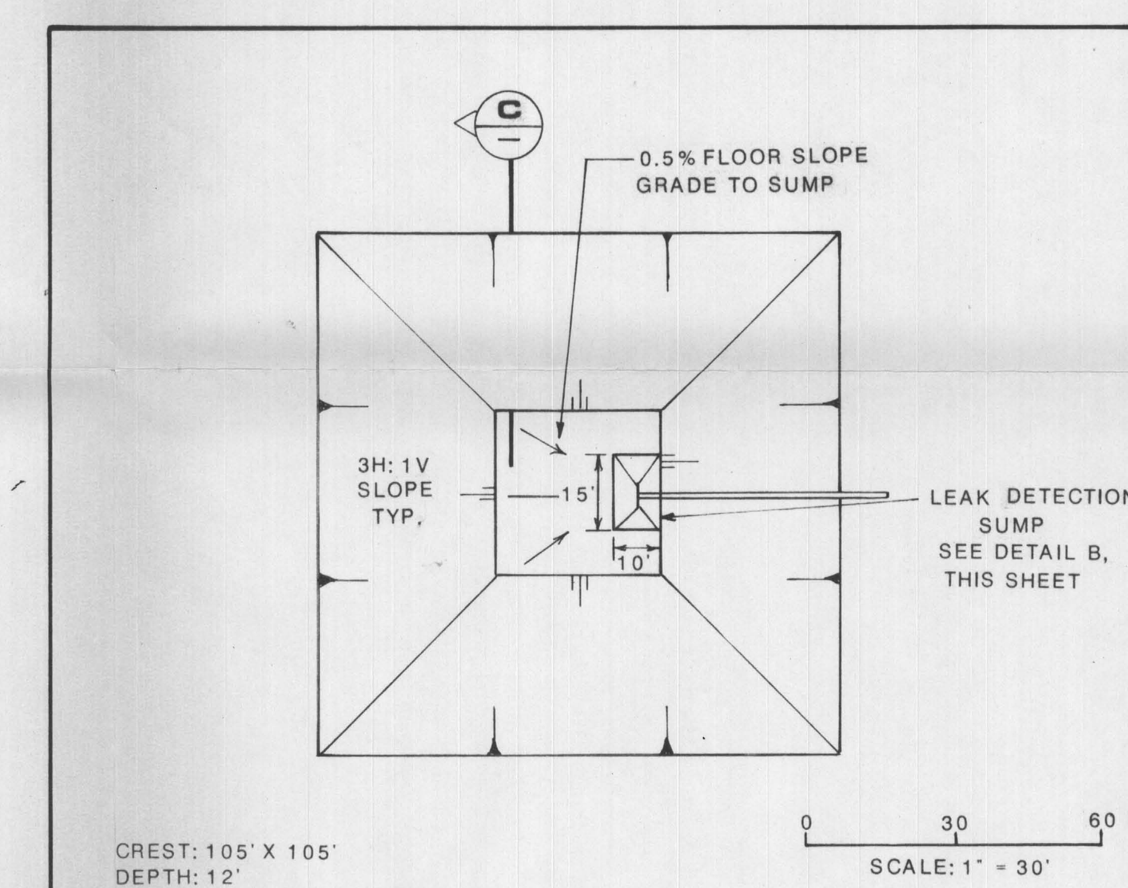
LEAK DETECTION SUMP DETAIL B



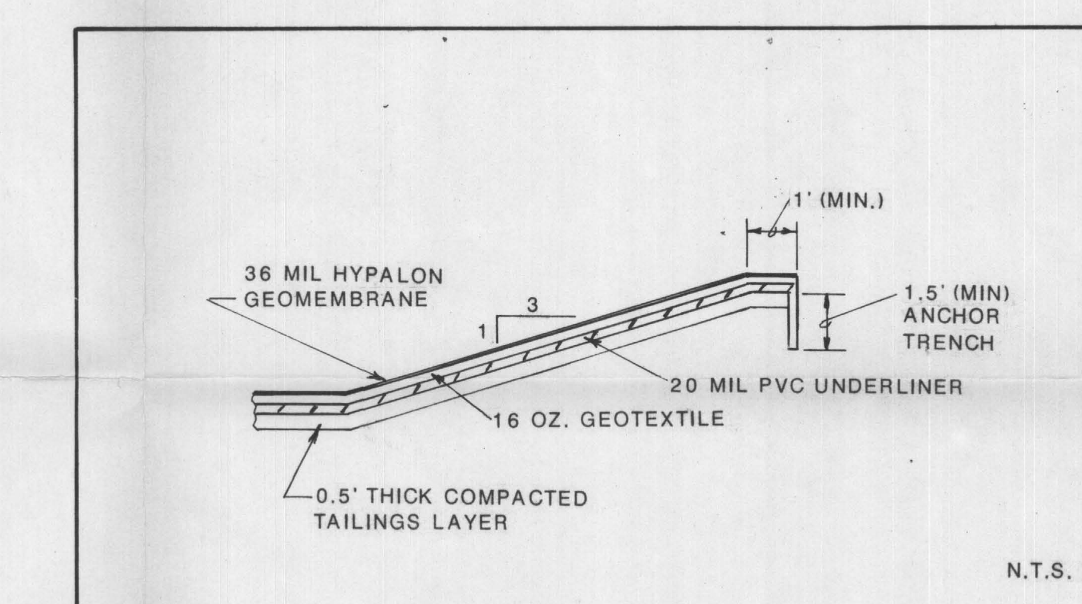
PLAN VIEW OF PREGNANT POND



PLAN VIEW OF STORM WATER (SURGE) POND



PLAN VIEW OF BARREN POND



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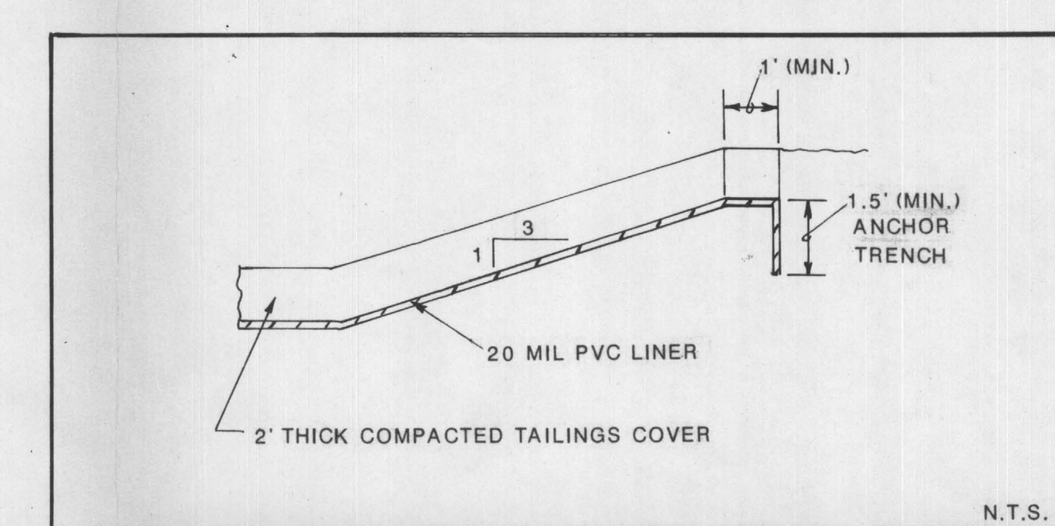
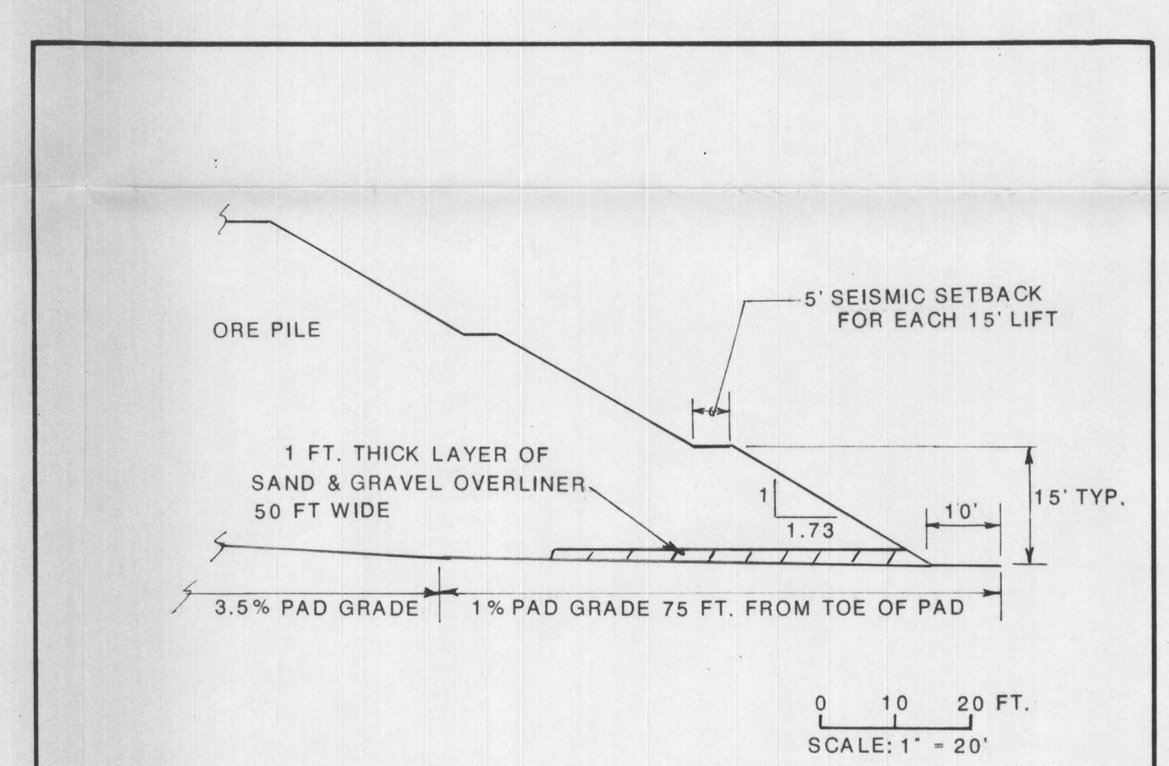


SECTION D



TYPICAL CROSS SECTION THROUGH LEACH PILE

NO.	DESCRIPTION	DATE
	REVISIONS	

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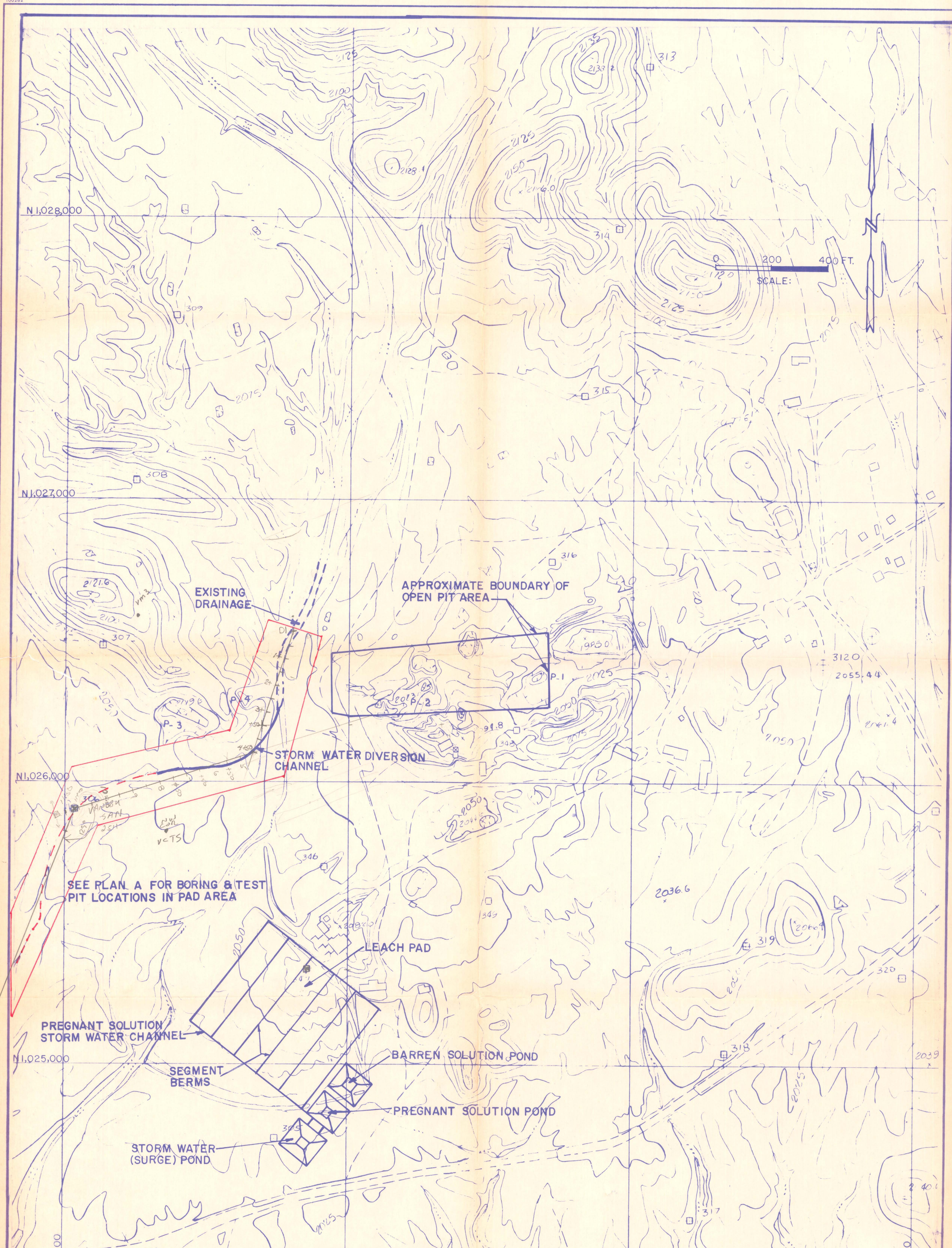
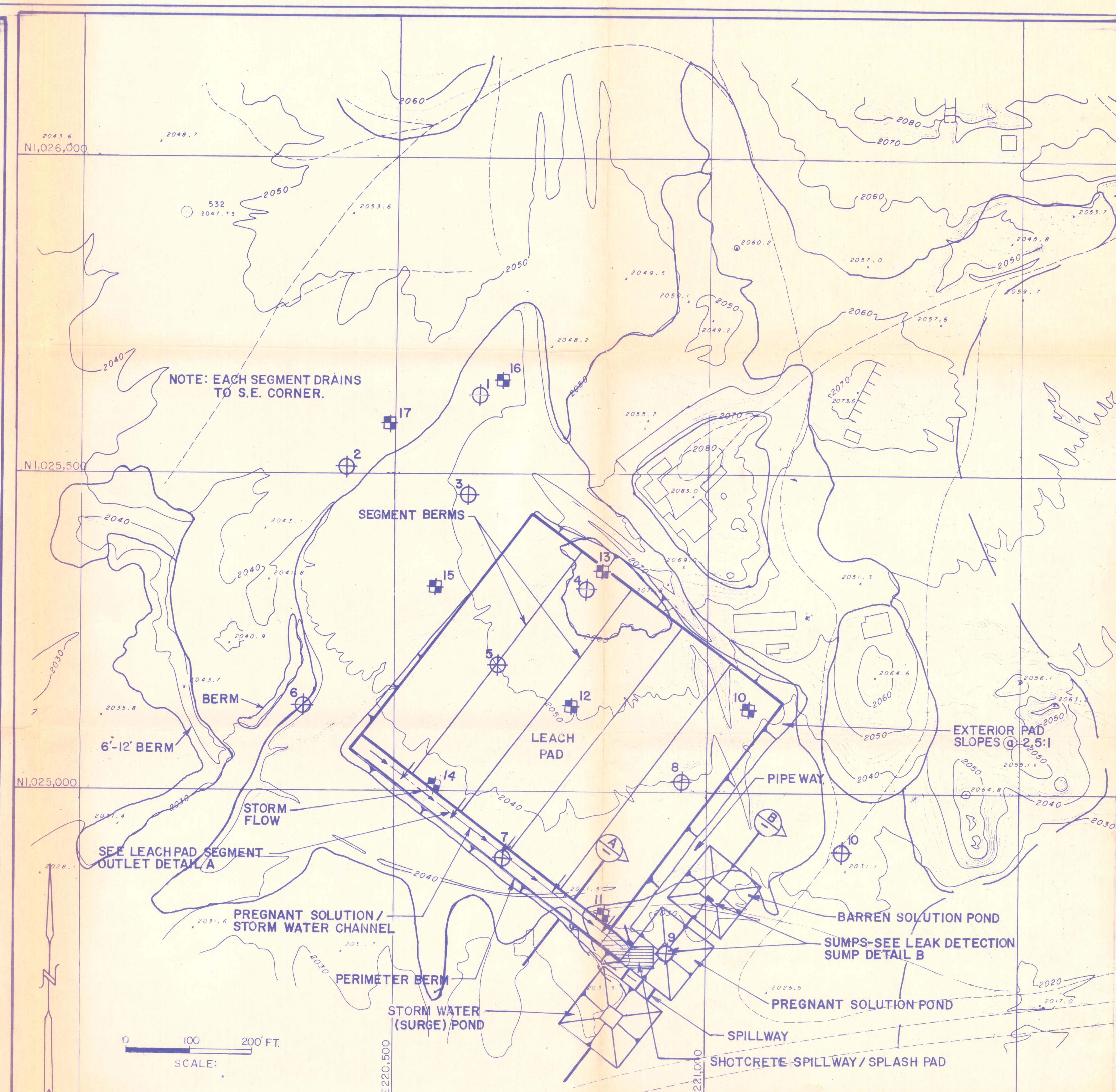
CONSULTING GEOTECHNICAL ENGINEERS

LEACH PAD DETAILS & TYPICAL SECTIONS
HEAP LEACH FACILITY DESIGN
VULTURE MINE PROJECT
NEAR WICKENBURG, ARIZONA

JOB NO.	DATE	DESIGNED BY	DRAWN BY	CHECKED BY	PLATE NO
E87-11	4-87	NJL	CAW	JRF	2



DESIGN LAY-OUT OF HEAP LEACH FACILITIES



PLAN VIEW OF LEACH PAD & PONDS
SHOWING BORING LOCATIONS
PLAN A

LEGEND

1 ⊕ - Boring Location And Number

1 ▣ - Backhoe Test Pit Location And Number

NO.	DESCRIPTION	DATE
	REVISIONS	

SERGENT, HAUSKINS & BECKWITH
CONSULTING GEOTECHNICAL ENGINEERS

LEACH PAD & POND LAYOUT
HEAP LEACH FACILITY DESIGN
VUTURE MINE PROJECT
NEAR WICKENBURG, ARIZONA

JOB NO.	DATE	DESIGNED BY	DRAWN BY	CHECKED BY	PLATE NO
E87-11	4-87	NJL	CAW	JRF	1

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