

BENTHIC SURVEY SUMMARY

On October 26, 2000, Chic Spann Regional Hydrologist and Steve McWilliams Watershed Program Manager accompanied Dr. Gerald Z. Jacobi on a collection and survey of the Valles Caldera Preserve. To better quantify water quality we conducted a benthic survey to catalog the invertebrates to use as an indicator of the existing water column condition. The reference reaches that were previously located and assessed for stream health were selected as survey sites. The assessment used Jaramillo Creek as the reference site (see following results).

Jaramillo Creek

The benthic survey used Jaramillo creek as the reference site and was non-impaired. Jaramillo Creek had the largest number of taxa (31) and the most diversity of organisms within the Valles Caldera.

Rio de los Indios

The benthic survey of Rio de los Indios indicated that the stream reach was non-impaired with 82% of the reference attributes

East Fork

The East Fork had lower number of taxa (23) probably due to homogeneity of the substrate (fine materials) and thermal consistency. The EPA bioassessment criteria using Jarimillo Creek as the reference gave the East Fork moderately impaired rating at 51%.

San Antonio Creek

To better quantify water quality we conducted a benthic survey to catalog the invertebrate population as an indicator of the existing water column condition. San Antonio Creek was rated slightly impaired using the EPA bioassessment at 65%. Using Jaramillo Creek as the reference the San Antonio contained the fewest taxa (22) that was probably due to a poorer quality of homogenous fine substrate.

Valles Caldera Benthic Macroinvertebrate Survey

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Introduction

Benthic macroinvertebrates consist of insects, crustaceans, worms, clams, snails, and other easily seen invertebrates which live on or within the substrate of aquatic ecosystems. They are the food base for fish and are 24 hour sentinels of water and habitat quality. Their presence or absence can give an indication of the quality of the environment (Plafkin et al. 1989, Barbour and Stribling 1991, Loeb and Spacie 1994, Garn and Jacobi 1996, and Jacobi, et al. 1998). Their numbers and composition (community structure, community balance, and functional feeding components) can be used to determine the suitability and condition of the environment to support aquatic life.

Study locations and Methods

Benthic macroinvertebrates were collected from four locations (East Fork of the Jemez River, Jaramillo Creek, Indian Creek, and San Antonio Creek) in the Valles Caldera during October 2000. Collections were at locations determined by the USFS to be PFC (proper functioning condition) reference sections. Three samples were collected at each location using a Hess type modified quantitative sampler (Jacobi 1978) from dominant substrates in the sections. Jaramillo Creek and Indian Creek contained angulate basalt rubble substrates while the East Fork of the Jemez River and San Antonio Creek contained finer gravel or sand substrates. All locations contained *Elodea* sp. and/or *Ranunculus* sp. as the dominant vegetation. Stream flows were less than 2 cfs and sample locations were in low gradient sections (< 1.3%). The East Fork of the Jemez River samples were collected near the origin of the stream flow, i.e., a spring.

Samples were preserved in the field in 85% ethyl alcohol. Macroinvertebrates were sorted from the debris and then identified and enumerated in the laboratory. Daniel McGuire assisted with the identification of the midges (Chironomidae).

Results and discussion

Results of this survey are presented in Tables 1 and 2. Table 1 contains a taxonomic listing of the organisms identified and Table 2 is a bioassessment of the "quality" of the macroinvertebrate community at each location using Jaramillo Creek as a reference site. Jaramillo Creek was selected as the reference because it contained the highest number of taxa found at the four locations and contained the greatest diversity of organisms.

Fifty-one total taxa were collected from the four locations (Table 1). Jaramillo Creek (JC1) contained a high of 31 taxa while San Antonio Creek (SAC1) contained the fewest, 22 taxa. The lower number of taxa at SAC1 and at the East Fork of the Jemez River (EFJ1) location (23 taxa) was due perhaps to the homogeneity of the substrate (fine material) and the probable thermal constancy. The highest standing crop (10,960 organisms per m²) was at (EFJ1). Standing crop values for all locations were equal to or greater than values from similar locations (unpublished data). Of the high standing crop at EFJ1, a disproportionate number (71%) consisted of the spiral cased caddisfly *Helicopsyche borealis*. Dominance by this taxon also reduced the diversity index to 1.83 (Table 2). This is in contrast to a high diversity index (3.53) at JC1. Here the dominant organism (30%) was the caddisfly *Hydropsyche* sp.. The higher diversity index showed a more even distribution of organisms in the sample.

The composition of all benthic macroinvertebrate communities was primarily by tolerant organisms; the community tolerance dominance quotient (CTQ_d) was 77 or greater for all locations (Table 2). (A CTQ_d value of less than 60 would show a dominance of more sensitive organisms). The number of sensitive EPT taxa (mayflies, stoneflies, and caddisflies) was intermediate for two locations (13 taxa each at JC1 and IC1), but low for EFJ1 and SAC1, 6 and 4 taxa, respectively. In contrast 13 of 22 total taxa in a collection from the Rio Cebolla at FS road 376 crossing were EPT taxa (Jacobi et al. 1999). In 1990 at Las Conchas on the East Fork of the Jemez River, EPT taxa represented almost half of the total number of organisms, 17 out of 36 taxa (Jacobi 1992).

Using the EPA recommended bioassessment criteria (Plafkin et al. 1989 and Barbour 1999) with Jaramillo Creek (JC1) as the reference, Indian Creek (IC1) was rated as "non-impaired" containing 82% of the reference attributes (Table 2). The East Fork of the Jemez River (EFJ1) was rated as "moderately impaired" (51%) and San Antonio Creek (SAC1) was rated as "slightly impaired" (65%). Impairment ratings at the latter two sites probably reflect the poorer quality homogenous fine substrate.

This survey by no means presents a complete taxonomic picture for each stream. The list only represents organisms from the dominant substrate and does not incorporate other habitats under varying current velocities.

Literature cited

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- Loeb, S. L. and A. Spacie. 1994. *Biological Monitoring of Aquatic Systems*. Lewis Publishers, Boca Raton, Florida. 381 p.
- Plafkin, J. L., M. T. Barbour, K. D. Porter, S. K. Gross, and R. M. Hughes. 1989. Rapid bioassessment protocols for use in streams and rivers. Benthic macroinvertebrates and fish - EPA 444/4-89-001. US EPA, Washington, D. C.

Table 1. Benthic macroinvertebrates collected from four stream locations in the Valles Caldera, October 2000.

	Stations			
	JC1 reference	IC1	EFJ1	SAC1
PLECOPTERA - stoneflies				
Perlodinae	6	0	0	0
<i>Cultus aestivalis</i>	0	0	0	6
<i>Hesperoperla pacifica</i>	0	255	0	0
EPHEMEROPTERA - mayflies				
<i>Baetis tricaudatus</i>	0	17	0	108
<i>Acentrella insignificans</i>	11	0	0	0
<i>Nixe</i> sp.	0	51	0	0
<i>Paraleptophlebia</i> sp.	85	11	0	0
<i>Tricorythodes minutus</i>	499	11	635	0
<i>Drunella grandis</i>	0	45	0	0
TRICHOPTERA - caddisflies				
<i>Glossosoma</i> sp.	34	0	0	0
<i>Hydropsyche</i> sp.	1423	754	0	0
<i>Ochrotrichia</i> sp.	23	28	0	0
<i>Stactobiella</i> sp.	11	0	0	0
<i>Leucotrichia</i> sp.	0	0	91	0
<i>Hesperophylax</i> sp.	34	23	34	210
<i>Ceraclea</i> sp.	57	6	85	17
<i>Nectopsyche</i> sp.	187	0	0	0
<i>Brachycentrus americanus</i>	119	176	187	0
<i>Helicopsyche borealis</i>	981	11	7830	0
<i>Neothremma</i> sp.	0	45	0	0
DIPTERA - true flies				
<i>Antocha monticola</i>	0	6	0	0
<i>Dicranota</i> sp.	62	159	0	0
<i>Hexatoma</i> sp. A	79	6	0	0
<i>Tipula</i> sp.	40	23	11	23
<i>Simulium</i> sp.	74	62	0	261
<i>Diamesa</i> sp.	0	312	6	0
<i>Thienemannimyia</i> sp.	40	0	0	23
<i>Orthocladius</i> sp.	6	266	6	0
<i>Hydrobaenus</i> sp.	0	0	0	6
<i>Brillia</i> sp.	0	0	0	6
<i>Eukiefferiella</i> sp.	0	17	0	0
<i>Nostococladius</i> sp.	23	170	0	0
<i>Cryptochironomus</i> sp.	0	0	6	11
<i>Microtendipes</i> sp.	11	34	28	0
<i>Pseudochironomus</i> sp.	0	0	0	6
<i>Micropsectra</i> sp.	0	0	0	17
ODONATA - damsel/dragonflies				
<i>Ophiogomphus</i> sp.	0	0	11	0
HEMIPTERA - true bugs				
<i>Graptocorixa</i> sp.	0	0	23	0
<i>Ambrysus mormon</i>	170	0	102	17
COLEOPTERA - beetles				

<i>Helichus</i> sp.	6	0	0	0
<i>Dubiraphia</i> sp.	0	0	414	0
<i>Optioservus</i> sp.	125	2262	652	238
LEPIDOPTERA - moths				
<i>Petrophila</i> sp.	45	0	0	0
MOLLUSCA - snails/clams				
<i>Physella</i> sp.	147	0	0	170
<i>Gyraulus</i> sp.	142	0	23	0
<i>Pisidium</i> sp.	91	28	204	1639
ANNELIDA - segmented worms				
Hirudinea	0	0	255	159
Tubificidae	215	0	11	85
<i>Tubifex</i> sp.	0	0	6	340
<i>Ophiodonias serpentina</i>	34	0	45	0
Lumbriculidae	6	306	0	11
PLATYHELMINTHES - flatworms				
<i>Turbellaria</i>	0	0	0	11
AMPHIPODA - scuds				
<i>Hyalella azteca</i>	0	0	295	516
Total (numbers/m2)	4786	5084	10960	3880

Table 2. Benthic macroinvertebrate bioassessment from four locations in the Valles Caldera, October 2000.

Metric	Stations			
	JC1 reference	IC1	EFJ1	SAC1
Calculated Value				
Standing Crop (No./m2)	4786	5084	10960	3880
No. of Taxa	31	26	23	22
BCI (CTQd)	77.4	74.7	88.3	98.3
EPT Index	13	13	6	4
EPT/EPT + Chiron.	0.98	0.64	0.99	0.83
Community Loss	0	0.50	0.74	0.91
% Dominant Taxon	30	44	71	42
Diversity	3.53	2.96	1.83	2.93
Scra./Scra.+Filt. Coll.	0.467	0.716	0.956	0.202
Shredders/Total	0.082	0.044	0.012	0.066
Percent of Reference				
Standing Crop (No./m2)	100	106	229	81
No. of Taxa	100	83	74	70
BCI (CTQd)	100	100	87	78
EPT Index	100	100	46	30
EPT/EPT + Chiron.	100	65	100	85
Scra./Scra.+Filt. Coll.	100	100	100	43
Shredders/Total	100	53	14	80
Score				
Standing Crop (No./m2)	6	6	2	6
No. of Taxa	6	6	4	4
BCI (CTQd)	6	6	6	4
EPT Index	6	6	0	0
EPT/EPT + Chiron.	6	4	6	6
Community Loss	6	4	4	4
% Dominant Taxon	4	0	0	0
Diversity	6	4	2	4
Scra./Scra.+Filt. Coll.	6	6	6	4
Shredders/Total	6	6	0	6
Biological Condition				
Total	58	48	30	38
% of Reference	100	82	51	65
Condition		NI	MI	SI

STREAM-LANDSCAPE SETTING (HYDROGEOMORPHIC CONDITION)

The Valles Caldera National Preserve is within a caldera that provides the headwaters of the Jemez River. To place the drainages into a well understood hydrogeomorphic classification system for practitioners to further understand the systems within the Valles and their relationship to the landscape setting each drainage is classified under Dave Rosgen's system with general characteristics found along the stream systems.

San Antonio Creek

The San Antonio stream system would be classified as an E4/E5 channel types. This is a gentle sloping broad riverine valley system. The material is sand dominated bed with scattered accumulations of gravel. Stream banks are composed of sandy mixtures with dense roots. This reach has slopes of less than 2 percent, width/depth ratios on less than 12, and entrenchment ratio of more than 2.2 and sinuosity of more than 1.5. Stream is functioning within the landscape setting with problem areas.

East Fork Jemez

The East Fork stream system would be classified as a E4 channel type. This is a gentle sloping broad riverine valley system. Materials comprising the channel are gravel beds, accumulations of sand, and occasional cobble size material. Stream banks are composed of sandy/gravel mix with dense root mats. Slopes of less than 2 percent with a width/depth ratio of less than 12:1, sinuosity of more than 1.5 and an Entrenchment ratio of more than 2.2:1 characterize the system. Stream has segments functioning within the landscape setting and others not functioning within the landscape setting

Jaramillo Creek

The Jaramillo stream type would be classified as an E3/E4 channel type. This is a riverine system with moderately steep slopes in the upper reaches to gently sloping in the reference reach and nearly level as it crosses the broad Valle Grande. Slopes are usually less than 2 percent except for the upper reaches (E3b). Entrenchment more than 2.2:1, sinuosity is greater than 1.5 and width/depth ratio is less than 12

Rio de los Indios

The Rito de los Indios system would be characterized as a B3/E3b-E4 channel type. This moderately steep and entrenched system is characterized by gradients of 2 to 4 % on stable alluvium. Sinuosity is reduced by travelways, log bridges, and abandon beaver dams. Width depth ratios and entrenchment varies down the drainage. Stream is constricted by breached stock tank, roads, and mounds.

Sulfur Creek Photo Guides

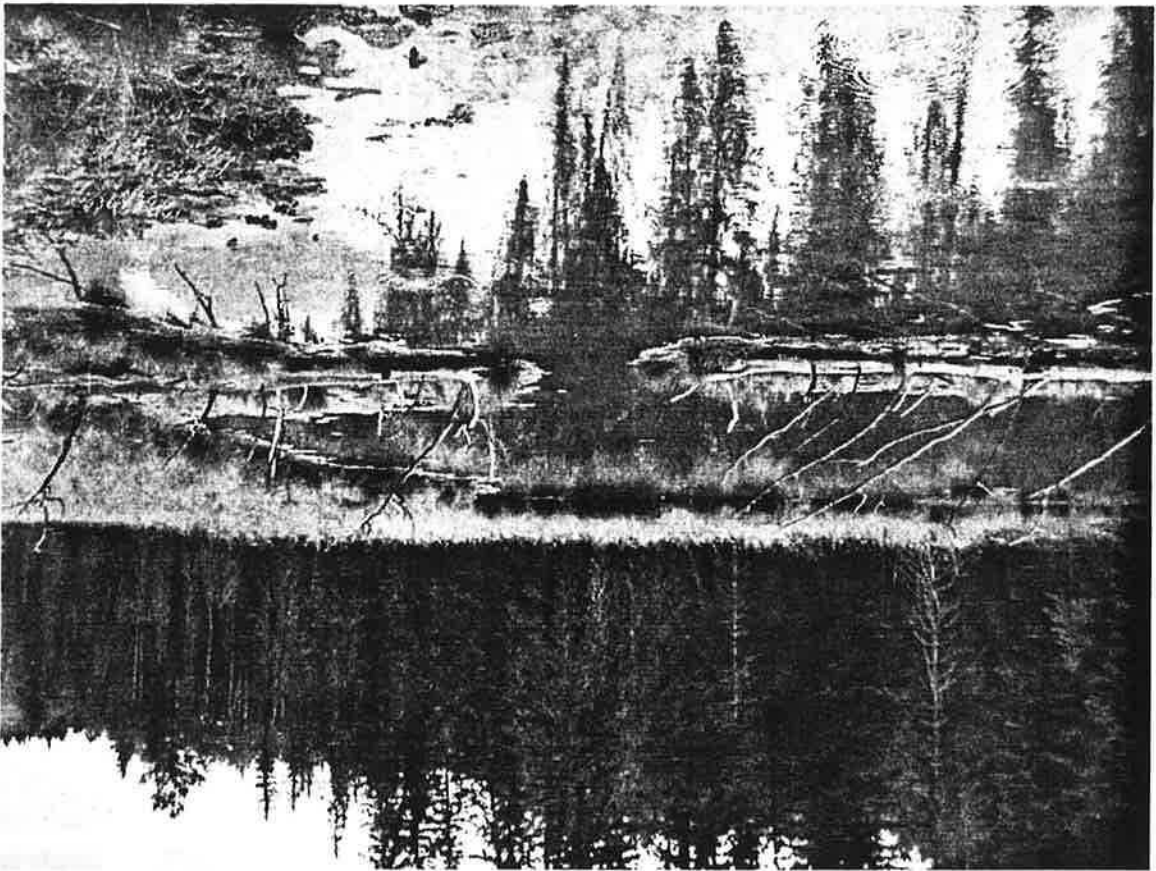


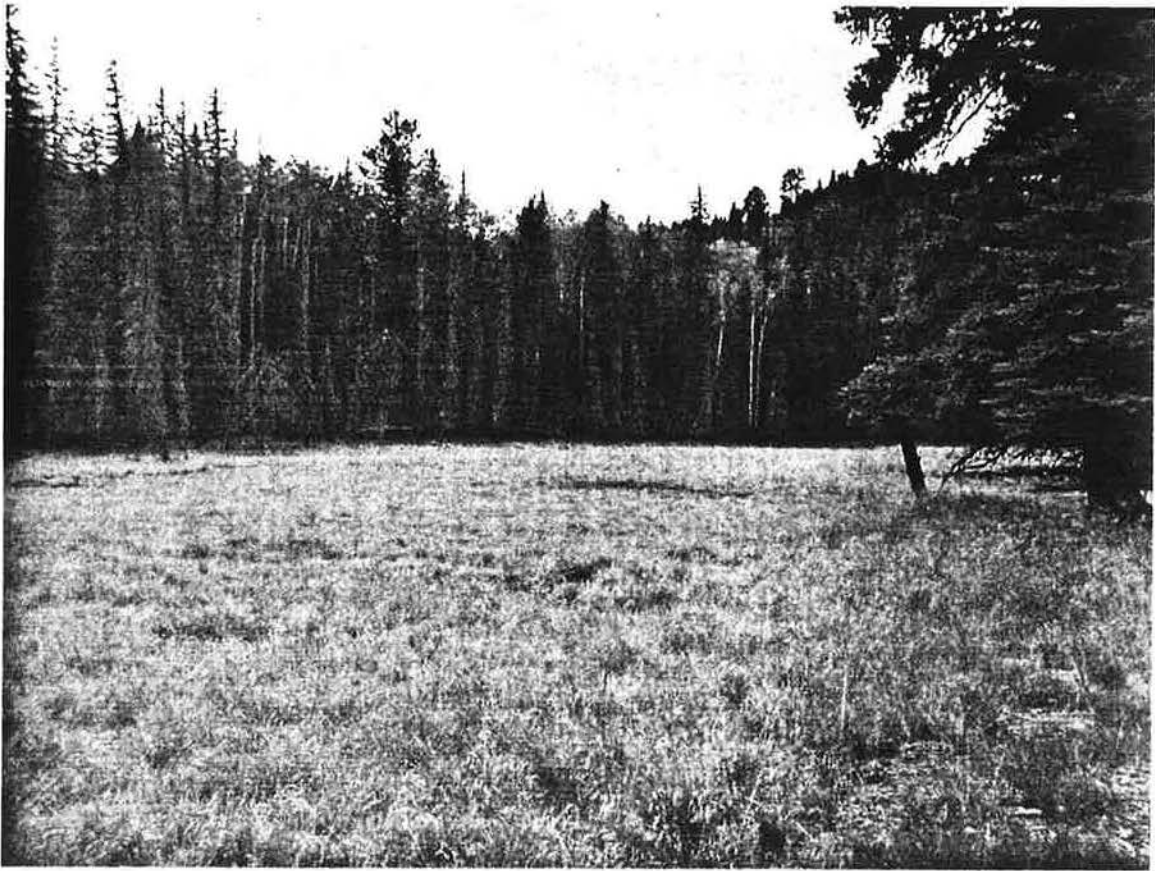
Photograph 1 Start of perennial water Sulfur Creek just above confluence with Alamo Creek



Photograph 2 Sulfur Creek looking toward confluence with Alamo. Well Head in background.

Photograph 3 Pond head end of Alamo Creek near well head Summer of 2000



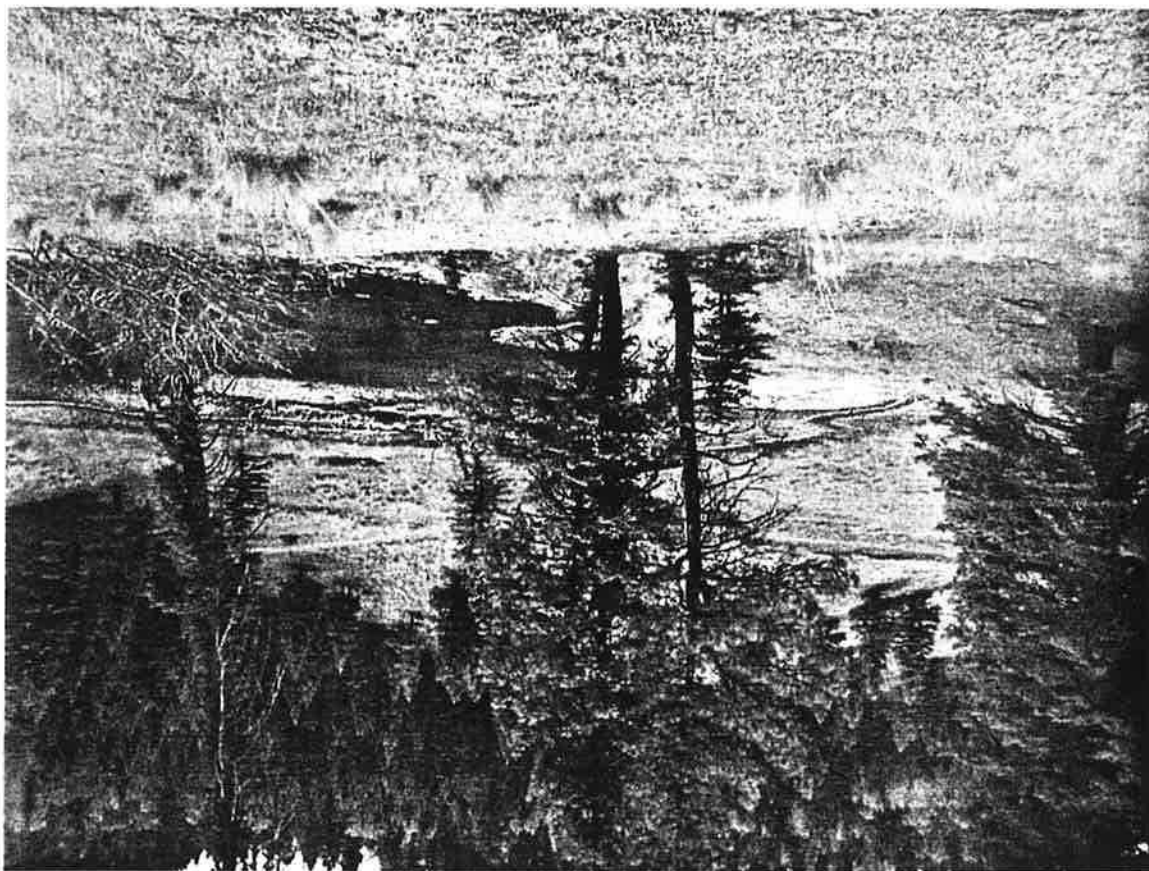


Photograph 4 view across Alamo Creek near upper well head just below pond (photo #3)

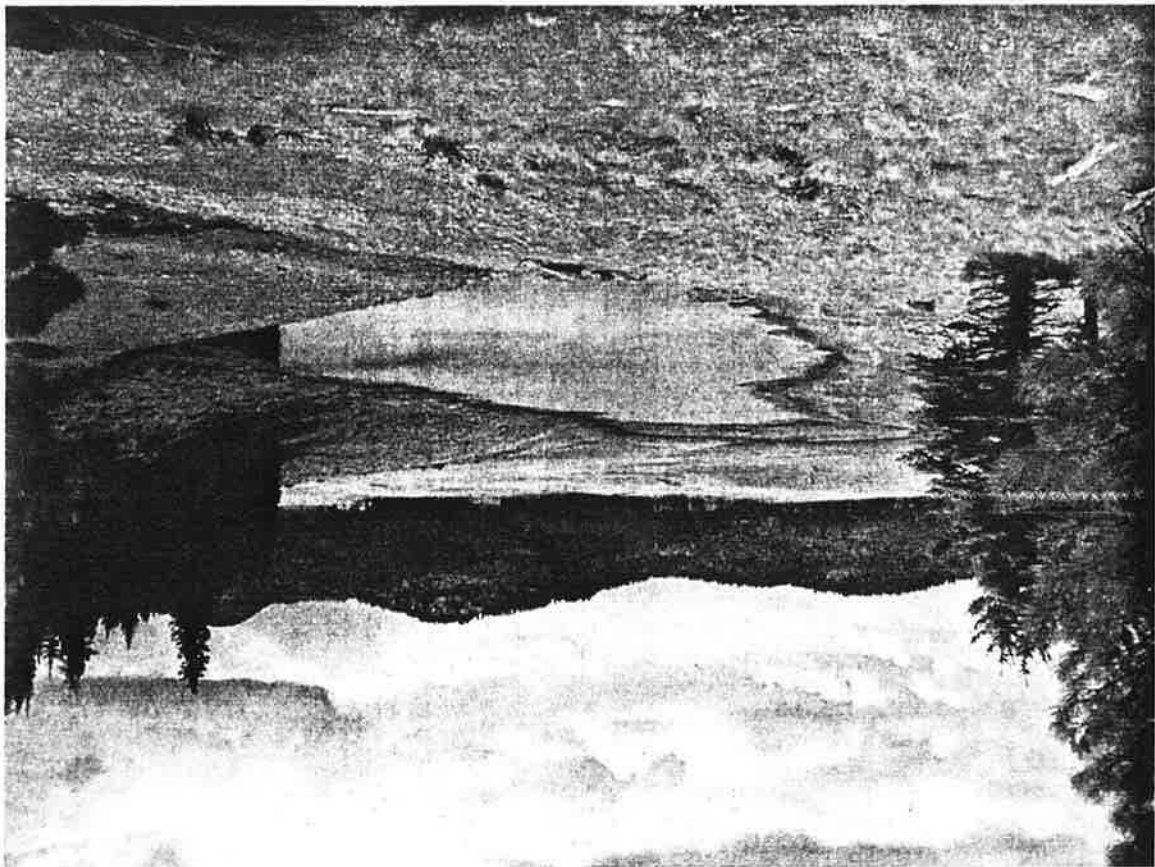


Photograph 5 View across Alamo Creek between stock tank and pond.

Photograph 6 Stock tank on Alamo Creek.



Photograph 7 Large stock tank west end of Valle Seco



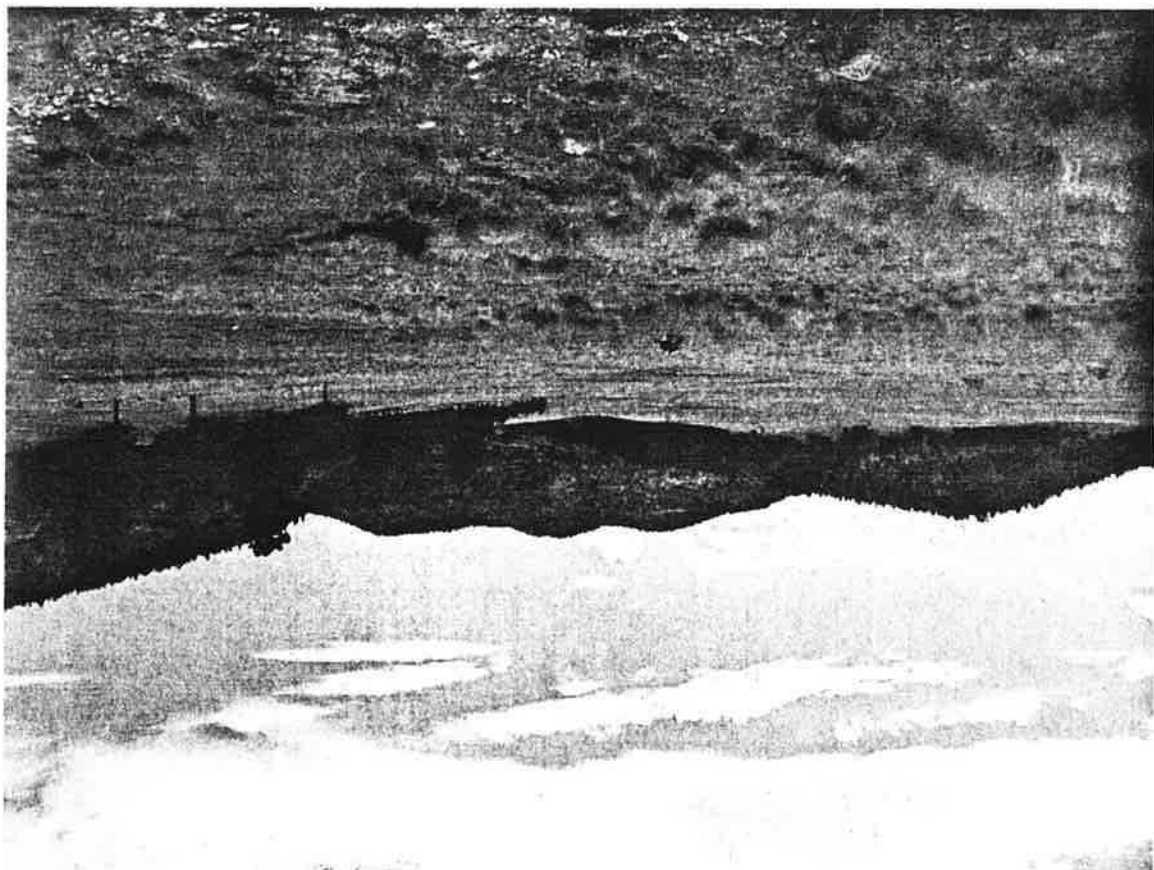


Photograph 8 View Across Valle Seco Summer 2000



Overview of hill slope photo Point

Photograph 9 View across Valle Seco (from east end looking west)



Baca Photo Points

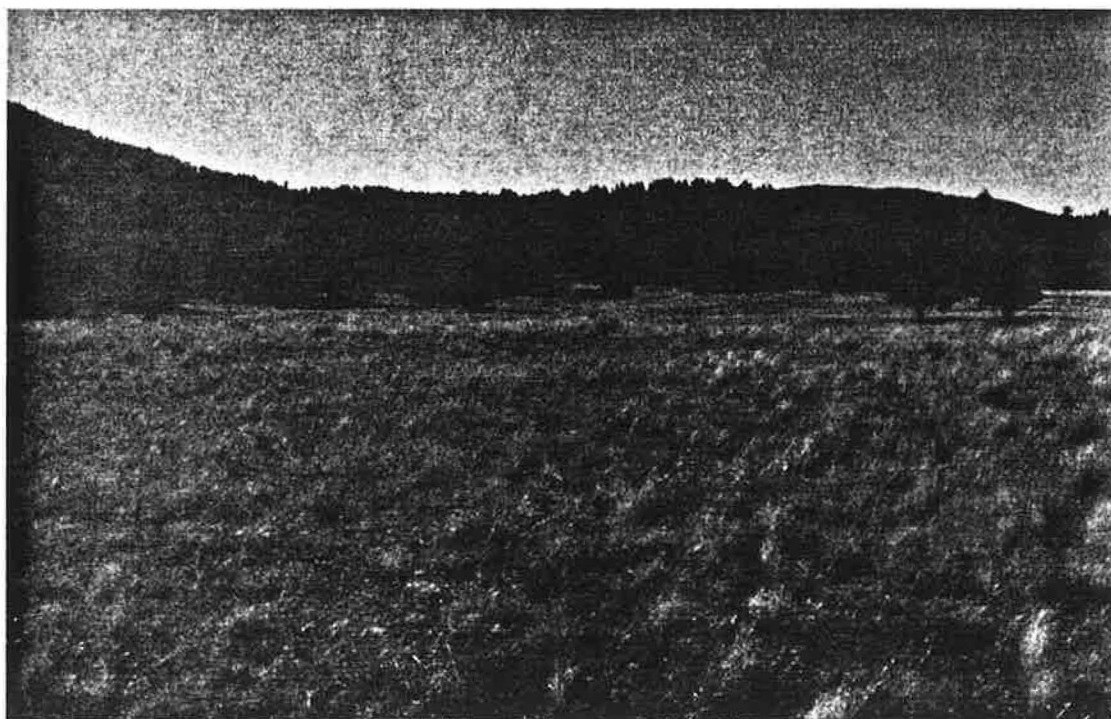
1. Jaramillo Creek small lateral head-cut above PFC section northwest from
a. 35 degrees 54.015 minutes north, 106 degrees 29.148 minutes west
2. Jemez head cut above spring
a. 35 degrees 52.328 minutes north, 106 degrees 26.724 minutes west
3. Disturbed Upland location on saddle between Jemez and San Antonio
a. 35 degrees 54.815 minutes north, 106 degrees 25.198 minutes west
4. Spring at west end Valle Toledo with incised drainage below
a. 35 degrees 57.564 minutes north, 106 degrees 29.296 minutes west
5. Swale south of confluence of Indian Creek
a. 35 degrees 57.608 minutes north, 106 degrees 29.408 minutes west
6. Hill a juncture between Valle San Antonio & Valle Santa Rosa
a. 35 degrees 58.201 minutes north, 106 degrees 31.209 minutes west
7. Head cut in upper Sulfur Creek
a. 35 degrees 55.831 minutes north, 106 degrees 35.458 minutes west

Jemez head cut photo point



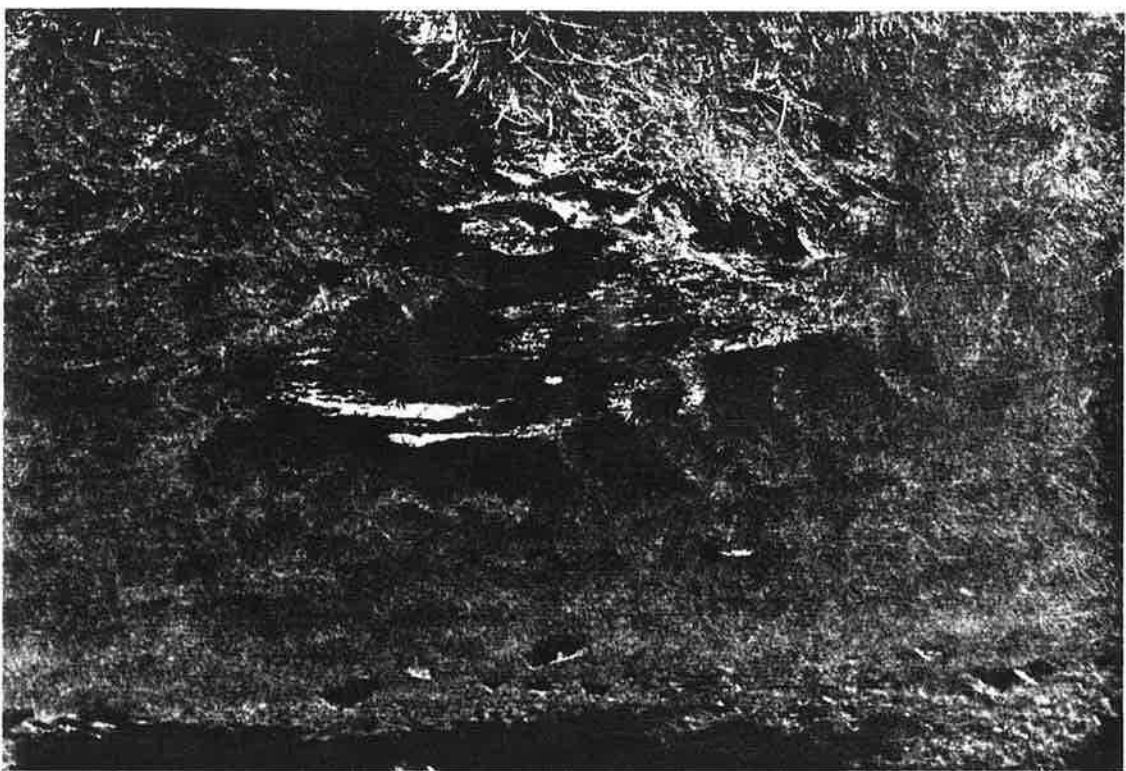


Upland Photo Point Summer of 2000

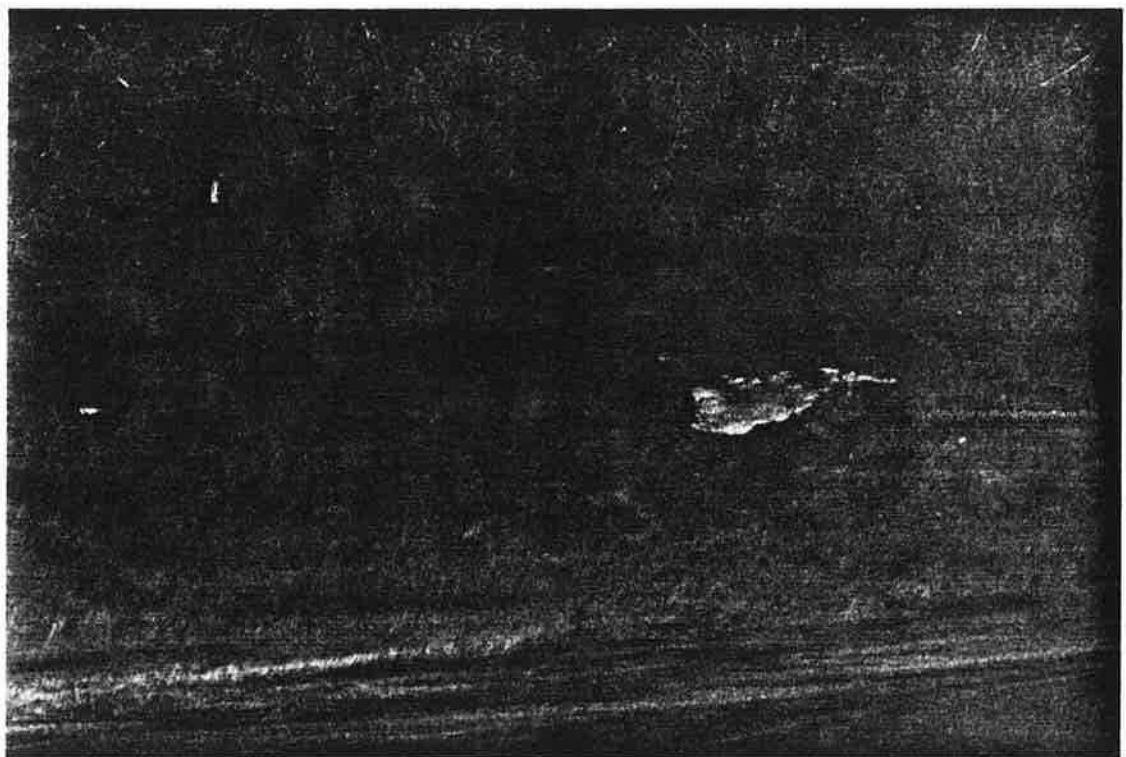


Photograph 1

Photograph 2



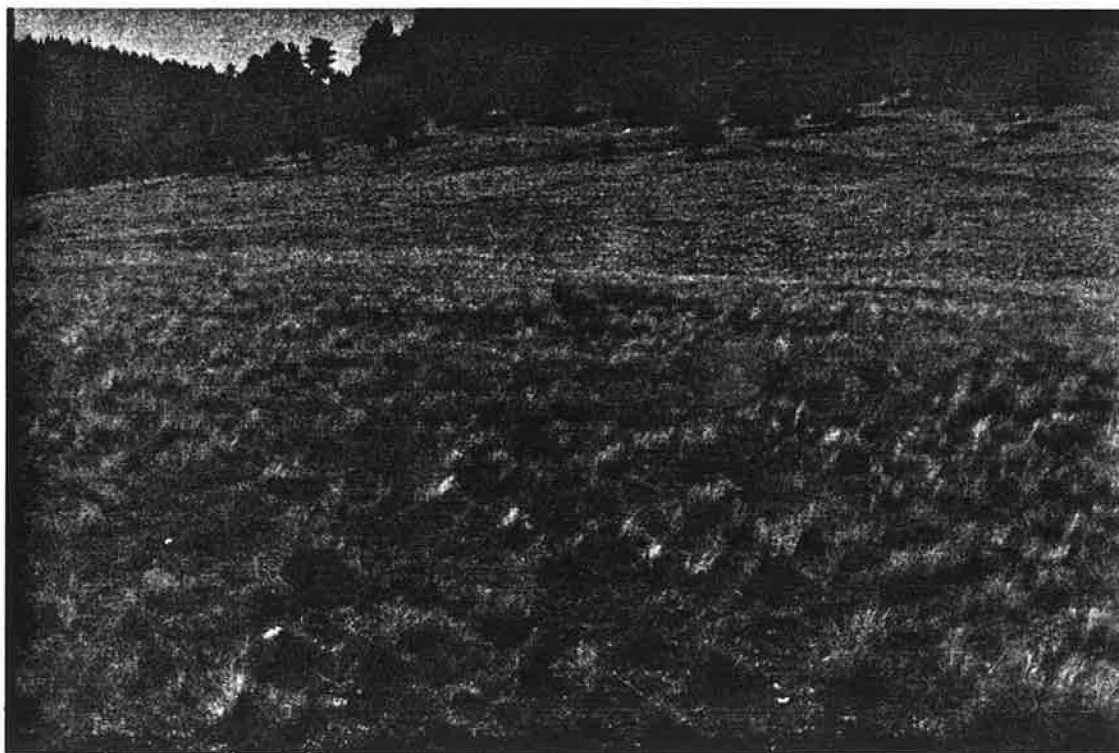
Spring Photo Point Summer of 2000





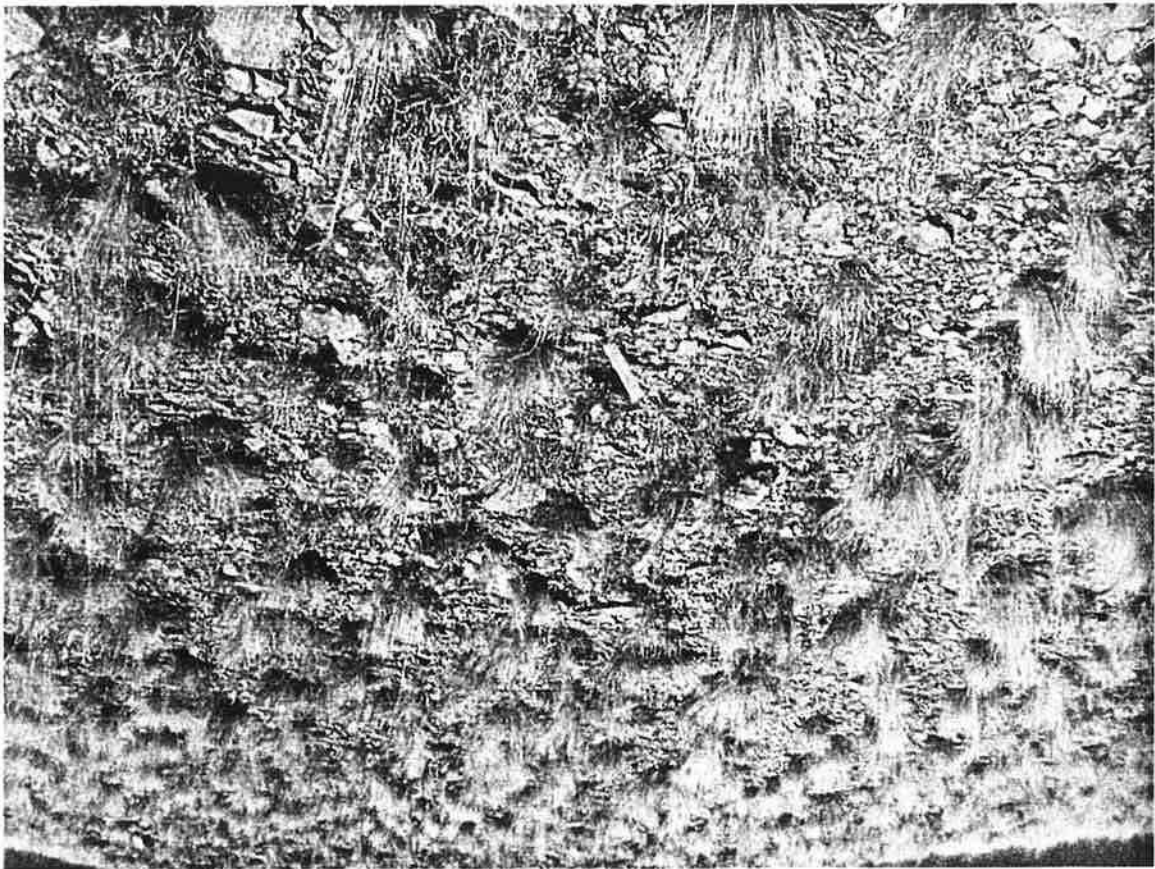
Swale photo point

Swale Photo Point Summer of 2000

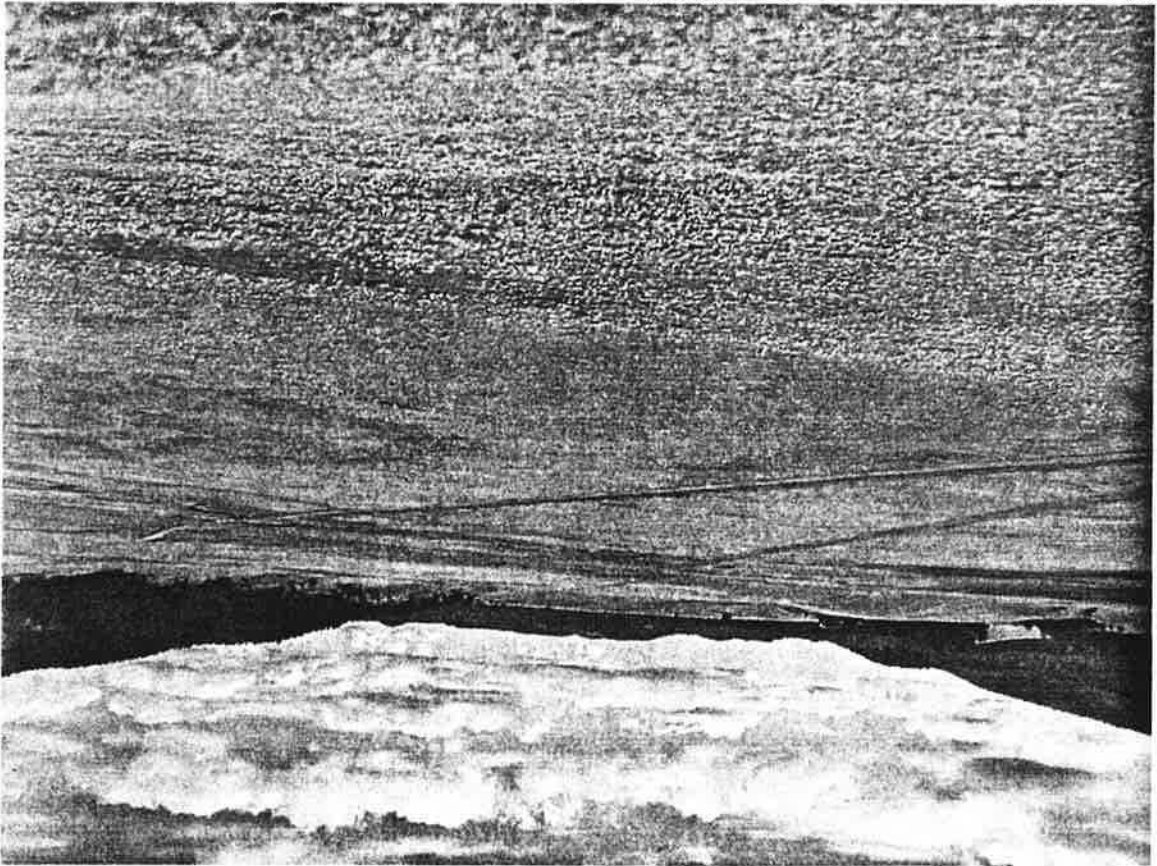


Over view of Swale photo point

Hill slope photo point



View of Valle San Antonio from Hill slope photo point Summer of 2000





Photograph 1 Close up Sulfur Creek photo point summer of 2000



Photograph 2 Head Cut upper Sulfur Creek Photo Point