DRAFT FIELD OBSERVATIONS REPORT

ATLAS ASBESTOS MINE COMPLEX

Prepared By:

Al Amen, Soil Scientist
Rhio Jackson, Reclamation Specialist
Eric B. Janes, Hydrologist
Al Riebau, Air Quality Specialist
Paul Summers, Hydrogeologist
Bruce Van Haveren, Project Manager

Division of Resources
Service Center
Bureau of Land Management
Denver, Colorado

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INTRODUCTION

The June 13-16, 1988 field trip was very well planned and implemented by the Bakersfield District and the Hollister Resource Area staffs. We received an excellent review of the area from the Aqueduct/Arroyo Pasajero area to and through the Atlas Mine Complex and over San Benito Mt. into the Clear Creek Basin. Our thanks and compliments are extended to Steve Addington, John Key, Tim Moore, and Dave Phillips for their hard work and enthusiasm which was very apparent during the field visit. On the first day, the SC technical team members were provided with well organized briefing packets that contained useful maps, related reports, and background information.

This draft report has been prepared promptly in order to be available for the management discussions that will take place July 5-8 at an Atlas Mine review. Under this timetable, some of our observations are of necessity tentative, without benefit of laboratory results or the opportunity for a complete team meeting since leaving California.

The general format of our report is: Observations, Additional Actions (including supplementary data collection and field investigations), and Report Summary.

In the past 5 months, we have incorporated in our work on Atlas an interdisciplinary approach that utilizes the following:

1. personal familiarity and experience with the Atlas area, serpentine soils, and contaminant transport;
2. site examination;
3. literature search and document review; and
4. review of supporting documents of many participating, affected, and regulatory organizations.

We estimate a final report will be forthcoming by August 8, 1988. Our initial observations and tentative determinations will be clarified through supporting information and analysis and further team discussion.

OBSERVATIONS - ATLAS MINE SITE

Soil and Vegetation Relationships

The soil survey (Order 3) identifies two main units--767 Atravesada-Pits, mine complex, 30 to 65 percent slopes; and 769 Dumps-Pits, 2 to 65 percent slopes--occurring within the Atlas Mine area and the adjoining Serpentine area. These map units are composed of one main soil taxonomic unit (the Atravesada soil) and two land types (Pits and Dumps). However, more detailed observations indicate the occurrence of three major soil taxonomic units, each reflecting a related vegetative cover, inherent productivity, erosion hazard, and potential source for soil (favorable plant growth) materials. The three major soil taxonomic units are described in the following paragraph.

The Atravesada soil is a well drained, shallow (10 to 20 inches) soil forming over Serpentine rocks with a high content of asbestos. These shallow soils occupy ridge tops and steep side slopes and are subject to a high erosion hazard. In addition to the Atravesada soil, moderately deep (20 to 40 inches) soils with thick reddish brown loam and clay loam subsoils commonly occur on smoother slopes and in cove and pocket-like areas. Small areas of deep soils occupy the concave cove-like areas, toe slopes, alluvial fans, and the narrow elongated tributary streams. The moderately deep and deep soils are forming in materials of more mixed origin.

On-site observations indicate the depth of soils forming from Serpentine have a strong influence on vegetation cover due to low water-holding capacity, restricted soil depth for root penetration, and stronger chemical effects of the inherent Serpentine parent material. These soils are generally high in base saturation and exchangeable magnesium and low in percent of exchangeable calcium causing a low calcium to magnesium ratio. They are also commonly low in available nutrients mainly nitrogen, phosphorous, and potassium.

Soil characterization data done by the USDA, SCS National Soil Survey Laboratory are available for the Atravesada soil. This information can be extrapolated to represent the shallow soils within the Serpentine area. The ~~moderately deep soil needs to be analyzed since it represents a large portion~~ of the area and has a higher inherent productivity.

Barren areas of weathered Serpentine rock commonly occur throughout the Serpentine area (See Photo and Figure). Observations indicate these areas were possibly created by accelerated erosion caused by fire which removed the vegetative cover from the shallow residual soils that once occupied these areas. The steepness of slope and chemical and physical characteristics of these barren areas strongly inhibit establishment of native plants. Some of these areas are used for ORV activities within the Clear Creek Management area.

The sparse vegetation established on the Atlas Mine site is inhabiting micro environment niches. These niches are void of the surface crusting and cementing phenomena typical of much of the mine site. Furthermore, these niches are characterized as having at least minimal topsoil mixed with the mine waste material and rock fragments (See Photos and) indicating the possibility of mixing materials to provide a plant growth medium. It appears these niches may have formed as a result of surface water flow transporting soil and seeds on to the mine site. This observation is supported by the fact that the majority of plants are established along small surface water flow paths and produce small seeds that require minimal soil covering for germination.

Soil (favorable plant growth materials) source areas are very limited within the Serpentine area. Some very small localized areas could be used; however, extreme caution must be taken to avoid exposing the weathered Serpentine rock or creating an erosion hazard. Stripping concave draw areas for use as spoil disposal areas and stockpiling the limited favorable growth materials for use in providing plant growth materials for surfaces could be effective. This could have been done at the Joe Pit Mine (operated by the King City Asbestos Company) as the adjoining concave drainage is being used for the spoil disposal (Figure 1 and Photo).

The phenomenon of "ice wedging," where cracks and wedges are created in upper soil profile horizons by frost action allowing soil surface materials to accumulate, provides a micro niche for plant establishment (Figure). This natural process can be mechanically replicated as a reclamation practice to establish plant cover on the Atlas Mine site. It has the advantage of requiring minimal new plant growth medium.

Mine waste and spoil material seem to absorb and retain moisture well. When sampling these areas, the surface 2 to 3 inches were dry and the underlying material was moist, indicating favorable water infiltration and water-holding capacity. We need to check for surface migration of more toxic materials.

Some soil piping is occurring within the spoil piles, indicating substantial infiltration and movement of water through the pile and also that spoil piles were not adequately compacted (Photo).

Surface crusting of spoil pile and ore area surfaces commonly occurs (Photo), possibly due to slight cementation and wind sorting forming a desert pavement-like condition with the rock fragments ranging most commonly in gravel size (2 mm to 3 inches in diameter).

Pond-like and level terrace-like structures seem to be effective in holding sediments around the edge of the waste area and spoil piles. Actual erosion and sediment movement from the waste and spoil pile seem to be limited.

<u>Water Resources</u>

Perennial surface water, with the exception of ponded ground water, was not apparent at the Atlas Mine site. This is not an unusual occurrence for this Mediterranean climate area since precipitation is limited (15-16"), and the drainage area above the millsite and spoils is relatively small.

Wet years (e.g., 1978, 1983) have not yet brought the spoils to such a saturated condition that pile stability is threatened. However, 1972-1988 have included several drought periods. Abnormally wet weather or extensive surface disturbance to the natural armoring of asbestos spoil (1988-1998) could reduce the stability of the spoils that we see today.

Surface water erosion of the mine spoil is minimal at present and is restricted to soil piping and discontinuous gullying on the east end. Both observations suggest high infiltration capacities in handling the past 16 years of storm events. A harsh set of differing precipitation events with less frequent dry spells could accelerate this erosion.

Coarse rock watershed cover imbedded in the natural spoil crusting (armoring process) is effectively absorbing raindrop energy and minimizing surface material loss.

Accelerated runoff in the vicinity of the millsite is clearly associated with the main access road up White Creek, through the project area, and on to the ridge at Spanish Lake. This runoff and associated material loss is caused by improper road drainage and mining exploration trails/roads. Extensive removal of vegetation in off-site areas has increased runoff. This uncontrolled runoff has caused deep ditchcutting through undisturbed soils at the toe of cut slopes and on steeper slopes. Most road drainage deficiencies could be easily corrected with water bars, proper placement of culverts, and with energy dissipators; however, some damage may be irreversible.

Asbestos fiber transport to Los Gatos Creek can be attributed more to off-site runoff and erosion down White Creek and from natural barren areas rather than from the Atlas millsite/spoil source areas. Relative amounts of this waterborne asbestos compared to air-transported asbestos amounts are not quantified; however, the air pathway may be more significant given the intermittent nature of surface-water flow as compared to year-round air movement.

Estimates of asbestos and sediment transport into surface waters off site from contributing areas to the main channels of White Creek and Los Gatos Creek have been made by Munn et al (1981) and by a Bureau of Reclamation contractor (personal communication, Dave Gore, 6/13/88). However, there are discrepancies between the two data sets which are not yet resolved.

The Atlas tailings dump is remarkably stable at present--both from a mass stability and surface stability point of view. Rills are not originating on the steep slopes of the dump. A few small gullies have developed on the dump, but they have been initiated on the compacted millsite pad where runoff concentrates. Although we did not dig any soil pits, we did observe that the tailings material was very moist just below the dump surface. Soil piping evidence also suggests a significant amount of percolation and lateral movement of water in the dump; however, there is very little evidence of water seeping out of the toe of the spoil pile.

Visual observations of the toe of the tailings dump indicate very little material moving off the dump and on to the undisturbed area below. An exception to this is the two or three gullies that have developed on top of the dump and are transporting material down the face of the dump. In the case of one gully on the east face, tailings material may be reaching an ephemeral drainage.

The tailings material appeared to have a very high water-holding capacity, an observation suggested by Scott Huntsman of Woodward-Clyde. Tailings samples collected by the team are being run for water retention characteristics. The results will be used to test preliminary field observations.

There is no visual evidence of mass instability on the tailings dump. We believe that surface and subsurface cracks on the dump are due to soil piping and to poorly understood forces in the spoil pile. We observed mass instability of a general nature at the top of the main ore production pit (Figure 1).

Potential sources of rock suitable for coarse fragment caps may exist in the area. Definite sources should be located and estimates made of available quantities.

The ground-water regime observed here is typical of a fracture-flow hydrogeologic system where a thin veneer of soil/regolith overlies fractured bedrock. Ground water occurs in two zones--an upper zone consisting of soil/regolith and a lower zone comprised of fractured bedrock. Specific ground-water conditions in the vicinity of the Atlas Mine site are characterized by fracture flow, low transmissivity, and fluctuating water levels. The quantity of water flowing in the system is believed to be relatively small and controlled by secondary porosity (fractures) within the Serpentine bedrock. Serpentine is not porous except for fractures that can transmit substantial quantities of water when fractures are numerous and interconnected. Water within the spoil pile may be infiltrating vertically to fractured bedrock. This could account in part for the lack of any seepage at the toe of the spoil pile.

Two springs were observed in the immediate vicinity of the mine, and several springs have been mapped by USGS on the Santa Rita Peak Quadrangle (1:24,000) at varying distances from the mine. These springs are located at elevations both above and below the mine site.

Ground-water conditions in the vicinity of the Atlas Asbestos Mine are characterized by fracture flow, low transmissivity, and fluctuating water levels. Ground water is not a critical component of the contaminant pathway of asbestos off site. However, ground water does have an important role in the long-term stability of the tailings piles.

Ground-water flow is discharged in many of the small gulches that occur throughout the area; therefore, the placement of mine tailings over discharge points can produce stability problems and possibly increase the sediment production from the tailings. Any remedial action plans that include reshaping or moving tailings need to include a detailed survey of ground-water discharge in the new storage area. Additional information needed prior to remedial action at this site is dependent upon the type of remedial action selected and the risk factors determined during the risk assessment.

The quantity of water flowing in the ground-water system at Atlas is believed to be relatively small. Ground water as a contaminant pathway that would endanger public health or the environment is believed to be of no significance. There appear to be no nearby ground-water users who would be at risk from asbestos transport in the ground water.

From a ground-water perspective, we suggest that, as the spoil pile becomes more saturated, internal hydrostatic pressures may increase until a sudden blowout of spent ore occurs near the toe of the pile. This would result in extraordinarily high sediment losses if this rubble were to reach a stream channel. The porosity of the tailing is likely very high (perhaps 50-60 percent or more). However, the spoil permeability is low, thus preventing seepage out of the pile. The fact that internal hydrostatic pressures have not reached this critical stage may suggest that the approximately 130-acre spoil pile is acting as a large porous reservoir, with much excess capacity to absorb and evaporate that fraction of the 15- to 16-inch annual precipitation which has an opportunity to percolate into the pile. Since drainage around the spoil pile on the north side is good, the spoil-pile water budget appears not to be influenced by runoff entering from upslope.

One of the two springs observed on the mine property has locally saturated the mine tailings and is believed to be responsible for the wide tension cracks observed along the road from the millsite to the upper production area (see Figure __).

Local BLM people reported that these tailings were saturated with ponded water ~~about June 1 where the road to the upper production area first crosses the~~ tailing pile. On June 14, the ponded water was gone, except for a very small pond on the east side of the road (see W-3/W-4, Figure 1). The source of this water is a small spring located northwest of the mine spoil. This same spring contributes ground water to the lower pond that is reported to be filled with water all year. Saturation of the tailings by discharge from springs can also induce failure of the pile due to high hydrostatic pressures. High pore pressures can take years to develop, but can result in sudden failure of the mine spoil.

Although asbestos is not likely moving through the ground-water system, other contaminants such as heavy metals may be transported in this manner. In any case, a review of down-gradient wells and springs for these pollutants should be conducted to clarify concerns.

Air Resources

The Atlas Mine presents several interesting air quality problems. First among these is the fact that no true asbestos fiber emission factors (e.g., the amount of pollutant emitted into the atmosphere) are available for the mine spoils and other surface materials. The lack of emissions factors derived from on-site testing makes accurate estimates of the actual contributions to health hazards from the inhalation of asbestos from the mine impossible. The lack of these factors also makes choosing treatments of the mine spoils to lower emissions, such as surfacing or chemical stabilization, difficult because there can be no methodology to develop criteria for success. In addition, the lack of emission factors from the mine site and the Clear Creek Management area (CCMA) Serpentine soils makes attribution of relative asbestos particle contributions from these areas to the EPA collected air sampling data impossible. Finally, the pathways of air transport off the Atlas Mine site need to be defined through modeling using the Topographic Air Pollution Analysis System (TAPAS) models to determine if winds are likely to carry asbestos particles to populated areas such as Coalinga.

At the Atlas site, it was observed that some spoils were crusting. This crusting mechanism appears likely to reduce airborne particle (and thus asbestos) emissions. Sources near the site, such as naturally uncrusted devegetated areas of Serpentine soils, upon visual inspection appear to be sources for asbestos emissions of potentially as high probability as the Atlas site itself. Off road vehicle activities on the Serpentine areas and vehicle traffic on CCMA roads appear to be highly probable sources of particulate emissions that may endanger human health. Dry conditions enhance particulate emissions from all areas for all activities.

There are no data on off-site transport pathways (e.g., meteorological windfield field simulations based upon site monitoring data) to populated areas. There are no emissions factors for the Atlas Mine spoils and other surface materials, Serpentine soils, vehicle traffic on roads, or ORV activities. The effect of soil moisture on Serpentine soils/Atlas spoils emissions rates is not quantified.

OBSERVATIONS - ARROYO PASAJERO

Vegetation adjacent to the California Aqueduct in the Arroyo Pasajero Outflow area (managed by Bureau of Reclamation) may have been indigenous prior to man's manipulation of the area, but persists now only because of the annual flood waters or perhaps a shallow ground-water interaction (See Photo).

Dave Gore, Bureau of Reclamation engineer, stated that the Arroyo Pasajero Outflow area has been accumulating sediment at a rate that is twice what was originally projected. The Bureau of Reclamation is evaluating land-use practices to minimize erosion and resultant sedimentation in the Arroyo Pasajero Drainage Basin (including public lands administered by BLM). We strongly recommend sharing BLM mulch management techniques presently being utilized for grazing and watershed management in the annual grassland type.

The sediments deposited next to the aqueduct have loamy to clay loam textures characteristic of material derived from mixed sources from the overlying series of tributary drainages within the Arroyo Pasajero Drainage. The Los Gatos Creek watershed is estimated to contribute 21 percent of the sediment yield (Munn, Busacca, and Trott, 1981). Observations indicate that most of the sediment is derived mainly from soil areas other than the Serpentine area. Soil texture seems to be more clayey than the soil sample analysis results in the report, Soil Sampling Data Report for the Atlas and Coalinga Sites, indicates. The soils are very productive, as illustrated by irrigated crops within the area, and show no significant toxic effects to plant growth. The Bureau of Reclamation has indicated that they need to remove sediments accumulated in the Arroyo Pasajero Outflow area. These sediments may be an excellent source of top dressing material for the Atlas Mine site as well as for other disturbances in the Clear Creek Management area.

OBSERVATIONS - JOE PIT ASBESTOS MINE

We noted that this is a very organized mine operation as viewed from a distance. Time, however, did not allow the opportunity for a thorough inspection of the mine. The orthophotoquad (Figure 1) indicated some potential problems. The waste-rock dump built in the draw east of the mine operation was, at that time (August 1981), ponding water immediately upstream of the dump, suggesting that no drainage facility was installed to pass channel flow through or around the dump. A hydrologic analysis should be made of this basin to ascertain potential flood risks, an item that should be addressed in the revised "Plan of Operation." The SC technical team would be pleased to assist the Hollister Resource Area and Bakersfield District staffs in their review of the revised Plan of Operation when it becomes available.

OBSERVATIONS - CLEAR CREEK MANAGEMENT AREA

The plant communities in the Clear Creek Management area seemed quite similar to the Knoxville area, Ukiah District. This was confirmed by Steve Addington who mentioned that the Clear Lake Resource Area Manager has recently visited the Clear Creek Management area to view and discuss similar asbestos concerns.

Plant species occurring in the Clear Creek Management area reflect a fire disclimax ecological setting.

The greatest diversity of perennial vegetation, dominated by manzanita, whitethorn buckbrush, leather oak, and chamise with an overstory of Digger and Jeffrey pine, occurs on the deeper soils overlying the Serpentine formation. As these cap soils erode, Digger pine and some manzanita persist. Fire and natural instability of the area probably are the primary erosional agents that lead to barren Serpentine exposures.

ADDITIONAL ACTIONS INVOLVING SC DIVISION OF RESOURCES

Laboratory Results

Seven water sample asbestos determinations by the Transmission Electron Microscopy (TEM) method and soil sample analyses are expected back to us by approximately July 15. Water and soil sample sites are located on Figure 1. These data will be evaluated and discussed in the August 1, 1988 final Atlas report. One soil sample each was taken from the mine area and from the spoil pile for chemical and physical analysis. The purpose was to determine the potential of material for plant growth. Water samples are being analyzed by the R.J. Lee Group at Berkeley.

Report Reviews

The SC technical team will be providing review comments and recommendations to Hollister Resource Area on three reports: the GIS Technical Proposal, the Woodward Clyde Risk Assessment, and the EPA proposal for Regional Source Assessment of Asbestos. When the SC receives the Hazardous Ranking System scoring sheets from Greg Baker of EPA, an evaluation of the scoring will be made for the Area Manager. Of course, the draft Remedial Investigation and Feasibility Study will be reviewed by the SC upon receipt.

Supplementary Data Collection and Field Investigation

Additional information needed prior to remedial action at this site is dependent upon the type of remedial action selected and the risk factors determined during the risk assessment.

The EPA is currently conducting a Remedial Investigation/Feasibility Study. This process has the purpose of defining the nature and extent of contamination at the site to the extent necessary to evaluate, select, and design a cost-effective remedial action. The Feasibility Study (FS) uses data from the RI to develop response objectives and present alternative remedial responses. These alternatives are then evaluated in terms of their engineering feasibility, public health protection, environmental impacts, and costs.

Until the RI process is completed, the following supplementary data/investigation requirements cannot be defined except in general terms. Therefore, the following concerns have been identified where additional data are deemed necessary regardless of the type of remedial action selected:

1. Conduct Revegetation field trials at the Atlas Mine site. This may be complemented by additional trials conducted at the Joe Pit Mine and the natural area. Specific locations for the vegetation trials should reflect the varying site conditions such as mill tailing piles and mine rock waste areas that occur at the Atlas Mine and areas to be tested thereby providing maximum technology transfer to other disturbed sites in the Clear Creek Management area.

Specific information on plot layout and design; sampling procedures; plant materials; and variables of top dressing, amendments, and cultural practices will be addressed in the final field report to the Hollister Resource Area.

2. Supplement the revegetation field trails with greenhouse studies. Several growth years can be represented in a single year under controlled conditions thereby yielding valuable information in a shorter time span than field trials. Again, further details will be included in the final report.

3. Conduct a meeting at Colorado State University for Bakersfield District/HRA personnel on how emission factors might be developed for the Atlas Mine complex. At the meeting, TAPAS modelling will be conducted, as proposed, subject to management approval by WY State Director.

4. Make measurements for the development of emissions factors using a portable wind tunnel.

5. Supplement the West Fresno County Soil Survey and update the San Benito Soil Survey for the portion covering the Serpentine area. To provide more specific soil interpretation for mine reclamation, additional detail is needed to identify key soil taxonomic units so that soil sample analyses can be extrapolated more accurately. This will also provide more effective soil data themes for the GIS. We suggest the use of Soil Landscape Project Methodology (SLAP) procedures to supplement the soil survey. This will utilize GIS and incorporate DEM and Landsat data.

6. Acquire chemical and physical analyses for the mine waste area and spoil pile material to determine reclamation potential and for design of remedial actions/alternatives. Chemical analyses need include phytotoxicity and nutrient deficiencies. Physical analyses needed include properties related to water retention/movement and stability.

7. Obtain additional soil characteristic data that represents key soil taxonomic units occurring in the Serpentine area. Locations are identified on orthophotograph, Figure . Chemical and physical analyses of major soil horizons are needed to determine soil-plant relationships within the area and revegetation potential.

8. Acquire geologic information that identifies locations of hard rock (dikes, etc.) for use as coarse fragments in plant growth medium, as rip-rap for erosion control, and as support structures (berms for spoil piles).

9. Core sample spoil pits to gather information related to moisture content, water movement, and water-holding capacity. This information will be used to determine the stability of spoil sites as well as reclamation techniques and land shaping. It is important to know what the outlook for long-term stability of the spoil-pile is if left in the present configuration.

10. Drill small-diameter monitoring wells into the tailings and install water-level observation wells and piezometers to measure hydraulic head trends within the spoil pile. Determine the percent saturation of the spoil pile.

11. Utilize cone penetrometer tests on the tailing piles to determine geotechnical properties of the material that has been placed on the piles. Some of the geotechnical parameters that can be measured by the cone penetrometer test are stratigraphy, undrained shear strength, internal angle of friction, and permeability.

12. Measure water levels in the observation wells and springs regularly to establish seasonal variability, if any.

13. Take water quality samples within the tailings and from the nearby springs (heavy metals from springs). Conduct additional water quality monitoring of flow coming around the spoil pile and into drainages below the pile tributary to White Creek. Determine the quality of springflow on and off the mine property.

SUMMARY

A recommended approach for reclaiming any disturbed site involves the following basic steps:

- Problem identification
- Problem analysis
- Treatment feasibility
- Analysis of alternatives (including cost effectiveness)
- Selection and enhancement of preferred alternative
- Project design
- Project implementation
- Monitoring

We are concerned that the data collection phase undertaken by EPA has not provided an information base sufficient to complete the problem analysis step and would not lead to an adequate treatment feasibility analysis. This conclusion is based on the previous discussion of data gaps.

A possible role for the SC technical team would be to supplement the problem analysis and treatment feasibility steps that EPA integrates in their RI/FS efforts.

The result would be a more substantial basis for selecting a "best practicable" treatment scenario that is both effective and reasonable.

The interim remedial resources being implemented by the Hollister Resource Area are, for the short term, appropriate and well thought out. They demonstrate a good understanding of processes operating at the Atlas site and a proactive agenda at implementing BLM management decisions.

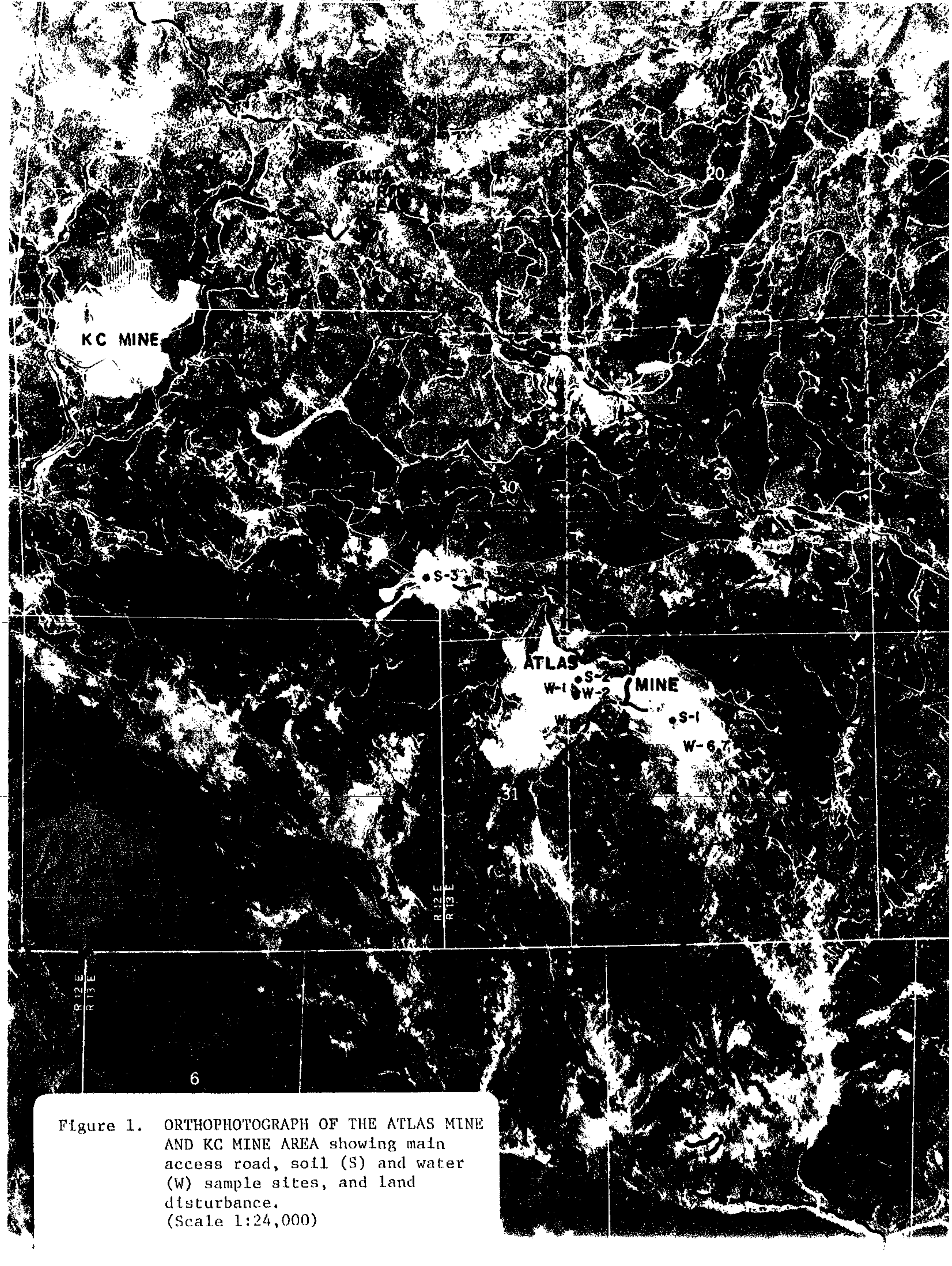

Figure 1. ORTHOPHOTOGRAPH OF THE ATLAS MINE AND KC MINE AREA showing main access road, soil (S) and water (W) sample sites, and land disturbance.
(Scale 1:24,000)