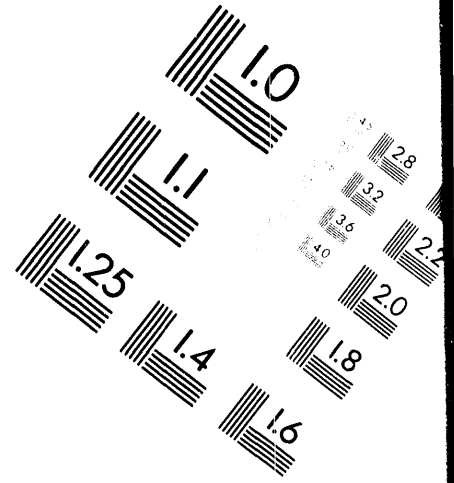
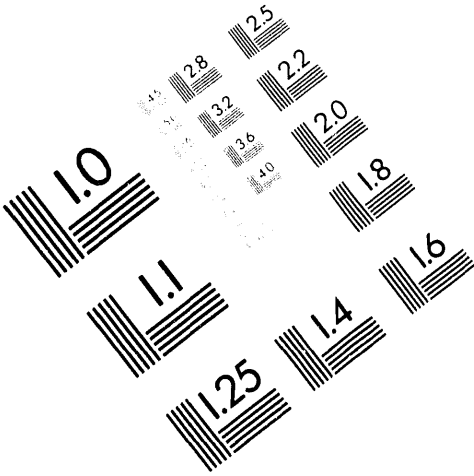




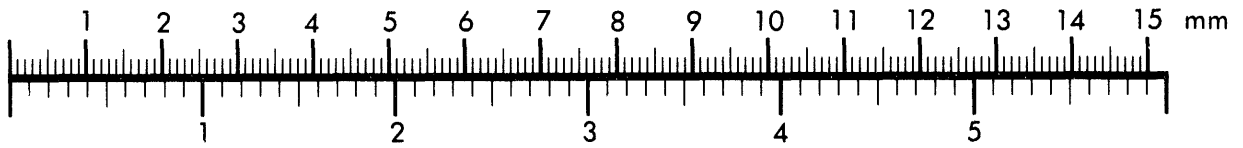
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**Association for Information and Image Management**

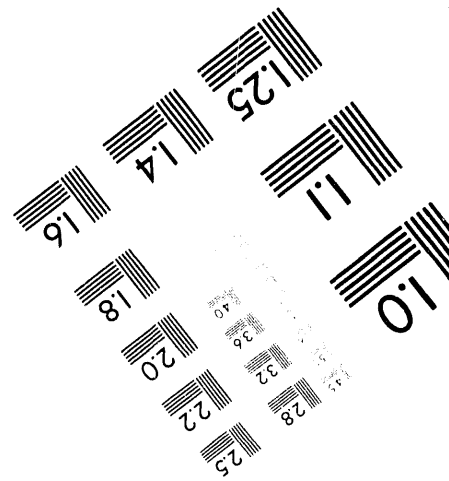
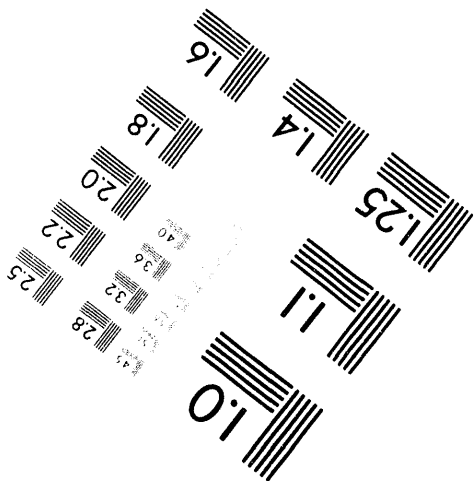
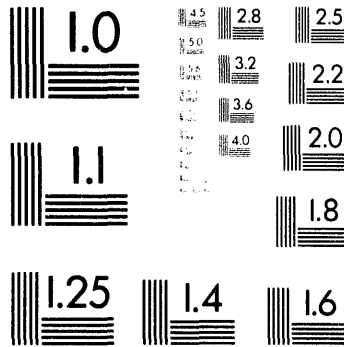
1100 Wayne Avenue, Suite 1100  
Silver Spring, Maryland 20910  
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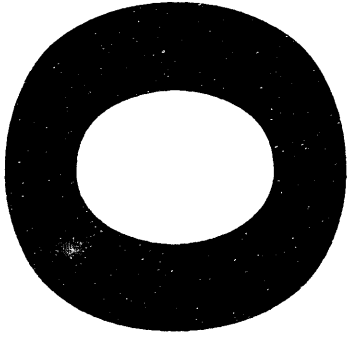
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BY APPLIED IMAGE, INC.



**GREAT BASIN PALEOENVIRONMENTAL STUDIES PROJECT  
TECHNICAL PROGRESS REPORT  
FOURTH QUARTER  
March – May, 1994  
Cooperative Agreement No. DE-FC08-93-NV11417**

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Reno, Nevada  
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**Submitted to:  
U.S. Department of Energy  
Yucca Mountain Site Characterization  
Project Office  
Las Vegas, Nevada**

**MASTER**

## **PROJECT AIM**

Examination of the paleoenvironmental and geomorphic records to determine the local and regional impact of past climates will advance the assessment of Yucca Mountain's suitability as a high-level nuclear waste repository. The project includes the integration of botanical, faunal and geomorphic components to accomplish this goal.

### **PALEOBOTANICAL STUDIES IN THE GREAT BASIN**

**Dr. Peter E. Wigand, Principal Investigator**

#### **Project Goals:**

Paleobotanical studies will reconstruct the response of vegetation to climate change at the community and the organismal levels in order to identify periods of mesic climate at Yucca Mountain and the adjacent region during the last 20,000 to 50,000 years. This is being achieved by integrating data obtained from continuous sediment records of pollen from lacustrine and playa sediments and by plant macrofossils and stable isotopes from fossil woodrat middens.

These data will be used to identify periods of much more mesic climate and provide information which can be used to estimate the magnitudes and durations of rainfall shifts by reference to modern distribution, characteristics and ecophysiology of analogous plant communities and/or indicator species. Of particular importance is determination of the amounts and actual duration of the availability of excess water during these periods. These estimates, in combination with those derived from ostracode and diatom analyses conducted by the USGS, will provide reasonable indications of variation in climate that can be used to reconstruct past extremes in infiltration rates that may serve as estimates of those that may be expected during the next 10,000 years at Yucca Mountain.

Evidence of periods of increased erosion related to increased runoff derived from the geomorphological studies will be linked with paleozoological data to refine estimates of the duration and magnitudes of such excess water availability. In this way, estimates of climate derived from the terrestrial environment can be compared with those derived from lacustrine environments to arrive at secure inputs for hydrological models of recharge.

#### **Progress on Tasks:**

##### **Palynological:**

Task 1     Extend the present 4,000 year vegetation history record from Lower Pahranaagat Lake, southern Nevada. This will provide baseline data to generate transfer functions for the interpretation of less complete Pleistocene paleoclimatic proxy records. Lower Pahranaagat Lake also provides the eastern terminus of a network of sites that straddle the Nevada Test Site and Yucca Mountain. As such, it will establish the regionality of any climate patterns that are revealed.

*Paleobotanical Continued*

*Progress: During the last quarter, we have completed counting additional samples from Lower Pahranaagat Lake. We now have 128 samples counted or approximately a sample for every thirty-one years. In addition, we have made final arrangements to continue coring Lower Pahranaagat Lake and Upper Pahranaagat Lake to extend the present 4,000-year-long vegetation history into the middle Holocene and perhaps into the Pleistocene. Preliminary results from ostracode samples submitted to Dr. R. Forester of the USGS appear to confirm some of the paleoclimatic conclusions derived from the terrestrial pollen record.*

**Task 2** Assemble a modern plant community pollen database.

*Progress: Assembly of a modern plant community pollen database has continued during this quarter. We have been setting out passive pollen traps this winter along elevational transects and near established weather stations so that modern weather data can be tied directly to the pollen record.*

**Task 3** Assembly of available palynological data from the Intermountain West into a data base, including the augmentation of the data from some of the localities previously examined by DRI in order to accomplish the goals of the project. This includes the submission of radiocarbon dates and tephra analyses for the resolution of chronologies and analyses of pollen samples taken at closer intervals to resolve the rates of climate change, their magnitude and the response of the vegetation community.

*Progress: Assembly of available palynological data from the Intermountain West into a data base is proceeding. In addition, we are putting the data into a format conforming with the guidelines followed by the National Geophysical Data Center.*

**Task 4** Coring selected southern Nevada localities for paleoenvironmental records.

*Progress: The requisite state-wide and local permits have been obtained from the BLM and Fish and Wildlife Service for the coring of selected southern Nevada localities for paleoenvironmental records. We expect to receive permission and verification of our schedule to core Indian Springs Playa and Three Lakes Playa within the month. We will be coring Lower and Upper Pahranaagat Lakes in July of 1994.*

**Paleonidological:**

**Task 5** Assemble available woodrat midden data from the Intermountain West into a database.

*Progress: Assembly of available woodrat midden data from the Intermountain West into a data base is on going. We are in correspondence with other investigators in an attempt to fill in gaps in the data where necessary.*

*Paleobotanical Continued*

Task 6 Process samples already collected that are pertinent to the goals of the project.

*Progress: Samples previously collected from the Pahranaagat Range of southern Nevada have been processed. Stable isotopic samples will be run on materials from these midden strata in the near future. Radiocarbon dates on twelve additional midden strata from a midden locality spanning 35,000 years near the northern terminus of the Great Basin climatic transect has increased the data base for that locality to forty-one dates. Insect remains from these woodrat midden samples continue to be analyzed by Dr. S. Elias, a subcontractee.*

Task 7 Collection of modern vegetation and climate data pertinent to interpretation of woodrat midden data in an analogue/nonanalogue manner.

*Progress: Collection of modern vegetation and climate data pertinent to interpretation of woodrat midden data for use in analogue/nonanalogue comparisons is on-going. These localities correspond, as much as possible, with the pollen collection localities mentioned above.*

Task 8 Select, collect and process new midden localities that are pertinent to the goals of the project.

*Progress: Recollection of old localities in southern and central Nevada was performed in May in order to flesh out the records from these areas. The localities were Owl Canyon in the Devil's Hole Hills, the Last Chance Range, Rainier Mesa, the Massachusetts Mountain area, and the Pahranaagat Range. Several of these localities are adjacent to places that are being or have been cored for pollen and ostracode records.*

**Problems Encountered:**

Nothing of significance.

**PALEOFAUNAS STUDIES IN THE GREAT BASIN**  
**Dr. Stephanie Livingston, Principal Investigator**

**Project Goals:**

The goal of this study is to construct a history of Great Basin vertebrates, particularly mammals, that will provide empirical evidence of past environmental and climatic conditions within the Great Basin as it is recorded by the animals. Taxonomic composition of archaeological and paleontological faunas from various areas within the Great Basin and morphological change within individual mammalian taxa at specific localities are being investigated to monitor faunal response to changing environmental conditions. Data are being obtained from published records, modern museum specimens, and raptor pellets to provide a modern control to which the paleofaunal data can be compared. This study will provide an independent set of surrogate data for use in building a model of past conditions and assessing the effects of past climate change on various aspects of the environment.

**Progress on Tasks:**

Task 1     Data collection from existing paleo– and modern–vertebrate collections.

*Progress: Data collection continues from the Floating Island Cave and Homestead Cave assemblages. A database of published Great Basin paleofaunas is compiled in a GIS-compatible format.*

Task 2     Field recovery of modern, archaeological, and/or paleontological vertebrate materials.

*Progress: The DeLong core for paleo–magnetic, ostracode and radiocarbon analysis is in progress. The field reconnaissance in Eureka Valley located two small rockshelters that may have the potential of stratified faunal remains.*

Task 3     Dating and other special analyses.

*Progress: Analysis of the core taken at the DeLong locality for chronological control is being conducted at University of California, Bakersfield under subcontract with Dr. Robert Negrini. Ostracodes from the core are being analyzed by Dr. Rick Forester, USGS, Denver.*

**Problems Encountered:**

No specific problems have been encountered.

**GEOMORPHOLOGY STUDIES IN THE GREAT BASIN**  
**Dr. Nicholas Lancaster, Principal Investigator**

**Project Goals:**

The objective of the geomorphology component of the paleoenvironmental program is to document the responses of surficial processes and landforms to the climatic changes documented by studies of packrat middens, pollen, and faunal distributions. This major objective will be achieved by a variety of projects designed to reveal the linkage between climate change and physical response. The project will focus on: 1) stratigraphic relationships between lake deposits and aeolian or fluvial sediments and landforms; 2) cut and fill sequences in floodplain and river-channel deposits; 3) identification of periods of dune mobility and stability; 4) documentation of episodes of alluvial fan and terrace development and erosion; and 5) correlation of (3) and (4) to climatically driven lake-level fluctuation as revealed by shoreline features such as strandlines and beach ridges. Numerical and relative dating of geomorphic events will be accomplished by a range of techniques including  $C^{14}$ , tephrochronology, dendrochronology, luminescence, and soil chronology.

**Progress on Tasks:**

**Task 1 Lacustrine Stratigraphy and Chronology.**

*Progress: Radiocarbon dates were received for two sets of samples from lacustrine deposits from the Black Rock Desert (Lake Lahontan) and Long Valley, Nevada (Lake Hubbs). Four dates from Lake Lahontan sediments were derived from core-sample ostracode specimens separated and analyzed by R. Forester, USGS. These samples document a rising Lake Lahontan in the period from ca. 22K BP to ca. 16K BP with a major fresh-water influx ca. 18K-17K BP (interpolated date). Five dates were obtained from ostracode and *Pisidium* tests taken from Lake Hubbs sediments. These samples document the presence of a pluvial lake in Long Valley from ca. 23K-14K BP. Manuscripts detailing the results of investigations in these two basins are in active preparation.*

**Task 2 Response of Alluvial Fans to Climatic and Base Level Changes.**

*Progress: During the past quarter, work in the Buena Vista valley pertaining to the relations between alluvial fan evolution and lake level of Pluvial Lake Lahontan has focused on four objectives:*

- (1) The completion of maps depicting the distribution of alluvial and lacustrine stratigraphic units, defined earlier, in the vicinity of the Klondike Canyon alluvial fan;*
- (2) The establishment of a relative and absolute chronology of alluvial and lacustrine stratigraphy for the Klondike Canyon area using  $C^{14}$  and relative age indicators;*
- (3) The determination of the timing and magnitude of local lake level fluctuations; and*
- (4) The development of a conceptual model of geomorphic response of the Klondike Canyon alluvial fan to both climatic change and lake level alteration.*



## *Geomorphology Continued*

*Preliminary interpretation of the data indicate that shoreline features (beach ridges and subaqueous bars) located in distal fan areas are late Pleistocene (12–14 ka) in age. However, older deposits may be located between younger deposits as lake levels fluctuated near the end of the Pleistocene. All of the shoreline features have been truncated by three younger fan surfaces believed to be of Holocene age. Little evidence is present of fan building or modification during the latest period of lake level regression. Thus, base level affects on alluvial fan evolution appear to be minimal.*

*During the coming quarter, field work pertaining to the Klondike Canyon alluvial fan will be completed and research of the alluvial fans on the west (opposite) side of the basin will begin. In particular, the deposition sequence of lacustrine and alluvial deposits in and in front of American Canyon will be studied.*

### **Task 3 Aeolian Sediments and Landforms:**

*Progress: We are currently assembling the data from stratigraphic and luminescence dating studies of sand ramps and dunes in the Mojave Desert. These data will be incorporated in an abstract for a presentation in a theme session "Desert Surface Processes" at the Geological Society of America Annual Meeting in Seattle, October 1994.*

### **Papers Presented:**

Graybill, D., and F. Nials

1994 "Tree–Rings and Climate: Implications for Great Basin Paleoenvironmental Studies"; Fifth Annual International High–Level Radioactive Waste Management Conference and Exposition, May 22–26, Las Vegas, NV.

Tchakerian, V.P. and Lancaster, N.

Geomorphology of Sand Ramps in the Mojave Desert, California. Response of Eolian Processes to Global Change, Abstracts of a workshop held at the Desert Studies Center, Zzyzx, California, March 1994. Occasional papers of the Quaternary Sciences Center, Desert Research Institute, v. 2, p. 107–108.

Clarke, M.L., Wintle, A.G., and Lancaster, N.

Infa–red Stimulated Luminescence dating of sands from the Cronese Basins, Mojave Desert. Response of Eolian Processes to Global Change, Abstracts of a Workshop held at the Desert Studies Center, Zzyzx, California, March 1994. Occasional Papers of the Quaternary Sciences Center, Desert Research Institute, v. 2, p. 21–22.

### **Problems Encountered:**

None to report.

**TRANSPORTATION**  
**Dr. Richard French, Principal Investigator**

**Project Goal:**

The goal of this project is to compare the results from three models (FESWMS-2DH, DAMBRK, and FLO-2D) that have been suggested as appropriate for evaluating flood flows on alluvial fans with the results obtained from the traditional one-dimensional, stochastic model used in previous research performed by DRI for the Yucca Mountain Project. In a previous research project, three alluvial fans with rail transportation alignments crossing them were identified; hydrologic data were collected; flood hazard/drainage analyses were performed using the one-dimensional stochastic model; and the results of the flood hazard/drainage analyses compared with the documented historic performance of the drainage system. Therefore, the basis for this comparison of model results will be these three alluvial fans.

**Progress on Tasks:**

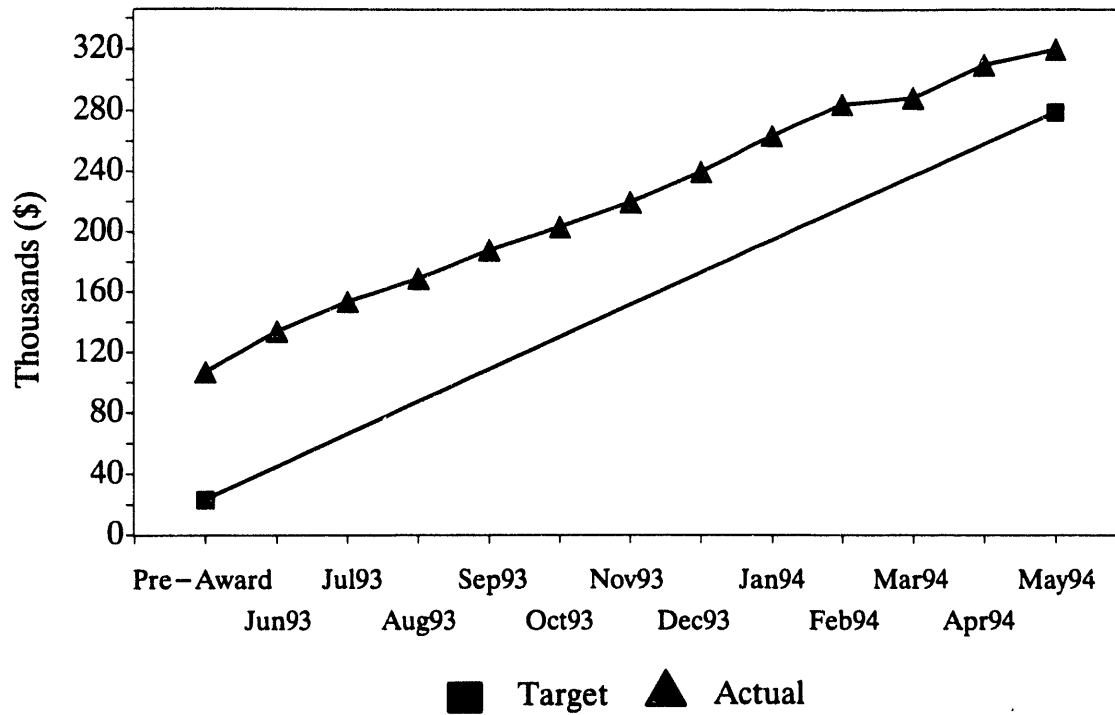
- Task 1 *Dr. O'Brien from FLO Engineering has digitized the maps of the alluvial fans and produced a grid system for the FLO-2D computer program. A FLO-2D model was developed using the previously developed hydrology from the UPRR1 alluvial fan (Stateline, Nevada). O'Brien has provided the UPRR1 model for review and comment. A preliminary review indicates that the UPRR1 model is accurate and compares well with another study performed in the same area. The hydrology for other study area alluvial fans will be provided by O'Brien in the near future to initialize the development of the other models.*
- Task 2 *Contacts have continued regarding difficulties with the FESWMS computer code. A sensitivity analysis of channel slope is progressing. Copies of these models have been sent to the USGS for review and comment regarding the use of this model for alluvial fan hydraulics.*
- Task 3 *Document sections of the geologic/hydrologic settings of the study area are being written and will be submitted to Ms. Julianne Miller's thesis committee by the end of June 1994.*
- Task 4 *A manuscript entitled "Preferred Direction of Flow on Alluvial Fans: Additional Data" has been submitted for possible publication in Journal of Hydraulic Engineering.*

**Problems Encountered:**

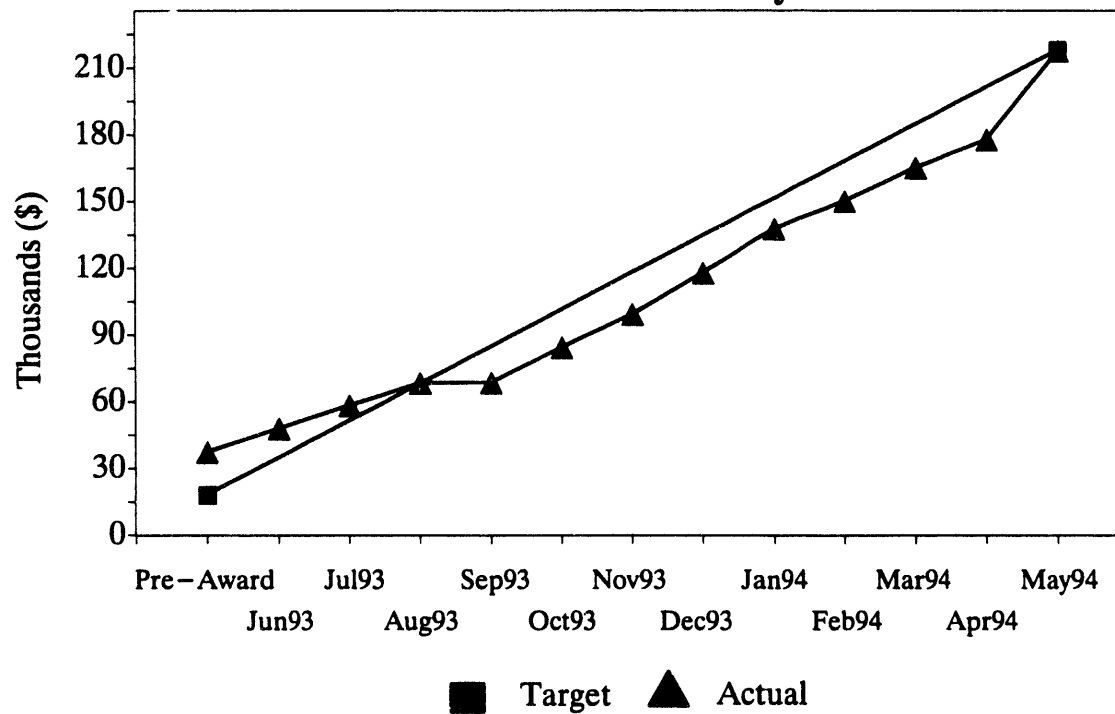
Sufficient funding is not currently available to meet the milestones and deliverables contained in the proposal.

# GREAT BASIN PALEOENVIRONMENTAL STUDIES PROJECT BUDGET SUMMARY

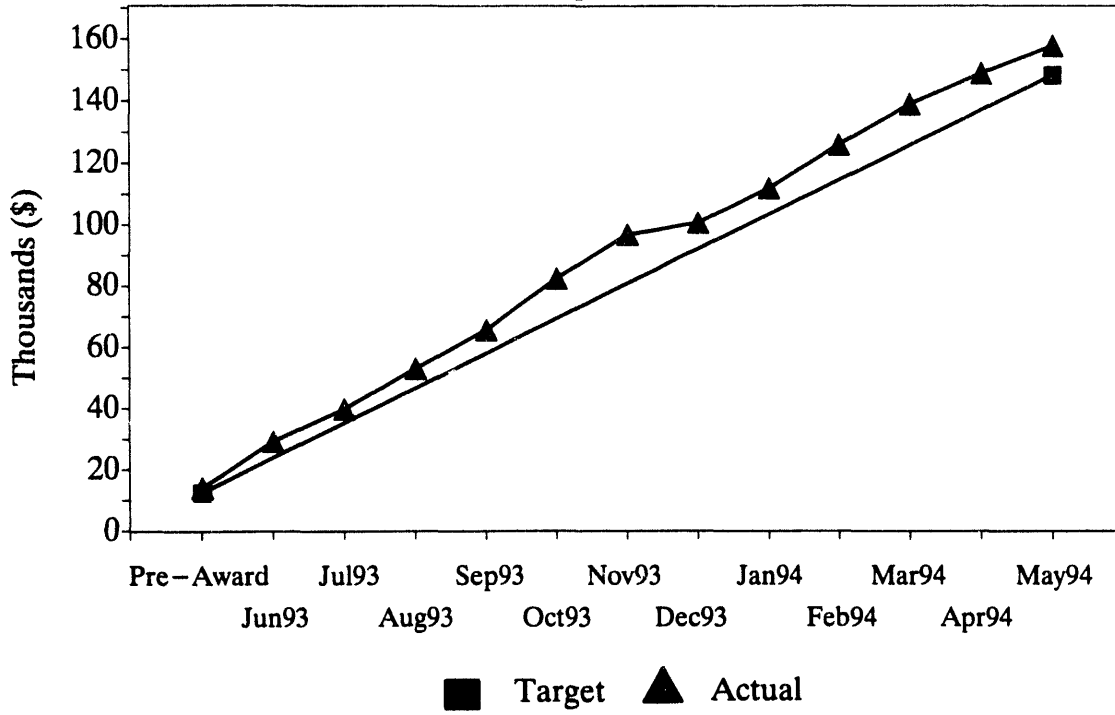
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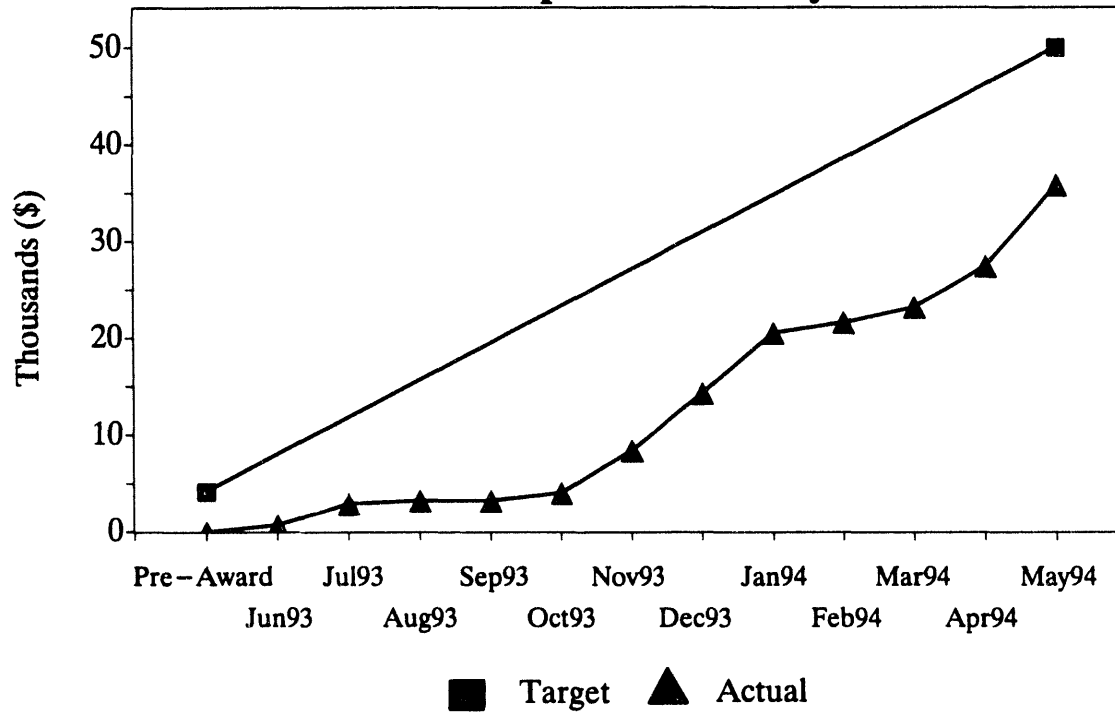
## Paleofauna Study



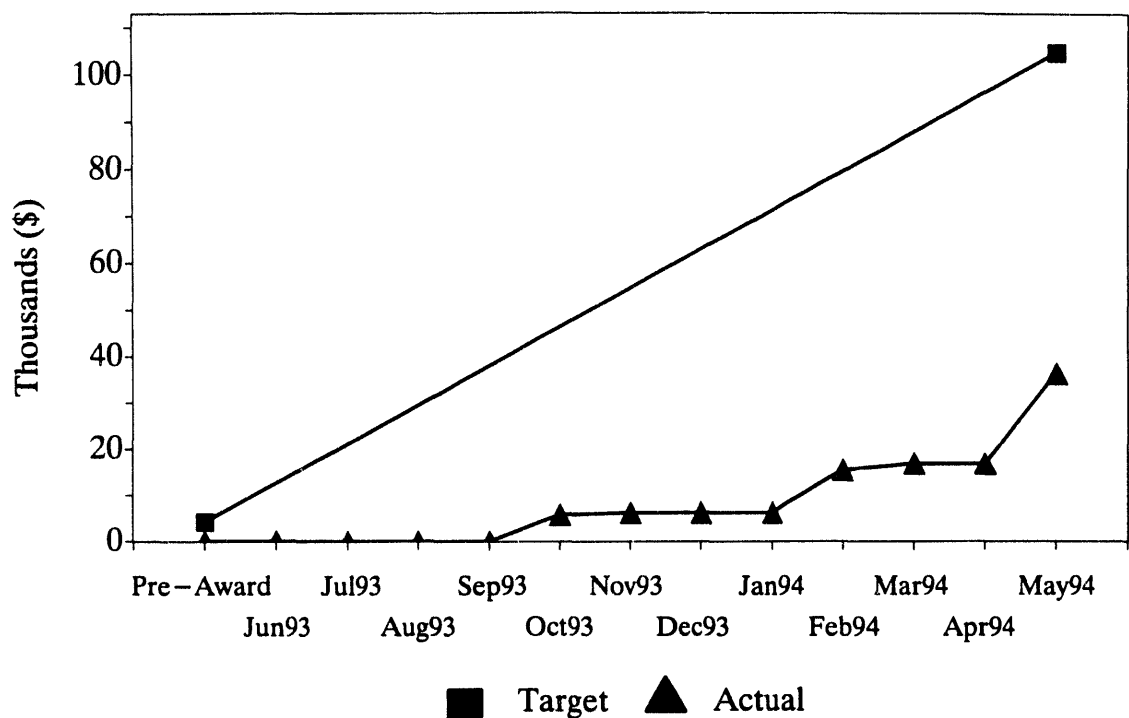
### Geomorphology Study



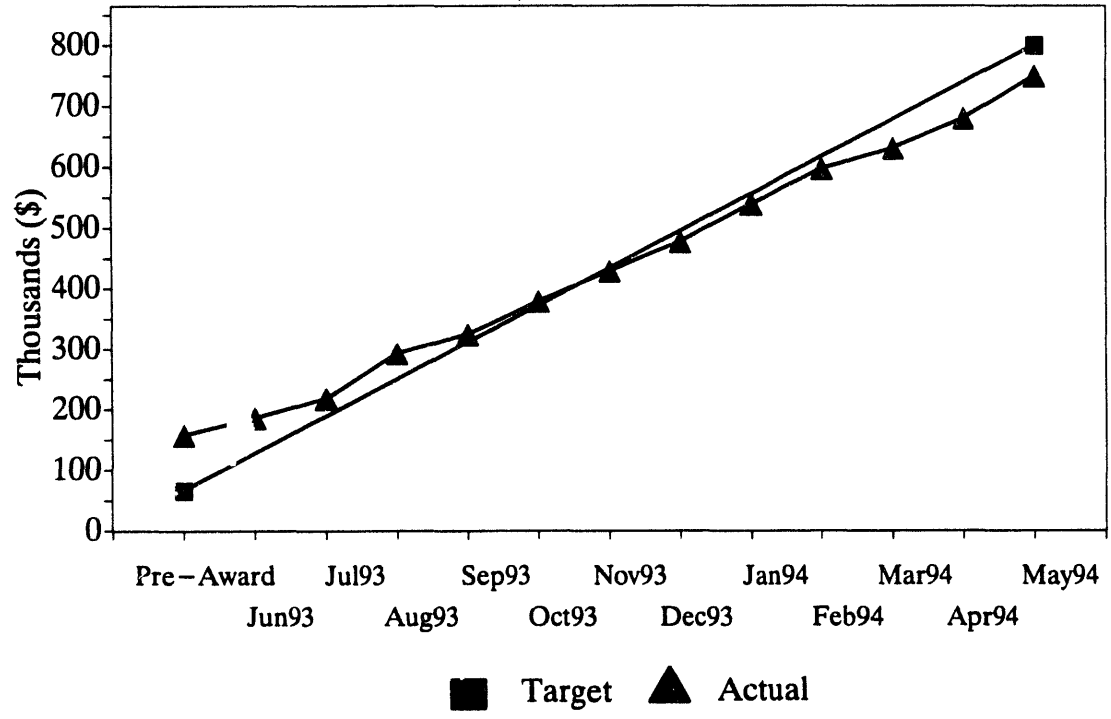
### Transportation Study



### Subcontracts



### Summary (All Tasks)



**DATE**  
**FILMED**

7/25/94

**END**

