NPS Form 10-900
(3-82)

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United States Department of the Interior
National Park Service

National Register of Historic Places Inventory—Nomination Form

For NPS use only

received

date entered

See instructions in *How to Complete National Register Forms*
Type all entries—complete applicable sections

1. Name

historic Desert Laboratory of the Carnegie Institution

and or common Tumamoc Hill

2. Location

street & number Intersection of W. Anklam Road and W. St. Mary's Road ___ **not for publication**

city, town Tucson ___ **vicinity of**

state Arizona **code** 04 **county** Pima **code** 019

3. Classification

Category	Ownership	Status	Present Use	
___ district	_xx_ public	_xx_ occupied	___ agriculture	___ museum
_xx_ building(s)	___ private	___ unoccupied	___ commercial	___ park
___ structure	___ both	___ work in progress	_xx_ educational	___ private residence
___ site	**Public Acquisition**	**Accessible**	___ entertainment	___ religious
___ object	___ in process	_xx_ yes: restricted	___ government	_xx_ scientific
	___ being considered	___ yes: unrestricted	___ industrial	___ transportation
		___ no	___ military	___ other:

4. Owner of Property

name University of Arizona (owns 340 acres) and Arizona State Lands Department (owns 520 acres, leased to Univ. of AZ)

street & number 1624 West Adams

city, town Tucson, AZ 85721 ___ **vicinity of** Phoenix **state** AZ 85007

5. Location of Legal Description

courthouse, registry of deeds, etc. Pima County Courthouse

street & number

city, town Tucson **state** Arizona

6. Representation in Existing Surveys

title Historic American Buildings Survey **has this property been determined eligible?** ___ **yes** ___ **no**

date 1981 _X_ **federal** ___ **state** ___ **county** ___ **local**

depository for survey records Library of Congress, Washington, D.C. (HABS No. AZ-138)

city, town Washington **state** D.C.

7. Description

Condition		Check one	Check one
_x_ excellent	_x_ deteriorated	_x_ unaltered	_x_ original site
_x_ good	___ ruins	_x_ altered	___ moved date _____
_x_ fair	___ unexposed		

Describe the present and original (if known) physical appearance

The Desert Laboratory occupies approximately 860 acres situated on and around Tumamoc Hill, about 2.5 miles west of central Tucson. The edge of the table summit is fringed with volcanic basalt, which prompted local Papago residents to call it Tumamoc, or Horned Toad Mountain. Tumamoc Hill rises about 800 feet higher than the surrounding Santa Cruz valley, its summit reaching 3108 feet. Vegetation is predominantly paloverde, creosote, ocotillo, saguaro, cholla, and other species characteristic of the Sonoran desert.

The historic laboratory buildings are located in the northeast portion of the Desert Laboratory tract, and consist of a volcanic rock shop building at the foot of the hill, and two basalt laboratory buildings and two stone reservoirs located halfway up the hill among a cluster of more recent buildings.

The Main Laboratory was the first of the Carnegie Institution's Desert Botanical Laboratory facilities to be constructed on Tumamoc Hill. The building was designed by S. F. Forbes of Douglas, Arizona, who was recommended by his brother, R. H. Forbes, a professor of desert botany at the University of Arizona. Begun in 1903, the building was originally L-shaped, containing the main laboratory space, a storeroom/drawing room, a library, a private study, and a darkroom. The laboratory was constructed of native volcanic rock removed from a nearby site. Circulation was outside the building along the east and south inner legs of the "L", via a tiled walkway. A noteworthy feature of the building was its ventilation system, which consisted of a broad-hipped roof with wide eave overhangs containing large grates in the soffits and an exit vent running the entire length of the roof ridge, which allowed the sun's energy to convectively flush the attic space with cooler outside air. In 1906 the building was expanded to accommodate the increased workload of the laboratory. The addition was designed by David Holmes, a Tucson architect who had supervised the construction of the original structure. The addition doubled the size of the laboratory structure, extending it in a U-shape to the east and adding a physical lab, a physiology lab, a chemistry workshop, a greenhouse for horticultural experiments, and a horticultural workshop. The entire structure was roofed in slate at this time. The completed laboratory featured a rooftop meteorological platform, a subterranean constant temperature chamber, and improved gas and water systems. The building has been slightly modified by the addition of evaporative coolers to the rooftop and minor spatial alterations on the interior. The University reroofed the building in 1971, removing the ridge vent and replacing it with turbine ventilators. The greenhouse has been rebuilt twice, by the Forest Service and the University, since 1940.

The Shop Building, at the bottom of the hill near the entrance road, was constructed in 1906 of native volcanic stone after designs by Godfrey Sykes, the facilities and maintenance director for the Desert Laboratory. F. M. Welsh of Tucson, who had built the addition to the main laboratory building, was the construction contractor. The stone walls were lined with a double wythe of brick and left exposed on the interior. Brick arches formed the openings, which were plastered on the exterior to create the appearance of

8. Significance

Period	Areas of Significance—Check and justify below				
___ prehistoric	___ archeology-prehistoric	___ community planning	___ landscape architecture	___ religion	
___ 1400–1499	___ archeology-historic	___ conservation	___ law	X science	
___ 1500–1599	___ agriculture	___ economics	___ literature	___ sculpture	
___ 1600–1699	___ architecture	___ education	___ military	___ social/ humanitarian	
___ 1700–1799	___ art	___ engineering	___ music	___ theater	
___ 1800–1899	___ commerce	___ exploration/settlement	___ philosophy	___ transportation	
X 1900–	___ communications	___ industry	___ politics/government	___ other (specify)	
		___ invention			

Specific dates 1903-1940 **Builder/Architect**

Statement of Significance (in one paragraph)

The Carnegie Institution was the first private organization in the United States to fund research in ecology. The Desert Laboratory of the Carnegie Institution opened in 1903 at Tucson, Arizona, and for over thirty-five years was the center for the study of North American desert ecology. The early botanical work funded by the Carnegie Institution combined physiology and ecology in a period when professional botany in the U.S. was evolving rapidly and ecology was only beginning to be identified as an aspect of biology in its own right. Much of the framework of plant ecology generally, and desert ecology in particular, was formulated under the aegis of the Carnegie Institution at the Desert Laboratory.

Notable among the distinguished scientists who made the Desert Laboratory a world-famous institution were Dr. D. T. MacDougal and Dr. Forrest L. Shreve. MacDougal's association with the Laboratory began in 1903; Shreve's in 1908. These men and their associates established the scientific foundations for the ecology of arid regions. Most important were their reports on the role of arid conditions in the evolution of flora and the migration of plants from humid zones. In addition to early studies covering the Southwest and northern Mexico, expeditions sponsored by the Desert Laboratory also conducted field experiments and observations in Australia, Turkey, Egypt, the Sudan, the Libyan Desert, Algeria, and South Africa. These various research projects of the Desert Laboratory concentrated on desert vegetation, with special attention to the morphology and physiology of the spinose and succulent types that inhabit arid regions, their adjustments to arid conditions, distributional movements, and the phytogeography of deserts in general. Scores of major publications by the Carnegie Institution and hundreds of articles contributed to transactions of societies and to periodicals resulted from the researches conducted at the Desert Laboratory. These contributions were instrumental in establishing the scientific bases for desert ecology, not only in the United States but throughout the world.

HISTORICAL BACKGROUND

In 1902 the Carnegie Institution in Washington, D.C., approved a $22,500 grant for the establishment and maintenance of a desert botanical laboratory for a period of five years, for the purpose of studying "the methods by which plants perform their functions under the extraordinary conditions existing in deserts." Frederick V. Coville, chief botanist for the U.S. Department of Agriculture, and Daniel T. MacDougal, assistant director of the New York Botanical Garden, were appointed to locate a suitable site and establish the laboratory. The scope of practical research at the new facility was to be the desert plant life of the world.

9. Major Bibliographical References

See continuation Sheet

10. Geographical Data

Acreage of nominated property 860 acres

Quadrangle name Tucson and Cat Mountain Quadrangles **Quadrangle scale** 7.5'

UTM References

	Zone	Easting	Northing
A	12	498160	3563170
B	12	498170	3565150
C	12	500100	3565160
D	12	500100	3564760
E	12	499760	3563190
F			
G			
H			

Verbal boundary description and justification

See Continuation Sheet and attached maps

List all states and counties for properties overlapping state or county boundaries

state	code	county	code
state	code	county	code

11. Form Prepared By

name/title Ann Huston, Historian

organization National Park Service, Western Region **date** September 1986

street & number 450 Golden Gate Ave., Box 36063 **telephone** (415) 556-7741

city or town San Francisco, **state** CA 94102

12. State Historic Preservation Officer Certification

The evaluated significance of this property within the state is:

__X__ national ____ state ____ local

As the designated State Historic Preservation Officer for the National Historic Preservation Act of 1966 (Public Law 89-665), I hereby nominate this property for inclusion in the National Register and certify that it has been evaluated according to the criteria and procedures set forth by the National Park Service.

State Historic Preservation Officer signature

title **date**

For NPS use only

I hereby certify that this property is included in the National Register

Keeper of the National Register **date** 11/12/85

Attest: **date**

Chief of Registration

ashlar stone. The hipped roof featured a broad eave overhang with soffit intake grates and a full-length ridge vent, as in the main laboratory building, and covered with slate tiles. The Shop Building housed iron- and wood-working tools to provide in-house service for maintenance and construction of laboratory machinery and equipment. The building was restored in 1982 by the University of Arizona.

The Chemistry Building, located to the southwest of the Main Laboratory, was built in 1914. F. M. Welsh, who built the Shop Building, served as construction contractor for the Chemistry Building along with a second contractor, J. Chapman of Tucson; Godfrey Sykes supervised construction. The Chemistry Building, like the other facilities, was constructed of native volcanic rock. The rock walls were lined on the interior with a double wythe of brick and painted. The flat-topped hip roof was utilized as an insolation deck for solar experiments. The interior of the building contained a main laboratory for chemical experiments and microscope work, a photochemical darkroom, a library, and a machine and chemical preparation room. The building was used as a chemical laboratory from 1914 to 1921, at which time much of the chemical equipment was removed to the Carnegie Institution's Coast Laboratory in Carmel, California. After 1921 part of the building continued to be used as a chemical laboratory and the remainder of the building was converted to office space. In 1938 the Chemistry Building burned, destroying the roof, floors, windows, doors, and equipment. The building was rebuilt by the U.S. Forest Service in the 1940s, with several changes. The flat hip roof was replaced by one containing soffit vents and a ridge vent; the original casement windows were replaced with wood double-hung sash and a window was added to the east elevation. Restoration work on the building was completed in 1984 under the supervision of the Arizona State Parks Department.

Two reservoirs of volcanic rock were constructed near the laboratory in 1906. A reservoir to retain rainwater runoff from the roof of the main laboratory building was built just to the south of the building. The collected water was used to maintain plant specimens. The second reservoir was built on the hill above the laboratory to help upgrade the inadequate city water system. The reservoir was supplied with water pumped from the Santa Cruz valley from a 400-foot deep well dug for the Desert Laboratory.

The surrounding acreage within the Desert Laboratory tract remained in its native vegetative state for studies in desert ecology conducted by residents and visiting researchers. The tract was fenced in 1907 to protect the vegetation and study plots from animal disturbance.

In 1940 the Carnegie Institution closed the Desert Laboratory as a result of economic problems caused by the Depression and shifting research interests. The property was transferred to the U.S. Forest Service for their Southwestern Forest and Range Experiment Station. During the 1940s the Forest Service added several new buildings, improved the water system, widened the entrance

road, and added power lines. One Forest Service building resembles the Desert Laboratory structures in its volcanic rock construction; the other buildings are of metal construction. None of the Forest Service buildings contribute to the significance of the Landmark.

Other non-contributing features within the landmark boundaries include two small lunar and planetary observatories and a number of radio repeater stations at the summit of the hill. Power and gas lines traverse portions of the property. A large, unused sanitary landfill, located in the southwest corner of the property, is returning to its natural desert character. An abandoned clay pit is located just north of the landfill. An amphitheater constructed by the Marine Corps is situated near the center of the property.

Archeological features are distributed in a pattern over the top and slopes of the higher portions of Tumamoc Hill. Low, free-standing rock walls built along the slopes of the hill have led researchers to define the site as a fortified hilltop habitation. Other archeological manifestations include oval and rectangular house-size remains, pottery fragments, mortar holes, petroglyphs, rock circles, trails, rock pits, and evidences of agriculture. The earliest datable artifacts are Cochise culture projectile points from about 3500 to 1000 B.C.; the most recent prehistoric items are pottery sherds associated with the Hohokam and dating from about AD 1200 to 1450. Construction of the north slope road and the communication and astronomical structures on the summit have caused considerable damage to the archeological resources along the summit and north slopes of Tumamoc Hill. In spite of this damage, Tumamoc is the only place boasting such a wide range of archeological manifestations in relatively pristine conditions and is by far the largest and most complex trincheras site in the Tucson Basin. The archeological remains have not been evaluated for their eligibility to the National Register and do not contribute to the significance of the National Historic Landmark.

After travelling throughout the southwestern United States and northern Mexico Coville and MacDougal selected Tucson because of its size, the university located there, and the variety of desert vegetation surrounding the area. The city of Tucson donated the original tract at Tumamoc Hill, which was soon enlarged to 860 acres. A small stone laboratory building was constructed at a cost of $3,843 and a water system installed. W. A. Cannon, also from the New York Botanical Garden and the first resident investigator at the Desert Laboratory, studied root systems and water relations of desert plants, while other researchers carried out small grant projects in 1904 and 1905. These studies endeavored to "record as fully as possible the environmental factors which surround and influence the plants of the desert day-by-day, and to measure the reaction of the plants to these stimuli."

In 1905 MacDougal was appointed director of the Carnegie's newly-created department of botanical research, which included direction of the Desert Laboratory in Tucson as well as the Coastal Laboratory at Carmel, California. MacDougal immediately hired Godfrey Sykes, an engineer living in Flagstaff that he had become acquainted with on a research expedition, to oversee construction and maintenance of the Laboratory property. MacDougal undertook an expansion of the laboratory facilities in 1906 at the recommendation of the Carnegie Institution. An addition to the main laboratory building doubled its size, providing space for chemical work on one side of the building and horticultural work on the other, as well as equipment for microscopic work and thermostatic apparatus for investigations of sunlight on respiration. A shop building was constructed in 1908 to house equipment and machinery used in construction and maintenance. A chemistry lab was completed in 1914.

A number of respected researchers conducted investigations at the newly-expanded laboratory, including: B. E. Livingston from the University of Chicago, awarded a grant for studies of water relations and evaporation; V. M. Spalding of the University of Michigan, who studied transpiration and distribution of desert plants; and F. E. Clements, who produced a large volume of work on plant succession. Visiting scientists who used the laboratory facilities lived in town or in temporary quarters at the foot of the hill.

The years 1910 - 1925 saw notable advances in soil-plant relationships and plant physiology, especially moisture relationships and ecological studies of individual species. MacDougal continued as director of the department of botanical research through 1928, although much of his time was spent at the Coastal Laboratory in Carmel. In 1928 the Carnegie trustees reorganized their biological investigations and appointed Dr. H. A. Spoehr as chairman of the Division of Plant Biology. Spoehr had been a prominent figure at the Desert Laboratory between 1911 and 1920, although his primary location was at the Carmel Coastal Laboratory after 1920.

The period from 1928 - 1940 was dominated by the research of Forrest Shreve,

whose contributions to the study of deserts are perhaps more often cited than those of any other North American. An internationally-recognized leader in desert plant investigations and preeminent in the new discipline of ecology, Shreve joined the Desert Laboratory staff in 1908 and remained until his retirement in 1945. Activities during this period included laboratory research, various plant physiological studies conducted on the laboratory grounds, and soil and climactic investigations, in addition to desert explorations focussed mainly on the Sonoran desert. Shreve served as editor of the journal Plant World, until it became Ecology, and was a founder of the Ecological Society of America. Even after the closing of the Desert Laboratory, the Carnegie Institution continued to finance Shreve's research in Tucson until his retirement.

By the 1930s the Depression had curbed much of the research activity at the Desert Laboratory. The laboratory closed in 1940 and was transferred to the U.S. Forest Service for use as the Southwestern Forest and Range Experiment Station, with the understanding that the property would continue to be used for research purposes. In 1960 the property was sold to the University of Arizona for use as its geochronology research center. The laboratory buildings are now used as classrooms and research facilities for palynology, palentology, and paleoecology. Graduate students continue today to monitor changes in some of the original desert plant communities studied by scientists in the early decades of research at the Desert Laboratory. Protection and interpretation of Tumamoc Hill as an Environmental Study Area have been proposed to further encourage environmental education through the observation and study of the natural desert environment and cultural features. Tumamoc Hill was designated a State Scientific and Educational Natural Area in 1981 for its biological excellence.

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Shreve, Forrest. The Desert and Its Life. (Washington, D.C.: Carnegie Institution, News Service Bulletin, Vol. III, No. 16, June 10, 1934).

Shreve, Forrest and Arthur L. Hinckley. "Thirty Years of Change in Desert Vegetation," Ecology 18 (October 1937): 463.

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Wilder, Judith C. "The Years of a Desert Laboratory," Journal of Arizona History 8 (1967): 179-199.

Verbal Boundary Description

The Desert Laboratory is roughly bounded by Anklam Road on the north, Greasewood Road on the west, 22nd Street on the South, and an irregular boundary on the east, following the ravine between Tumamoc Hill and Sentinel Peak (see attached map showing exact boundary location).

Legal Description

The Desert Laboratory property is located within the following portions of Township 14 South, Range 13 East:

S½ of SE¼ Section 9
S½ of SW¼ Section 10
SW¼ of SE¼ Section 10
W½ of Section 15 (not including 22nd St. R/O/W)
W½ of NW¼ of NE¼ Section 15
E½ of Section 16 (not including 22nd St. or Greasewood Road R/O/W)

Boundary Justification

The boundaries include the 860-acre tract of property that was originally granted to the Desert Laboratory. Although the property contains a small number of isolated intrusive features, its historic use as a scientific research center has been maintained through two transfers of ownership. The property retains the desert vegetation and landscape for which it was originally selected as a desert research facility and which has been in continuous research use for over eight decades.

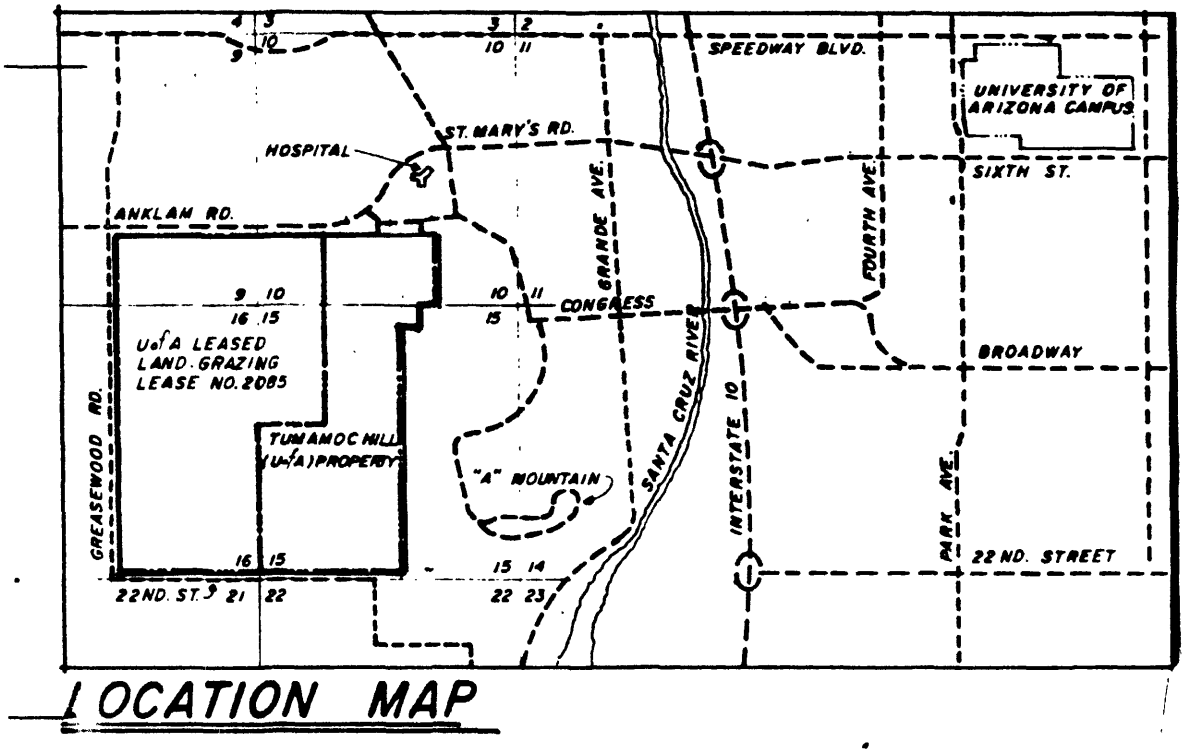
Maps

Map A. U.S.G.S. Quadrangles
Map B. Location Map
Map C. Boundary Map
Map D. Archeological Sites and Structures
Map E. Property Developments and Easements
Map F. Contributing Structures (Laboratory Level)

Desert Laboratory N.H.L.

Map B

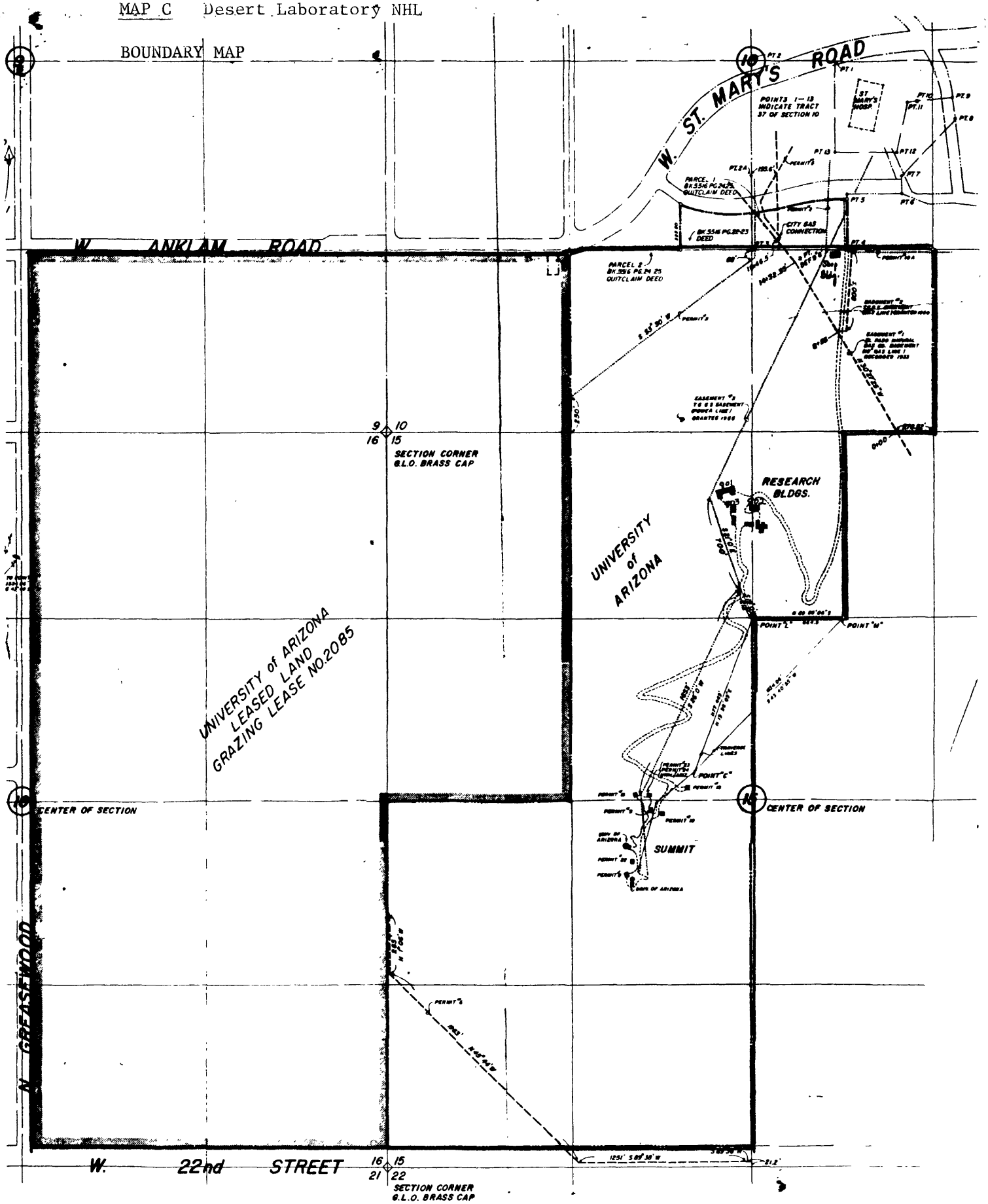
Source: "Easement and Special Permit Map, Tumamoc Hill Property," Pima County Assessor's Office, 1975, revised 1977.



LOCATION MAP

MAP C Desert Laboratory NHL

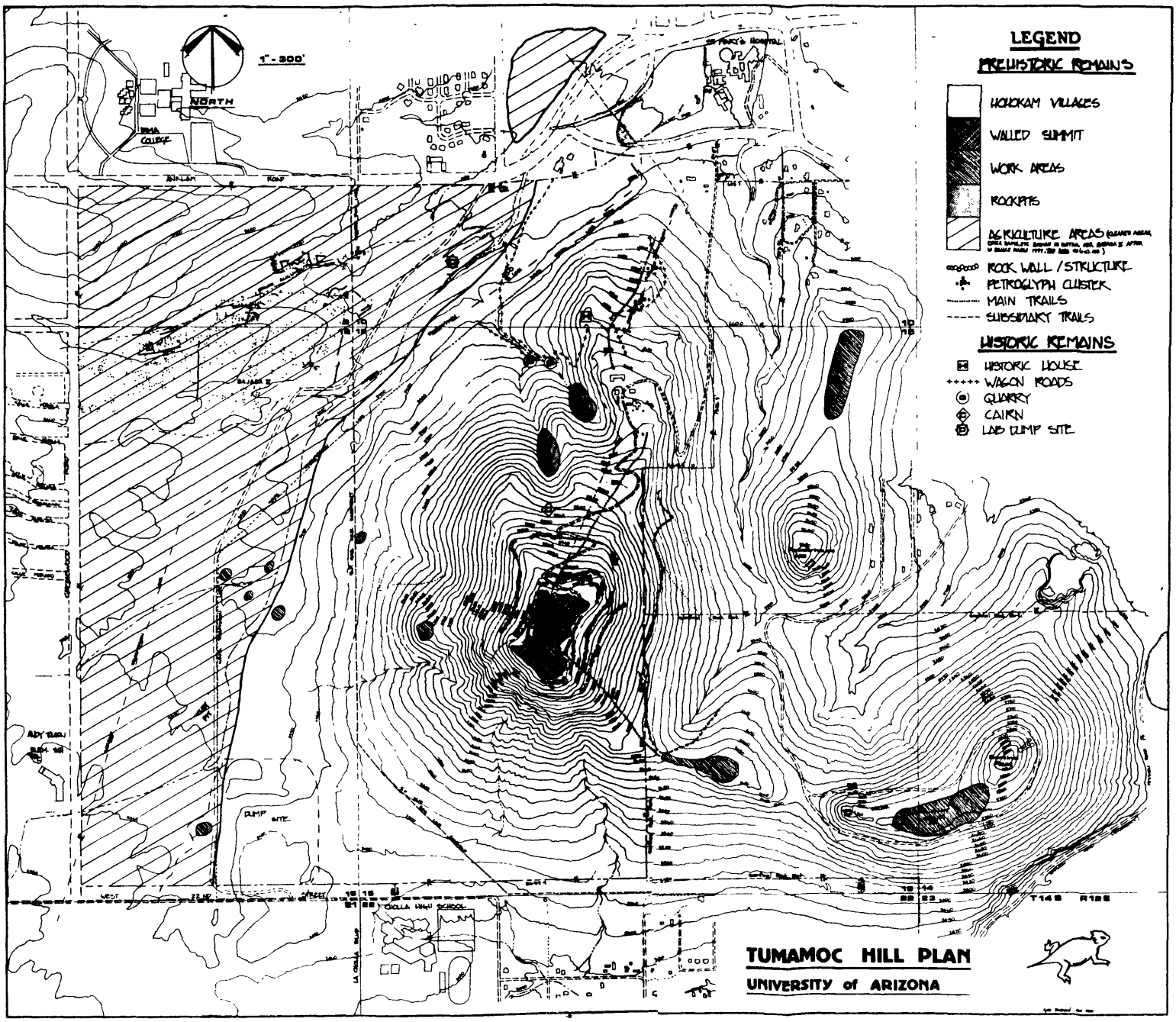
BOUNDARY MAP



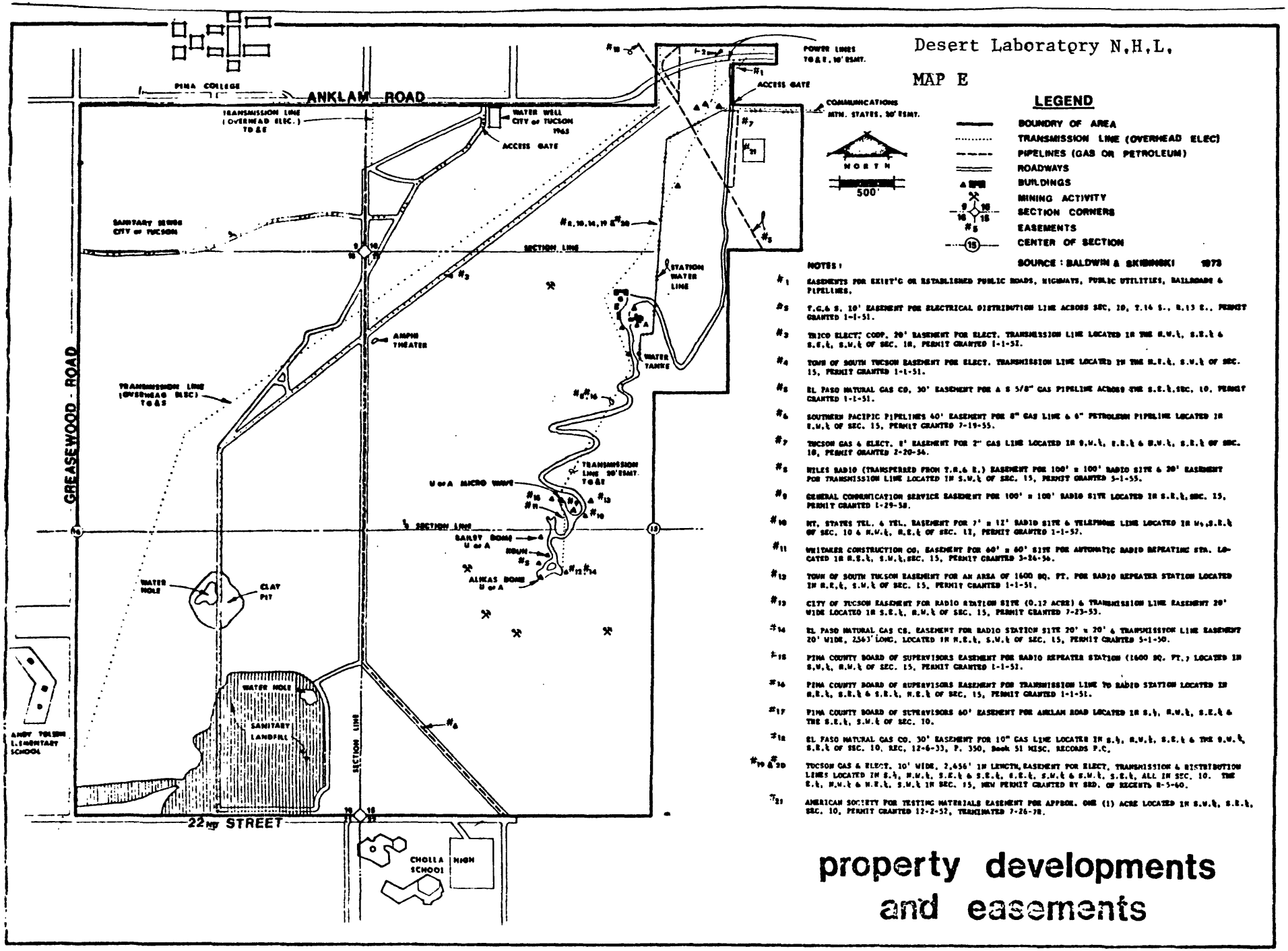
Source: Pima County Assessor's Office, Tucson, Arizona
"Easement and Special Permit Map, Tumamoc Hill Property" 1975, revised 1977

MAP D Desert Laboratory N.H.L.

ARCHEOLOGICAL SITES AND STRUCTURES



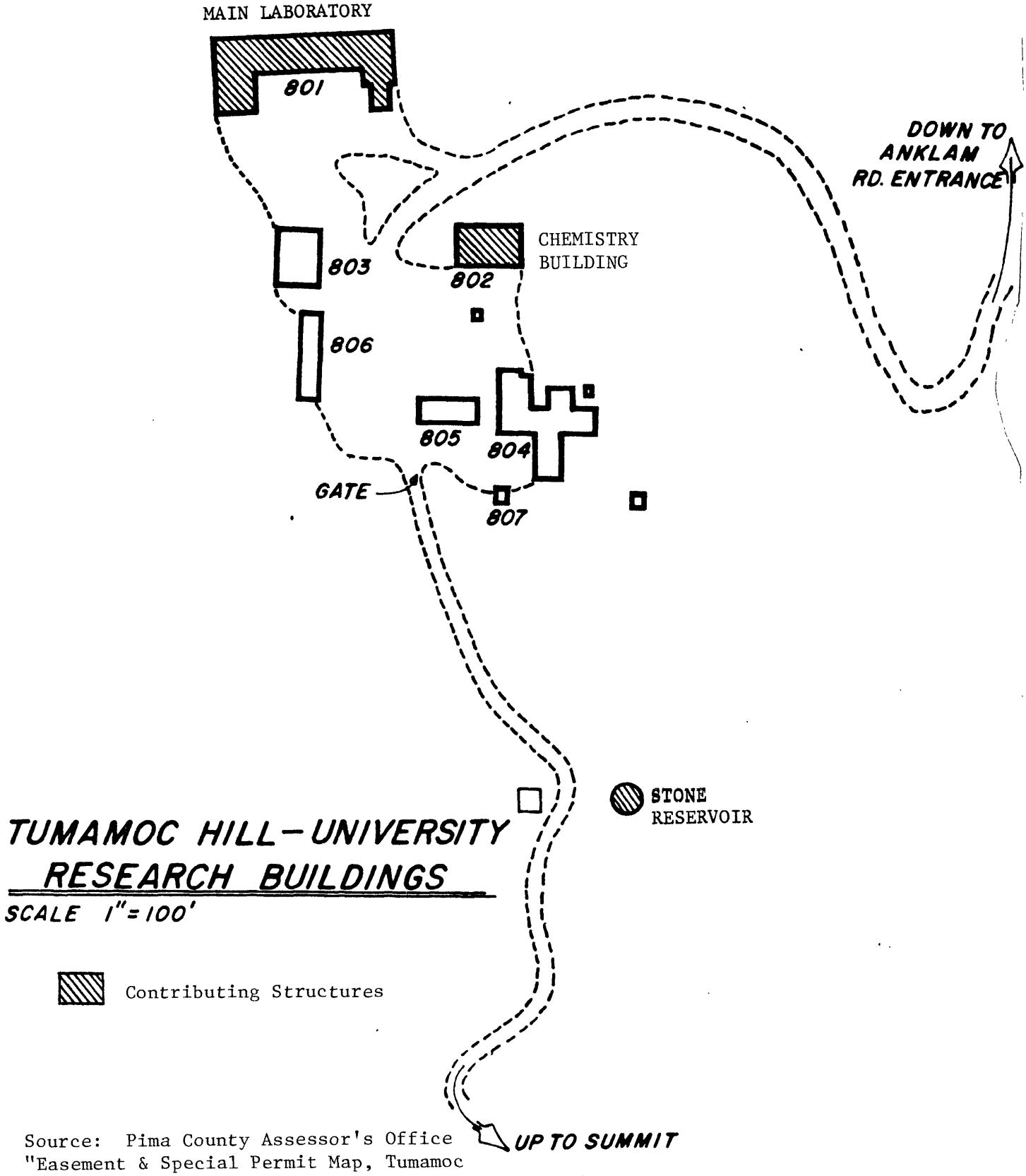
Source: Tumamoc Hill Planning Committee, Tumamoc Hill Policy Plan (Tucson: University of Arizona, 1982).



Source: Baldwin, Brickler et al. An Environmental Study Area Plan for Tumamoc Hill. Tucson: University of Arizona, n.d., p. 41.

MAP F Desert Laboratory NHL

CONTRIBUTING STRUCTURES (LABORATORY LEVEL)



Source: Pima County Assessor's Office
"Easement & Special Permit Map, Tumamoc Hill Property," Tucson, Arizona, 1975, revised 1977