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FINAL ENVIRONMENTAL STATEMENT

VERY LARGE ARRAY

Assistant Director for
National and International Programs
National Science Foundation
Washington, D. C. 20550

October 6, 1972

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NATIONAL SCIENCE FOUNDATION
ENVIRONMENTAL STATEMENT -- VLA

September 1972

SUMMARY STATEMENT

Responsible Agency: National Science Foundation, Washington, D.C. 20550

Administrative Action: Very Large Array

Brief Description: The Very Large Array is a major new instrument which will make possible important advances in radio astronomy. The VLA will consist of 27 dish-shaped radio antennas, each 82 feet in diameter, distributed along three arms consisting of double railroad tracks, arranged in the form of a wye, with 120 degrees between each arm. Two of the arms will be 13 miles long and the third, 11.8 miles. VLA construction and operations will directly affect approximately 3,500 acres, of which an estimated 2,800 acres are required for the three arms of the wye. The remaining acreage will be used for access roads; a central headquarters complex consisting of buildings, water supplies, sewage treatment facility, and a staging area for the field erection of antennas; and an aircraft landing area.

A site has been identified in New Mexico, fifty miles west of Socorro, in the counties of Socorro and Catron, in the eastern end of a broad valley known as the Plains of San Augustin. Approximately one-third of the land is presently owned by private individuals and another third is owned by the State of New Mexico. The remaining one-third is held for the Federal Government under the custodial care of the Bureau of Land Management.

Summary of Impact and Adverse Effects: The impact of the VLA upon the environment will be minimal. The tracks will be placed on sloping embankments averaging less than five feet in height. These gentle slopes will permit free and natural movement of livestock and wildlife. Only the 100 quarter-acre observing stations, the airstrip, and portions of the headquarters complex will be enclosed with stock fencing; the total amount of fenced land is estimated not to exceed 200 acres.

The long term environmental effects of the VLA will result mainly from the daytime work activities of some sixty persons at the facility. The work activities will be confined to the headquarters complex with infrequent use of the airstrip and the arms of the wye to relocate antennas and maintain the antenna observing stations. Waste treatment and refuse disposal will comply with New Mexico state regulations. There will be no emitted electromagnetic radiation associated with VLA operations since the VLA will not transmit radio waves but merely receive radiation from astronomical objects in space.

VLA operations require a low population density and the absence of nearby sources of electromagnetic interference. Certain types of industrial development on the Plains of San Augustin are undesirable unless measures are taken to properly shield local sources of electromagnetic radiation. Coordination between future developers and the NRAO would minimize potential interference with the radio astronomy program. Preservation of the present natural, open space quality of the valley would provide the best environment for high quality radio astronomy observations.

Alternatives Considered: Six other sites were determined to meet the minimum requirements essential for VLA operation, but the Plains of San Augustin site was clearly superior technically and economically, and can be developed with a minimal environmental impact.

The following were requested to comment:

Department of Agriculture
 Department of Commerce
 Department of Defense
 Department of the Interior
 Department of Transportation
 Environmental Protection Agency
 Federal Power Commission
 General Services Administration
 State of New Mexico

Written comments received from:

Agriculture
 Commerce
 Interior
 Transportation
 GSA
 New Mexico

A summary notice of the draft was published in the Federal Register July 19, 1972, to announce to State and local agencies and the public that copies of the draft were available from the Foundation.

The draft statement was made available to the Council on Environmental Quality on July 3, 1972. The final statement is made available to the Council on Environmental Quality on October 6, 1972 and a summary statement is being published in the Federal Register.

PART I

BACKGROUND

Higher angular resolving power has always been a major goal of radio astronomy instrumentation development. The need for higher angular resolution led, in the 1950's and early 1960's, to the extensive development and use of radio interferometers - combinations of two or more separate radio telescopes - in England, Australia, and the United States. These interferometers, although sophisticated, had serious disadvantages that limited their usefulness. A second generation of interferometers was built in England and at the National Radio Astronomy Observatory (NRAO), Charlottesville, Virginia, in the mid-1960's which gave "pictures" of radio sources with moderately high angular resolution, using the technique of supersynthesis pioneered by Professor Martin Ryle of Cambridge University. Even then, however, it was clear that the lack of speed and the low sensitivity of these small arrays restrict the number of astrophysical problems which can be attacked.

Astronomers have had a continuing need for a high angular resolution instrument capable of making radio observations with great speed and sensitivity. The instrument should be able to make polarization measurements, measure the properties of spectral lines, and discriminate between adjacent radio sources. With such an instrument, astronomers would be able to carry out observations of extragalactic objects and make radio source surveys critical to our understanding of cosmology. Such an instrument would be suited to the study of radio radiations from the neighborhood of stars as well as those arising from complex organic molecules in space.

In response to the need of the scientific community for such a radio telescope, the NRAO undertook, in 1964, development and design studies for a new major antenna system. After some years of intensive effort, these studies were completed. The antenna system, which has become known as the Very Large Array (VLA), will consist of 27 dish-shaped radio antennas, each 82 feet in diameter, distributed along three long arms, arranged in the form of a yee, consisting of railroad tracks. Two of these arms are 13 miles long and a third, slightly shorter, is 11.8 miles in length.

This sensitive, high resolution, image-forming instrument is designed to produce pictures of radio sources in the sky comparable with the finest optical photographs. By positioning the antennas along their tracks, the field of view of the VLA may be varied within wide limits. In this respect the VLA is the radio equivalent of a zoom lens. At the two initially proposed operating frequencies of 2695 MHz (11.1 centimeters) and 8085 MHz (3.7 centimeters) the system will have resolutions of 1.0 and 0.35 seconds of arc, respectively.

The VLA will exceed by one to two orders of magnitude the sensitivity and angular resolution of any existing or proposed array. The antenna system will produce detailed two-dimensional maps of radio sources over most of the observable sky, including regions where most other arrays can resolve sources in only one direction. In addition, the VLA will have the ability to detect and measure the properties of the very faint radio sources. These sources are faint, either because of their low intrinsic brightnesses or their locations at remote distances. Radio astronomers also will be able to measure the properties of radio sources superimposed upon complex backgrounds such as the Milky Way. The VLA is expected to make major contributions to our understanding of the laws of gravity, physical processes in interstellar gases, the origin and evolution of stars, the universe, and life itself.

PART II

THE SITE

An evaluation team from NRAO began the search for a VLA site in 1965. In evaluating potential VLA sites, NRAO investigators applied several primary criteria which directly influence the scientific performance of the VLA.

The criteria were:

1. The site must be extensive enough to accommodate the three arms of the wye-shaped antenna system. To obtain the desired high angular resolution, the site for the antenna must be at least 22 miles across. The 27 antennas of the VLA will be confined to the three radial strips, each of which will be 600 feet wide. Two of the strips will be 13 miles long and the third, the north-south arm, slightly shorter.
2. To facilitate efficient VLA performance during observations of low declination radio sources, the site should permit the placement of one arm of the wye between 4 and 10 degrees off the local north-south meridian.
3. The site should be relatively flat so that the branches of the wye can be constructed economically with a grade less than two percent at any location.
4. The site should be as far south as possible to permit observations of the greatest amount of sky.
5. The site should be at a high and dry location so as to minimize the effects of water vapor and atmospheric irregularities upon VLA performance.
6. The site should be removed from regions of human activity that create sources of electromagnetic interference. Nearby large cities and certain equipment used in manufacturing, mining, and gas well drilling activities interfere with successful radio astronomy observations. Radar and communications

relay stations, military electronic activity and even a high density of local air traffic can be disturbing sources of interference for the VLA.

These criteria led NRAO to concentrate its search on sites located in the southwestern part of the continental United States, south of 42 degrees north latitude and west of the 100th west longitude meridian.

Additional criteria relating to such environmental questions as natural hazards, human factors, utilities access and natural resources development were also applied. These include:

1. Natural hazards to the VLA caused by weather phenomena such as floods, high winds, and hail should be minimal. The site should be located away from earthquake-prone regions such as fault zones and regions of high seismic activity.

2. No developable natural resources should exist in the area of the site whose exploitation would affect adversely the VLA performance.

3. The site should be within reasonable commuting distances of towns or cities having adequate housing, schools, shopping facilities and medical services for the observatory staff.

4. Raw materials for construction, an ample water supply and electrical power for the facility should be locally available.

In addition, several miscellaneous factors, such as the ease of acquiring the site, labor costs, and road construction requirements, were considered in evaluating the relative merits of various sites.

Using these site selection criteria, the NRAO team produced a basic list of 34 possible sites.^{1/} Closer examination of these 34 sites using topographic maps, meteorological data, and site visits reduced this list to seven. These

^{1/} A Proposal for a Very Large Array Radio Telescope Vol. IV. Green Bank, West Virginia: National Radio Astronomy Observatory, December, 1971.

seven locations were studied in great detail, including site studies by an experienced engineering firm and measurements of atmospheric water vapor at three of the more promising ones. Although all seven sites met the minimum criteria for acceptability, one, located 50 miles west of Socorro, New Mexico, was judged clearly superior in every respect, including the impact on the existing environment, and recommended as the site for the VLA (Figure 1). The National Academy of Sciences reviewed the site selection process in February 1972 and endorsed the choice of the site as the optimum location for the VLA.

The site is located in Socorro and Catron countries, in the eastern end of a broad valley known as the Plains of San Augustin, approximately 22 miles west of the town of Magdalena. The center of the site is situated approximately two miles south of U.S. Highway 60, at an elevation of 6,960 feet above mean sea level.

It is estimated that VLA construction and operation will require approximately 3,500 acres of range land. Of these, approximately 1,200 acres are presently owned by private individuals; 1,200 acres are owned by the State of New Mexico; with the remainder held by the Federal Government under the jurisdiction of the Bureau of Land Management. No additional land will be required for the VLA in the foreseeable future.

The terrain in the valley is generally very flat and sloping in a southwesterly direction. It is surrounded by mountain peaks, all of which are located in national forests, having elevations in excess of 9,500 feet. Vegetation on the site consists of sparse stands of low grama grass. The grass is more dense in the bottom lands where water is retained for longer periods after a rainfall. In most places the grass cover is adequate to prevent sand and dust from blowing except during the strongest winds. There

is no tree cover and only occasional scattered growths of small sagebrush add to the expanse of grama grass. The land is used for cattle grazing and is estimated to carry about ten head per section (640 acres). Water for livestock is obtained from wells and stored in steel tanks and open ponds.

The Plains area and the surrounding mountains have been extensively explored in past years for copper, uranium, lead, zinc, and silver. No developable deposits were found.^{2/} The Kelly District, on the eastern slope of San Mateo Mountains near Magdalena, has been, in the past, a big producer of lead and zinc. There is no mining activity at present.

Seismic and gravity techniques have been used by oil companies to gain information about underground structures and explore opportunities for oil and gas production. A well was drilled to bedrock (Precambrian) at a depth of 12,284 feet at a site some six miles west of the Augustine station by the Sun Oil Company in 1966. The test well proved to be dry and was abandoned.

^{2/} Mineral and Water Resources of New Mexico, New Mexico State Bureau of Mines and Mineral Resources, Bulletin 87, 1965.

PART III

FACILITIES REQUIREMENTS

An estimated 2,800 acres of the required 3,500 acres total are necessary for the three arms of the wye. Of the remaining acreage, 640 acres are needed for a central headquarters complex containing five buildings, water supplies, a sewage treatment facility, and a staging area for the field erection of antennas. Only 200 acres of this 640 acre headquarters complex area will be fenced. In addition, an aircraft landing area, including a taxi-way and aircraft tie-down area, will occupy an estimated fenced area of 30 acres.

The railroad tracks and associated observing stations that form the arms of the wye are important parts of the VLA. The trackage consists of two pairs of standard gauge railroad tracks spaced 18 feet apart. The railroad tracks will permit the mobile antennas (weighing about 160 tons each) to be transported to and from the various observing stations distributed along the arms of the wye, as well as carrying personnel and maintenance equipment to the observing stations. The observing stations, of which 100 are anticipated, are located adjacent to the railroad tracks within the planned 600-foot wide strip. By placing the observing stations off to the side, the main railroad tracks are left clear for other vehicle movement. No roads will be necessary along the arms of the wye once railroad track construction is complete.

Antennas can be transferred from one branch of the wye to another at the wye apex, where the tracks meet to form a railway junction. The trackage and

its supporting gravel ballast will be designed to carry combined antenna and transporter weights as high as 225 tons. The maximum allowable track grade at any point is 2%. The transporters will move at speeds less than five miles per hour.

Each of the observing stations will consist of a small square parcel of land, one quarter of an acre in extent, with its center located approximately 125 feet from the center line of the main tracks. Each station will contain three concrete foundations, one for each of the antenna support legs, electrical power connections, and a small maintenance shed. A short railroad spur, intersecting the main track at right angles, will provide access to the observing station. Because of the need to prevent livestock interference in telescope operations and the hazard of exposed high voltage power connections, each observing station will be enclosed with a four-foot high open mesh stock fence. Two fifteen-foot gates across the railroad spur will lock together at the spur center line when closed.

Electric power in the general vicinity of the site is supplied by the Socorro Electric Cooperative, Inc. The Cooperative has a 69 kilovolt circuit, with overhead static protection, running from Socorro to Magdalena, New Mexico. From a transformer station in Magdalena a 25 kilovolt circuit runs west to the Arizona state line, passing close to the proposed headquarters building complex. This power source provides a reliable electrical service base that has proven satisfactory for existing users and will be adequate for the VLA. The Socorro Electric Cooperative plans to upgrade its service to the area and will have a 69 kilovolt circuit running past the site by 1974. The Cooperative has confirmed that the existing 25 kilovolt circuit is capable of meeting

the normal operating needs of both the VLA antenna system and the headquarters complex with no detriment to other local users. The total normal operating requirement for the VLA site is 800 kilowatts, with occasional surges to 1600 kilowatts, without excessive voltage drops. It is planned that power will be distributed to the observing stations by buried cables running the length of the arms of the wye. Connections to these cables for telescope operation will be made within the confines of the fenced observing stations.

Three access roads will be built as part of the site development: an entrance to the headquarters complex from state highway 78, one leading to the air strip from old U.S. highway 60, and one leading to the staging area from the headquarters buildings. These roads will have all-weather asphaltic concrete surfaces, a seven percent maximum grade, and adequate drainage. The total length of all three access roads will be less than one mile.

Present plans for the headquarters complex to be located near the wye apex include five basic structures: (1) a laboratory and office building for VLA staff and visiting scientists (10,000 square feet); (2) a VLA operations, control, and electronic equipment building (15,000 square feet); (3) an eight-vehicle garage, storage and maintenance shops facility (20,000 square feet); (4) a dormitory for visiting scientists' use (8,000 square feet); and an antenna maintenance building (12,000 square feet) located adjacent to the antenna staging area.

The dormitory will be equipped to provide modest living accommodations, including sleeping, kitchen, and recreational facilities for approximately 30 persons. These facilities are intended to meet the on-site needs of transient

VLA users when the antenna system becomes operational, including scientists, engineers, and support personnel. In FY 1981 and beyond, as many as 40 visiting scientists are expected during the course of a year. They will stay on the site for periods of time ranging from a few days to several weeks.

When the system becomes fully operational in FY 1981, a VLA operational support staff will be located at the site. It is anticipated that the group will include 25 scientists, engineers, and technicians, 17 administrative personnel, and a shop maintenance group of 20 individuals. The support staff will be built up gradually from an initial group of 12 at the time partial operations begin in FY 1976.

During the nine-year construction phase, a project management group also will be located at the site. It is anticipated that this group will number 17 in FY 1973, rise to a maximum of 28 in fiscal years 1975 and 1976, and fall to zero at the end of the project in fiscal year 1981. In addition, approximately 100 contractor employees will be working at the site during the VLA construction. They will include engineering and construction personnel, and technical and supervisory specialists. Members of the operational support and project management groups and contractor personnel are expected to live away from the site in communities where adequate housing, shopping facilities, schools, and medical facilities exist. The nearest such community of any size is Socorro, New Mexico, a town with a population of 6,000 located 50 miles east of the site. Detailed studies of the economics and available facilities in Socorro, New Mexico, indicate that the community can readily absorb 60 families without placing undue stress upon existing housing, schools and community services.

The water supply at the site will consist of a high pressure storage system with a well, an elevated storage tank, chlorinator, and softener. The water supply requirement for the VLA is based upon the need for five thousand gallons per day of potable water with 50 thousand gallons reserved for fire fighting. Investigation of existing wells on the site and a 1954 survey of the water table indicate that this quantity is obtainable.^{3/} The site is located upon alluvium-filled layers which serve as the aquifer. The water will be delivered from the well by an electric, submersible centrifugal pump and then conveyed by pipes to an elevated 65-thousand gallon storage tank.

The proposed sewage treatment facility consists of two total retention evaporative lagoons, meeting design and construction criteria of the New Mexico Environmental Improvement Agency. This type of sewage treatment system requires minimum maintenance and is relatively trouble free.

The aircraft landing area is located two miles away from the headquarters complex. This facility is designed to meet Federal Aviation Administration classification standards as a basic utility airport. The 5,200 foot runway will run approximately east-west, in line with the prevailing winds, and have a 1,000 foot long open area at each end. In addition, a 30-foot wide paved taxiway and a 150-foot by 200-foot apron will be located at one end of the air strip. No hangar is planned but aircraft tie downs will be provided. The entire area will be fenced.

The antenna staging area is intended to provide a clean hard surface area

^{3/} Bushman, F. X. and Valentine, C. P. Water Well Records and Well Water Quality in the Southwestern San Augustin Plains, Catron County, New Mexico, New Mexico State Bureau of Mines and Mineral Resources, Circular 26, 1954.

for the field erection of antennas during construction and as a maintenance area afterwards. It will be approximately 800 feet long and 300 feet wide and have antenna spur railroad tracks extending its length. The area will have a hard stand for crane operation and assembly, and a 12,000 square foot building for final antenna assembly, repair and maintenance.

PART IV
IMPACT ON THE ENVIRONMENT

The VLA is expected to have a minimal impact on the environment. The tracks will be placed upon sloping embankments averaging less than five feet in height. These gently sloping embankments should permit free and natural movement of livestock and wildlife. Only the 100 quarter-acre observing stations, the airstrip and portions of the headquarters complex will be enclosed with stock fencing, the total amount not to exceed 200 acres. Where private fences cross the railroad tracks, adequate gates or livestock guards will be installed to protect ranching operations. The railroad embankments and open areas where the grassland has been removed will be reseeded in native grasses.

The National Register of Historic Places of the U.S. Department of the Interior has been consulted and no historic sites on the National Register were found to fall within the area affected by VLA construction. The NRAO will work closely with the New Mexico State Advisory Committee for Historic Preservation and will have anthropologists and archaeologists available to identify and survey areas of potential historical and archaeological value prior to and during ground clearing operations. Several New Mexico archaeologists have expressed interest in cooperating in this endeavor.

The VLA will not deleteriously affect drainage conditions in the valley. The NRAO site evaluation team assessed the problems associated with the distribution of run-off water and flooding in the area and has incorporated the requirements of local topography, geology, climate, water-shed size and shape, percolation and infiltration of the soil, vegetation, antecedent storms,

base flow, and precipitation into the site planning. Consultations were held with specialists of the U.S. Departments of the Interior and Commerce, drainage engineers of the New Mexico State Department of Highways, and hydrologists from the University of New Mexico. The conclusions were that the site itself has good overall drainage characteristics, and that proper placement of culverts and other drainage control measures will prevent any water control or flooding problems arising from the presence of the VLA. The NRAO project management team will work closely with the architects, engineers, local soil conservation personnel, and subcontractors during VLA construction to ensure that proper measures are taken to eliminate potential drainage problems.

The northern branch of the wye has almost a flat grade, rising only 50 feet in the first eleven miles of its length. Only a modest amount of filling is necessary over limited portions of this branch. This branch will cross a major highway, U.S. 60, about two miles north of the wye apex. The crossing will conform to American Railway Engineering Association standards.

The extreme end of the northern branch encounters an irrigation project currently being undertaken by a local property owner. NRAO scientists have found that termination of this branch at 11.8 miles, rather than the originally proposed 13 miles, will avoid interference with the irrigation project without seriously affecting VLA operations. The southwestern branch crosses the normal undisturbed drainage lines from the surrounding run-off area and has a low gradient for practically its entire length. The drainage demands on this branch are expected to be light except where sheet flooding enters from the hills on the northern side. Culverts and drainage channels will be used for

control in this area. The southeastern branch also is quite flat over most of its length. At the extreme end, a sizable wash area exists which will require some earthwork and other erosion control protection. Throughout most of the railway base, only the top six inches of the ground surface will need to be removed in order to place the embankment material. Adequate supplies of gravel and rock aggregate for embankment material are obtainable from existing nearby borrow pits.

There is no emitted electromagnetic radiation associated with VLA operations. The VLA does not transmit radio waves, but merely receives radiation from astronomical objects in space. In addition, there is no electromagnetic radiation emitted by the auxiliary electronics of the VLA system.

PART V

ADVERSE ENVIRONMENTAL EFFECTS

The presence of the VLA is not expected to alter drainage patterns in the Plains of San Augustin in a way to adversely affect the environment. The NRAO architects and engineers will work closely with professional hydrologists and erosion specialists during the development of the site to assure that no drainage problems will arise.

Because of the limited fencing and sloping embankments on the arms of the wye, the impact of the VLA upon the free and natural movement of livestock and wildlife is expected to be minimal. The Plains of San Augustin have a fairly limited amount of fauna, consisting primarily of birds, prairie dogs, ground squirrels, coyotes, rabbits, lizards, snakes and an occasional antelope.

VLA operations require the absence of local sources of disturbing electromagnetic interference. Certain types of industrial, manufacturing and mining development in the Plains of San Augustin are undesirable, unless steps are taken to keep interference at a very low level. This can be accomplished in most instances by proper shielding of motors, generators, welding equipment, and other radio emitting sources. Vehicular traffic on nearby U.S. Highway 60 poses no problem for radio astronomy observations since the effects that vehicle electrical systems introduce into the observational data can be readily removed.

The American Telephone and Telegraph company operates a microwave relay system in the vicinity of the Plains of San Augustin. One link of this system crosses the Plains and includes a 318-foot high relay tower

located 1.6 miles north of the proposed southeast arm of the VLA. The presence of this tower does not present a problem since the transmission channels are confined to the frequency ranges 2112 to 2128 MHz and 5960 to 6420 MHz, well away from the operating frequencies of the VLA. The bandwidths of the channels are less than 30 MHz wide and should not interfere with VLA operations.

The likelihood of commercial development seems small since the Plains of San Augustin is occupied by only a few scattered ranches, and has no immediate industrial or recreational value; the valley has no mineral resources that appear to be worth exploiting, and is far removed from potential manufacturers' sources of supply and a labor force. Coordination between the NRAO and future developers could minimize potential interference with the VLA radio astronomy program.

The present open space quality of the Plains will be preserved by the construction techniques outlined in Part IV. Maintenance of the existing character of the Plains with its primary industry of cattle grazing would provide the best environment for high quality radio astronomy observations. From the point of view of the visual impact upon the open space quality of the Plains, the antenna system will blend completely into the valley.

As was mentioned in Part III, no roads will exist along the arms of the wye when construction of the arms is finished. This will prevent tourists and unauthorized visitors from travelling along the VLA arms. Because the VLA is a major scientific research facility, tourists are expected to visit the site. The NRAO will develop a public information program including lectures, displays and guided tours that will confine all tourist activity to the headquarters building complex.

PART VI
ALTERNATIVES

In addition to the Plains of San Augustin site, six other sites in the southwestern United States were found to meet the minimum requirements established. However, all six are at much lower elevations, a characteristic that would adversely affect the ability of the VLA to operate at short wavelengths because of the greater amount of water vapor in the atmosphere at lower elevations. In addition, the alternate sites have one or more of the following characteristics: 1) difficult local terrain, 2) severe air pollution, 3) poor weather, and 4) extremely remote location. At three of the alternate sites, the extensive earth excavation required during construction would be prohibitively expensive and have a major environmental impact on the surrounding terrain. Two of the sites suffer from persistently troublesome levels of dust and haze in the atmosphere and from severe hailstorms. In the case of four of the six sites, no town exists within a reasonable commuting distance that could accommodate the families of the VLA operations and maintenance staff.

PART VII

IRREVERSIBLE RESULTS AND IRRETRIEVABLE COMMITMENTS

The final design, construction, and operation of the VLA is not expected to produce any irreversible results or irretrievable commitments. A minimum of earth excavation will be necessary and few permanent scars would remain if the project were to be abandoned.

Past mineral surveys in the Plains by the New Mexico State Bureau of Mines and Mineral Resources show little possibility of any future mining or other mineral recovery activities.

The area will be maintained in a virtually "as is" condition and cattle grazing and normal wildlife activity will not be affected.

Future industrial, manufacturing, and mining developments in the Plains of San Augustin should be carefully evaluated. Commercial developers would need to take precautions to properly shield sources of electromagnetic radiation, eliminate potential hazards to the railroad tracks, embankment material and observing stations forming the arms of the wye, and ensure no disruption of VLA operations. Potential developers should coordinate their plans with the NRAO.

Similarly, future microwave relay facilities in the valley should be designed so as to minimize interference with the VLA radio astronomy programs. It would be undesirable to locate telecommunications facilities in the Plains that transmit or receive on frequencies close to the VLA operating frequencies. In particular, ground stations designed to receive transmissions from satellites at or near the VLA operating frequencies could not be permitted in the valley.

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122, pp. 1-25, 1960.

COMMENTS ON THE DRAFT ENVIRONMENTAL STATEMENT

Comments received have been taken into account in preparing this final environmental statement. These comments are attached as follows:

ANNEX

- A Department of Agriculture
- B Department of Commerce
- C Department of the Interior
- D Department of Transportation
- E General Services Administration
- F State of New Mexico



DEPARTMENT OF AGRICULTURE
OFFICE OF THE SECRETARY
WASHINGTON, D. C. 20250

JUL 13 1972

Mr. T. O. Jones
National and International Programs
National Science Foundation
1800 G Street, N. W., Room 703
Washington, D. C. 20550

Dear Mr. Jones:

We have had the draft environmental statement on the Very Large Array (VLA) reviewed in the Department of Agriculture and have no questions or comments regarding this proposed development.

Sincerely,

A handwritten signature in cursive script, appearing to read "T. C. Byerly".

T. C. BYERLY
Coordinator, Environmental
Quality Activities



July 31, 1972

Mr. T. O. Jones, Deputy Assistant Director
National and International Programs
National Science Foundation
1800 G. Street, N. W., Room 703
Washington, D. C. 20550

Dear Mr. Jones:

The draft environmental impact statement for the Very Large Array which accompanied your letter of July 3, 1972, has been received by the Department of Commerce for review and comment.

The Department of Commerce has reviewed the draft environmental statement and has the following comments to offer for your consideration.

One possible adverse effect of the Very Large Array project of potential but unevaluated significance is the prevention of further industrial development and mineral exploitation in the Plains of San Augustin Valley in order to prevent interference with the proper operation of the project. The draft environmental statement does not contain any information on anticipated future economic development without the project. Nor does the environmental statement describe current industrial activity or the presence of mineral resources that could be exploitable at some future time.

Another subject of concern that occurred to us that was not dealt with relates to the presence of Highway U. S. 60 crossing the array. Automobile engines generate radio-frequency interference. We can conceive of future requirements that automobile traffic in the area be

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controlled, limited or banned, or that a significant U. S. highway either be closed or relocated at substantial expense. We think that it would be desirable for the environmental statement to speak to this possibility.

Certainly, if mining would generate harmful interference, automotive engines crossing the actual array could be significant.

In a similar vein, we think that it would be desirable for the environmental statement to discuss the possible blocking of future telecommunications facilities, particularly microwave relays, but also possibly satellite ground stations, including local receiving stations of the type to be used in India.

We hope these comments will be of assistance to you in the preparation of the final statement.

Sincerely,



Sidney R. Galler
Deputy Assistant Secretary
for Environmental Affairs



UNITED STATES
DEPARTMENT OF THE INTERIOR
OFFICE OF THE SECRETARY
WASHINGTON, D.C. 20240

ER 72/833

SEP 11 1972

Dear Mr. Jones:

The draft environmental statement for the Very Large Array (VLA) seems oriented towards the technical reasons for selection of the Plains of San Augustin as the proposed site. The list of criteria for site selection does not contain those relating to the environmental effects of VLA. The existing environment and environmental impacts could be more adequately described and discussed.

The Site

One criterion for site selection was that the site be removed from sources of human activity that create sources of electromagnetic interference. Included within this criterion were mining and gas drilling. While there is little evidence that any known mineral resource would be affected by the project and there are few indications of mineral potential in the adjoining area, a discussion of the mineral resources would be helpful in evaluating the effects of the project.

Another requirement is that the site be located away from fault zones and regions of high seismic activity. The last major earthquake in the area was in the 1880's. Since considerable damage was sustained in Socorro, the epicenter was probably near Ladron or the Socorro Mountains. According to local residents, major cracks (one to three feet wide) developed over the entire San Augustin Plains. Minor tremors have been felt since then.

Another requirement was that the site be within commuting distance of a city having adequate housing and public facilities. Socorro, the nearest city, has a population of 6000 people. During the nine year construction phase, assuming an average family size of only two, the population will increase by 300 people because of VLA. The statement indicates that facilities are adequate. Are these facilities presently under-utilized? A more complete assessment of any possible dislocation to Socorro's economy and infrastructure could be made in the statement. The region is economically depressed.

The statement also indicates that communications relay stations would interfere with radio astronomy observations. Two micro-wave facilities, one on the "Little Divide" on the east side and one on the west side near the crest of the Datil Mountains, are presently in operation.

Environmental Impacts

Detailed descriptions of the impacts of the project on topography, soils, water and open space values are not included. The impact on open space might be apparent over hundreds of square miles.

Impacts on wildlife are not discussed in a significant manner. A list of the wildlife species present in the area would be helpful in assessing impacts.

The statement is deficient in its review of impacts resulting from withdrawal of underground water to meet the needs of the project. A more detailed discussion of underground water supplies would be helpful.

The statement indicates that further development of the Plains of San Augustin would be curtailed. It is difficult to assess the magnitude of this impact without some idea of the space needed to meet the isolation requirements of VLA. The statement indicates that the project will require approximately 3400 acres. This may include only the land needed for project facilities. If no development is allowed between the arms of the wye, as much as 530 square miles may be affected. The statement should discuss the extent of this impact upon the affected land owners and should consider measures which might be taken to mitigate this impact, such as acquisition of development rights.

The nearest property listed on the National Register of Historic Places is the Gallinas Springs Ruin in the Magdalena vicinity about 7 1/2 miles north of the junction of U.S. Highway 60 and State Road 52. The final environmental impact statement should reflect compliance with the Historic Preservation Act of 1966, by indicating consultation with the National Register of Historic Places and stating, if substantiated, that the project will have no effect on National Register properties. It is also recommended that the project be discussed with the State Liaison Officer with respect to properties being considered for nomination to the National Register and that his findings be reflected in the statement.

The State Liaison Officer for Historic Preservation for New Mexico is the Acting State Planning Officer, State Capitol, 403 Capitol Building Santa Fe, New Mexico 87501.

The statement does not consider the impact of the proposed facility upon possible archeological resources of the area. Since significant archeological remains are known to exist elsewhere in the Plains of San Augustin, it is recommended that a survey of the area involved be conducted by competent archeologists and that the survey findings be incorporated into the statement. Whenever the presence of archeological resources is indicated, the statement should outline the procedures to be followed to locate, identify, and preserve or salvage such resources in advance of construction activity.

The Museum of New Mexico, Santa Fe, or the University of New Mexico, Albuquerque could provide archeological assistance for such a survey.

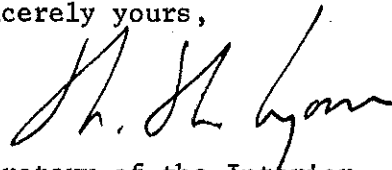
Alternatives

The statement does not describe the seven alternative sites that were considered and does not consider the alternative of not developing the project. The environmental impacts of each alternative are not discussed.

The statement doesn't include a discussion of the relationship of short-term use to the maintenance and enhancement of long-term productivity.

The section on irreversible and irretrievable commitment of resources does not discuss the possible loss of mineral resource values.

Sincerely yours,



Deputy Assistant

Secretary of the Interior

Mr. T.O. Jones
Deputy Assistant Director
National and International Programs
National Science Foundation
Washington, D.C. 20550



U. S. DEPARTMENT OF TRANSPORTATION
FEDERAL HIGHWAY ADMINISTRATION

117 U. S. Court House
Santa Fe, New Mexico 87501

IN REPLY REFER TO

Mr. T. O. Jones
Deputy Assistant Director
National and International Programs
National Science Foundation
1800 G Street, N. W., Rm. 703
Washington, D. C. 20550

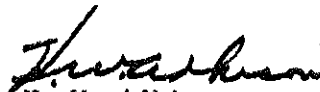
Dear Mr. Jones:

Your draft environmental statement on the Very Large Array (VLA) has been reviewed in this office, and we find there are no adverse impacts of national significance with respect to the highways of the area.

The New Mexico State Highway Department is the coordinating agency to contact in the development of plans for the intersection of your access road with US 60 and the crossing of the highway by the railroad tracks for the north branch wye.

We appreciate being afforded the opportunity to review your draft environmental statement.

Sincerely,


H. W. Adkison
Division Engineer



OFFICE OF THE SECRETARY OF TRANSPORTATION
WASHINGTON, D.C. 20590

July 11, 1972

Mr. T. O. Jones
Deputy Assistant Director
National and International Programs
National Science Foundation
1800 G Street, N. W.
Room 703
Washington, D. C. 20550

Dear Mr. Jones:

We appreciate the opportunity to comment on the draft environmental impact statement on the Very Large Array (VLA), transmitted with your July 3 letter. This office has no specific comments to offer on the statement.

However, we have referred the draft statement to the Federal Highway Administration Division in New Mexico for his review. Any comments he may have to offer will be submitted directly.

Sincerely,

A handwritten signature in cursive script, appearing to read "M Convisser".

Martin Convisser, Director
Office of Environmental Quality
Office of the Assistant Secretary for
Environment and Urban Systems

UNITED STATES OF AMERICA
GENERAL SERVICES ADMINISTRATION
WASHINGTON, D.C. 20405

ANNEX E



AUG 30 1972

Mr. T.O. Jones
Deputy Assistant Director
National and International Programs
National Science Foundation
Washington, D.C. 20550

Dear Mr. Jones:

As requested in your recent letter, the General Services Administration has reviewed the draft environmental impact statement for Very Large Array.

Our review of this draft environmental statement discloses no problems of concern to this agency.

Sincerely,

A handwritten signature in cursive script that reads "Rod Kregar".

ROD KREGER
Deputy Administrator

STATE OF NEW MEXICO



STATE PLANNING OFFICE

BANTA FE

OFFICE OF DIRECTOR

July 25, 1972

Mr. T.O. Jones
Deputy Assistant Director
National and International
Programs
National Science Foundation
1800 G Street, N.W., Room 703
Washington, D.C. 20550

Dear Mr. Jones:

I have carefully reviewed your Draft Environmental Statement Very Large Array, and commend you on what appears to be a very objective analysis.

Many important points were discussed in our May 15, 1972, meeting in Magdalena, New Mexico, with representatives of your office, the National Radio Astronomy Observatory, and the land owners of the San Augustine Plains. Most of the issues covered in that meeting have been included in your statement; however, I have noticed that a few points have been omitted. With the interests of the land owners in mind, I would like to see the following four items also implemented in your final draft:

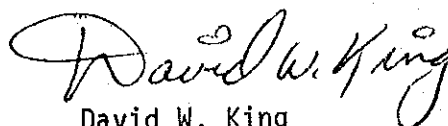
1. Assurance that if any grassland is destroyed it will be replaced,
2. A statement that no tourists will be allowed along the arms of the array,
3. A statement that no roads will be constructed alongside the arms of the array, and
4. A statement to insure that additional land will not be required at a later date.

I feel as though we have established a good working relationship with these land owners, and in an effort to maintain this alliance, and keep them fully informed of all action, I have forwarded each of them a copy of your draft statement and my comments. I have also advised them to inform my office of any major discrepancy they may find in your statement that has not been covered by my remarks.

Mr. T.O. Jones
July 25, 1972
Page 2

I would like to thank you very much for the opportunity to review your draft and provide this input to your final environmental statement. Please continue to keep my office informed of all action at your end, and I will continue to do the same.

Sincerely,

A handwritten signature in cursive script that reads "David W. King". The signature is written in dark ink and is positioned above the typed name and title.

David W. King
State Planning Officer

DWK/CK/ns

STATE OF NEW MEXICO



STATE PLANNING OFFICE

SANTA FE

OFFICE OF DIRECTOR

August 4, 1972

Mr. T. O. Jones, Deputy Assistant Director
National Science Foundation
1800 G. Street, Room 703
Washington, D.C. 20550

Dear Mr. Jones:

In reference to the National Science Foundation's proposed Very Large Array project to be constructed in the San Augustine Plains of New Mexico, it has been brought to my attention by one of the property owners, Mr. Marvin Ake, that the National Science Foundation plans to restrict the ranchers from any development on their private land, as this might interfere with reception.

You have stated in your draft environmental statement on page 11:

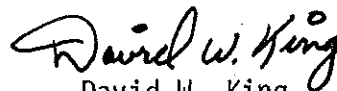
"Because VLA operations require a low population density, low levels of human activity and the absence of local sources of electromagnetic interference, further industrial development of the Plains of San Augustine would be curtailed. Mining and manufacturing activities or development that would produce electromagnetic radiation could not be permitted in the valley because they would preclude successful radio astronomy observations."

For my personal knowledge, and on behalf of the property owners to be affected, I would appreciate it very much if you would elaborate on this situation, explaining exactly what type and size industrial development, mining, and manufacturing activities, at what distances from the Array, and to what degree they would be curtailed. I feel the ranchers' right to develop their land in the most advantageous manner must be protected. Would you please forward this information to my office at your earliest convenience, and also include it in your final environmental statement.

Mr. T. O. Jones
August 4, 1972
Page 2

Thank you very much for allowing us the opportunity to comment on the Very Large Array project. If you have any questions on this request, or if I can assist you in any way, feel free to contact me anytime.

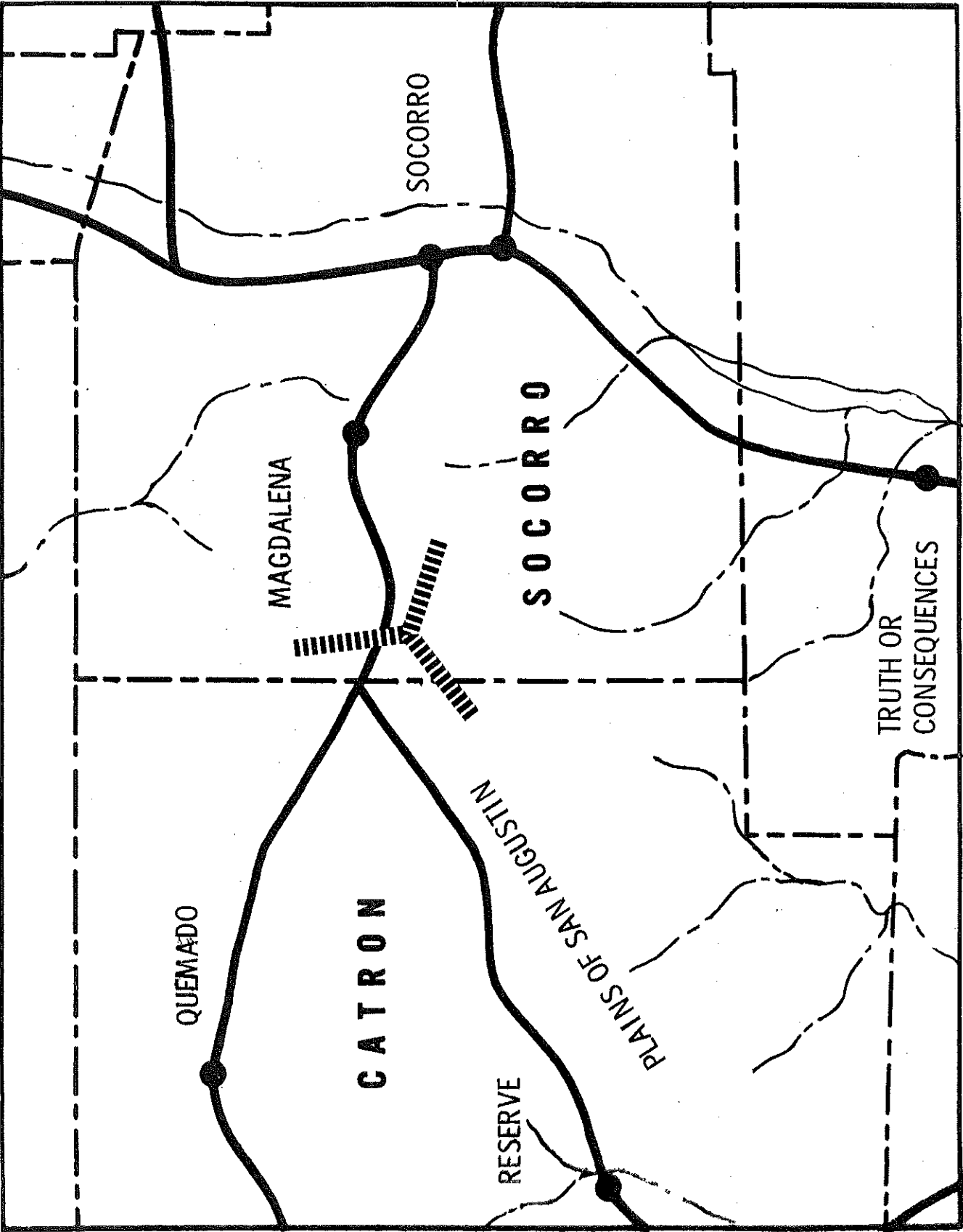
Sincerely,

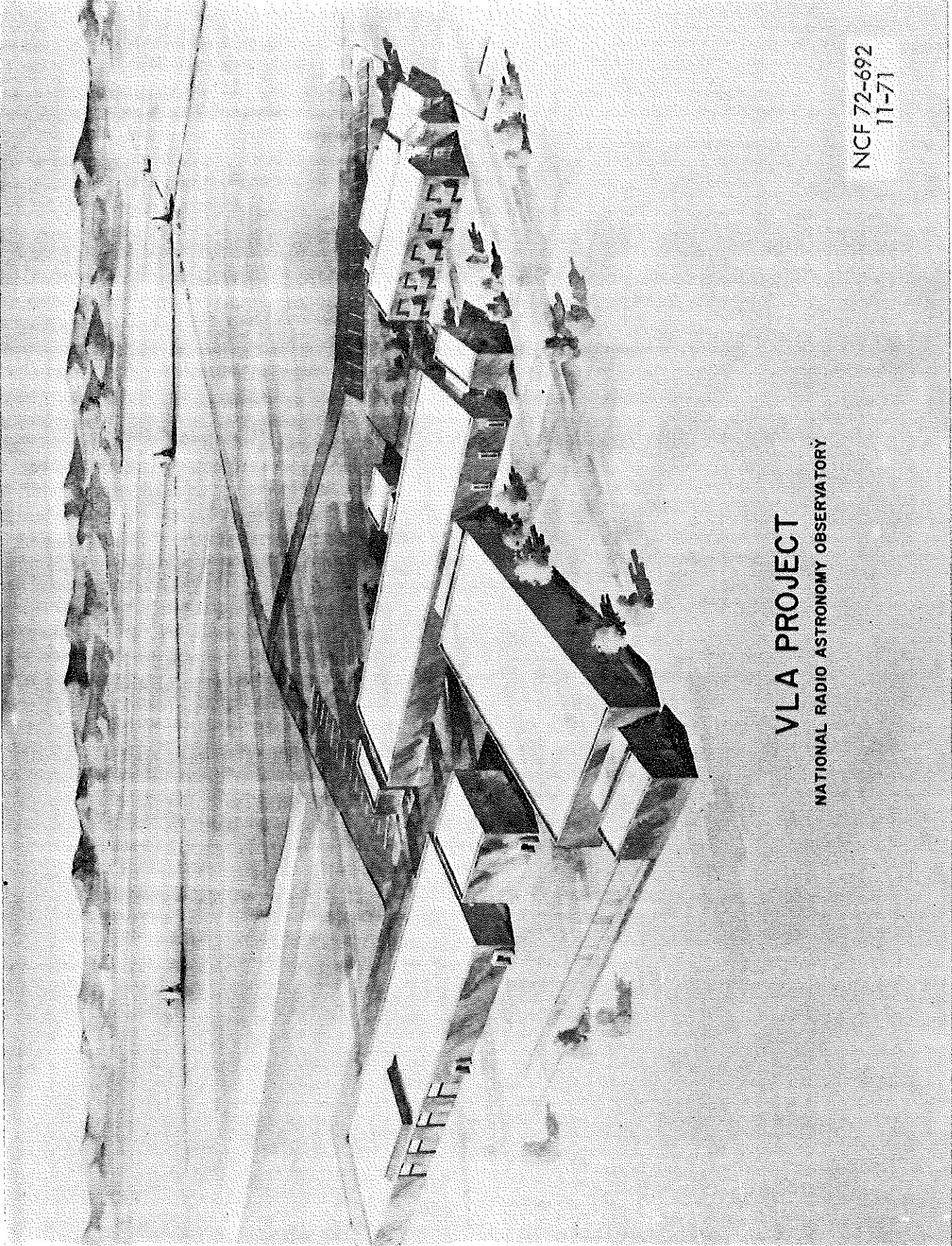


David W. King
State Planning Officer

DWK:CK:pls

copies to: Mr. Jay Taylor, P.O. Box 2748, Amarillo, Texas 79105
Mr. Jack Bruton, P.O. Box 177, Datil, New Mexico 87821
Mr. Michael Harriet, 603 Park Street, Socorro, New Mexico 87801
Mr. B. E. Walker, P.O. Box 158, Fort Hancock, Texas 79839
Mr. Malcolm S. Major, Jr., P.O. Box 367, Magdalena, New Mexico
Montosa Cattle Company, P.O. Box 125, Magdalena, New Mexico 87825
Mr. Henry D. Wellborn, P.O. Box 155, Datil, New Mexico 87821
Mr. W. W. Benton, P.O. Box 163, Datil, New Mexico 87821
Mr. Marvin Ake, P.O. Box 4, Magdalena, New Mexico 87825
Mr. Lee Graham, Datil, New Mexico 87821





VLA PROJECT
NATIONAL RADIO ASTRONOMY OBSERVATORY

NCF 72-692
11-71

