United States General Accounting Office

GAO

Report to the Honorable
Harry Reid, U.S. Senate

December 1999

FEDERAL FACILITIES

Alternative Land Uses Could Save Water at Fallon Naval Air Station, Nevada

GAO/RCED/NSIAD-00-42

Contents

Abbreviations

DOD	Department of Defense
FAA	Federal Aviation Administration
NAS	Naval Air Station
NOTS	Naval Ordnance Test Station

GAO
Accountability * Integrity * Reliability

United States General Accounting Office
Washington, D.C. 20548

Resources, Community, and
Economic Development Division

B-283968

December 10, 1999

The Honorable Harry Reid
United States Senate

Dear Senator Reid:

The U.S. Navy, which operates the Fallon Naval Air Station (NAS) in Nevada, pursues a strategy for managing land around its runways–the runway protection zone–that requires extensive water usage in an area where water is scarce. The Fallon area averages less than 5 inches of rain per year. Since the 1950s, the Navy has maintained a "greenbelt" at the air station that consists of acreage leased to local farmers who grow irrigated crops on the land. In the Navy's view, having a "greenbelt" serves to protect the operational capability of the facility by reducing the risk of fire, lowering the chance of bird strikes or other damage to aircraft from foreign objects, and controlling dust. Since 1990, the Navy, on average, has annually used approximately 1.6 billion gallons of surface water supplied by the local irrigation project to irrigate this land. According to Fallon NAS officials, the average annual water consumption for the balance of Fallon NAS has been 219 million gallons, which is drawn from wells. Other military facilities and commercial airports located in similar environments have opted for land use approaches that are less water intensive.

At your request, we gathered information on (1) the aviation safety and operational requirements for the runway protection zone at Fallon NAS, (2) the alternative land use strategies Fallon NAS identified in response to congressional direction[1] and how it evaluated them, and (3) the current

[1]In 1990, the Congress passed P.L. 101-618, which requires the Secretary of the Navy to "undertake a study to develop land management plans and measures to achieve dust control, fire abatement and safety, and foreign object damage control on those lands owned by the United States within the Naval Air Station at Fallon, Nevada, in a manner that, to the maximum extent practicable, reduces direct surface deliveries of water." Upon completion of the study, the Secretary of the Navy must "select and implement land management plans or measures developed by the study . . . upon determining that water savings can be made without impairing the safety of operations at Naval Air Station, Fallon."

land use strategies at five military facilities and two commercial airports that operate in similar environments.[2]

Results in Brief

Fallon NAS must comply with the Department of Defense's (DOD) aviation safety and operational requirements for runway protection zones. These requirements specify the maximum safe heights for buildings, towers, poles, and other possible obstructions to air navigation. Under these requirements, where possible, areas immediately beyond the ends of runways and along primary flight paths should be developed sparsely, if at all, to limit the risk from a possible aircraft accident. At Fallon NAS, the agricultural and other low-density land uses are compatible with air operations. The land surrounding the airfield is owned by the Navy and leased to farmers for agricultural use, which is permitted by DOD.

Fallon NAS gave detailed consideration to three land management strategies in developing its current approach to managing land in the runway protection zone in the early 1990s. Each of these strategies involved irrigating the greenbelt. As many as 11 different land management strategies were identified at the outset, but three of them were eliminated before an initial screening because Fallon NAS officials believed they would be environmentally or economically unacceptable or would cause unacceptable operational or safety impairments. Fallon NAS officials eliminated five of the remaining eight strategies prior to a detailed analysis because they believed the strategies did not meet the Navy's evaluation criteria, which were based on provisions of the law. The criteria Fallon NAS used in evaluating these land management strategies were based on the officials' assessment of whether the strategies would minimize dust, bird strikes, fire and other hazards; would enhance air safety; and, to a lesser extent, would reduce the amount of irrigation water used. After a detailed analysis and the application of these criteria, Fallon NAS officials selected the strategy that involves conventional farming combined with water conservation practices because they believed it would have a very high probability of satisfying the safety goals while providing moderate water savings compared with the air station's historical usage.

[2]These seven airports in desert locales were Lemoore Naval Air Station, Calif.; China Lake Naval Air Weapons Station, Calif.; Yuma Marine Corps Air Station, Ariz.; Luke Air Force Base, Ariz.; Nellis Air Force Base, Nev.; Sky Harbor International Airport, Ariz.; and McCarran International Airport, Nev.

At the seven other military facilities and commercial airports we visited, the land management strategies varied; two used strategies involving greenbelts, while five did not. The military facilities and commercial airports operating in desert-like conditions similar to Fallon NAS' have employed land management strategies that have resulted in water savings. For example, Sky Harbor International Airport, in Phoenix, Arizona, converted a significant amount of its surrounding area to desert landscaping that receives little or no watering. Airport officials also adopted other water conservation measures such as using rock to replace watered vegetation. These efforts helped save the airport about 70 million gallons of water in 1997. At Nellis Air Force Base in Nevada, the terrain around the runways has always been mostly “disturbed” desert (regrown native plants, thistle, or weeds) that is not watered. Because of the base's increased emphasis on desert landscaping, water consumption has dropped by almost half, from about 1.4 billion gallons in fiscal year 1996 to about 760 million gallons in fiscal year 1999. Fallon NAS officials said that they were aware of these other land management strategies but that, to date, they had not studied them in detail.

Background

Fallon NAS was constructed in the 1940s on land that previously had been farmed using water provided by the Bureau of Reclamation's Newlands Reclamation Project. Prior to the project, which was authorized in 1903, early settlers irrigated about 20,000 acres using simple diversions from the Truckee and Carson rivers. The Newlands project nearly quadrupled the amount of irrigated land to 78,000 acres, and the land surrounding the airfield has been irrigated farmland since. In the 1950s, the Navy obtained, as a buffer against encroachment, land surrounding the airfield that had been irrigated farmland. It has since leased the bulk of that land to farmers. Fallon NAS officials believe that continued use of the land for agriculture is of value to the local community as well as to the air station. They point out that the City of Fallon and Churchill County are concerned that any reduction in Fallon NAS' irrigation could have a negative impact on the recharging of the underlying aquifer, cause the manifestation of noxious weeds in fields, and have an impact on the economics of neighboring ranches and farms.

The Navy currently holds water rights under the Newlands project for approximately 2,900 acres of the land at Fallon NAS. Of this acreage, the Navy has active water rights to about 1,900 acres of land. Water rights are attached to specific parcels of land, and Fallon NAS is entitled to 3.5 acre-feet of water per acre of water-righted land from the Newlands project. An

acre-foot is the volume of water sufficient to cover an acre of land to the depth of 1 foot, which is about 325,900 gallons. The water rights for the remaining 1,000 acres are inactive.[3] The active water rights, which would equal about 2.2 billion gallons, are used to obtain irrigation water to support the Navy's 3,595-acre greenbelt surrounding Fallon NAS' airstrip areas. The greenbelt has consumed an average of 1.6 billion gallons of this irrigation water each year since 1990. This figure includes drought years in which less water than the normal allocation was available and other years in which water over and above the acreage's entitlement was made available.

As can be seen in figure 1, about a third of the greenbelt acreage lies inside the runway protection zone.

[3]Fallon's acres with inactive water rights have been taken out of agricultural production and used for concrete pads, housing areas, or other structures.

Figure 1: Fallon NAS' Runway Protection Zone and Greenbelt Area

Under Public Law 101-618, enacted in 1990, officials at Fallon NAS were required to develop an alternative land management plan that would control dust, provide for fire abatement and safety, and control damage to aircraft from foreign objects, while at the same time reducing the use of irrigation water. The law also required Fallon NAS to select and implement land management plans without impairing the safety of air operations. Under this act, the Navy has discretion to determine what constitutes operational air safety for Fallon NAS. In addition, the Secretary of the Navy was required to consult with the Secretary of Agriculture and other interested parties to fund and implement a demonstration project and test site at Fallon NAS for the cultivation and development of grasses, shrubs, and other native plant species. The project's goal was to help with the restoration of previously irrigated farmland in the Newlands project area to a stable and ecologically appropriate dryland condition.

In responding to the act's requirements, the Navy studied various land management strategies, consulted with the Secretary of Agriculture and interested parties, and selected a strategy for the greenbelt that combines conventional farming with water conservation practices. Fallon NAS officials have started to implement this strategy for the runway protection zone. When fully implemented, the strategy would use approximately 1.4 billion gallons of water per year, somewhat of a decrease from the average of 1.6 billion gallons used annually in recent years.

Aviation and Safety Requirements for the Runway Protection Zone at Fallon NAS

Fallon NAS is governed by aviation safety and operational standards established by DOD for runway protection zones.[4] DOD's standards for military facilities and the Federal Aviation Administration's (FAA) standards for commercial airports require runway protection zones to protect lives and property. Under these standards, airports can obtain sufficient authority to restrict the use of the land for the runway protection zones in three primary ways. First, an airport can purchase the approach areas outright. Second, an airport can seek zoning requirements to control the way land owned by others is used. Third, an airport can purchase easements proscribing the incompatible use of land owned by others.

[4]We define “runway protection zone” as including clear zones and “accident potential” zones. Thus, runway protection zones encompass those areas that are immediately adjacent to and just off the end of runways and beyond, where the potential for accidents is considered to be significant or measurable.

Outright ownership is preferable because it gives an airport maximum control.

It is DOD's and FAA's policy to oppose incompatible land uses that are proposed for property within the runway protection zones. Incompatible land uses include residences and places of public assembly such as churches, schools, hospitals, office buildings, and shopping centers. Compatible land uses within the runway protection zones are generally uses such as agriculture or golf courses that do not involve concentrations of people or the construction of buildings or other structures. DOD and FAA also allow other land uses that do not attract wildlife and that do not interfere with navigational aids. Neither policy requires the establishment of a greenbelt.

Fallon NAS Limited Its Detailed Consideration to Three Alternatives

In arriving at the land management strategy for Fallon NAS, the Navy considered three alternatives in detail. Each involved continued irrigation of land in Fallon NAS' greenbelt.

As many as 11 different land management strategies were identified by Fallon NAS officials at the outset. Three strategies were eliminated from consideration before the initial screening was conducted. These three included covering the greenbelt with asphalt, cement, or rocks, or allowing the irrigated fields to go fallow. These strategies were eliminated because the officials believed that they would be environmentally or economically unacceptable or would cause unacceptable operational or safety impairments. They also felt that the strategies would be expensive to maintain and would not provide a “soft” landing for any aircraft accident.[5]

The remaining eight land management strategies were subjected to an initial screening on the basis of how they would contribute to the Navy's policy of zero accidental aircraft mishaps and at the same time fulfill the requirements of P.L. 101-618. Four evaluation criteria were used to assess the viability of the strategies:

- controlling dust and damage from foreign objects, including bird strikes;
- minimizing fire hazards;

[5]Navy officials could provide us with no documentation of studies supporting the contention that vegetation provides a safer landing than other surfaces.

- establishing a high probability of achieving safety objectives and contributing to zero-mishap management; and
- reducing the direct surface deliveries of irrigation water.

Of the eight land management strategies, five were eliminated because Fallon NAS officials believed those strategies did not meet the evaluation criteria. These five strategies ranged from changing the plants allowed to be grown in the area to using drainwater for irrigation.

The remaining three land use strategies were then subjected to detailed consideration. Table 1 presents a comparison of the features of the three strategies Fallon NAS officials considered in detail.

Table 1: Comparison of Land Use Strategies Considered in Detail for Fallon NAS

Land use strategy	Crop planting pattern	Irrigated land (acres)	Nonirrigated land (acres)	Water savings (millions of gallons per year)
(1) Conventional farming with water conservation practices	Alfalfa hay, tall fescue/clover mix, barley, tall wheatgrass pasture, and improved irrigated pasture	1,914	1,681	750.4
(2) Alfalfa and pasture cropping pattern with water conservation practices	Alfalfa hay, improved irrigated pasture, and barley	1,914	1,681	1,039.2
(3) Conventional farming of fewer acres but with no water conservation practices	Alfalfa hay, tall fescue/clover mix, and tall wheatgrass pasture	1,653	1,942	414.9

Source: *Environmental Assessment for the Management of the Greenbelt Area at Fallon Naval Air Station*, 1994.

The first and second strategies considered in detail included water conservation practices. The methods considered for saving water included lining canals, leveling fields for proper drainage, establishing windbreaks, and improving irrigation scheduling. The third strategy would not have required any changes to the way Fallon NAS officials had been managing the greenbelt land but would have reduced the use of water by irrigating fewer acres. Fallon NAS officials believed that, over time, this strategy would result in land degradation and that there was a low probability that it would control safety hazards such as dust, fire, and damage to aircraft from foreign objects and bird strikes.

In considering these strategies, Fallon NAS officials made no distinction between the greenbelt areas that lie within the runway protection zone and the areas that lie outside the zone. Approximately 1,145 acres of the greenbelt lie within the runway protection zone, while 2,450 acres are outside of it. We found no analysis that had determined whether the 2,450 acres of the greenbelt outside the runway protection zone required the same level of prevention of foreign objects, bird strikes, or dust as the 1,145 acres within the zone. Fallon NAS officials confirmed that no such distinction had been made in conducting their analyses.

Fallon NAS officials selected the first strategy: conventional farming with water conservation practices. At the time, these officials believed that the advantages of this strategy were the very high probability that it would satisfy the safety goals for the greenbelt for the long term and provide moderate water savings. They believed that the disadvantage would be the substantial capital, operations, and maintenance costs of the water conservation methods.

When fully implemented, the chosen strategy would encompass 1,914 water-righted acres of land, using approximately 1.4 billion gallons of water per year. Navy officials believed that the plan would be costly to implement because it included lining irrigation canals with concrete, leveling fields for proper drainage, and other measures. According to Navy officials, the total cost to implement all these measures could be as much as $3.5 million.

Since selecting the strategy of conventional farming with water conservation practices in 1995, Fallon NAS officials have undertaken efforts to implement it. As of May 1999, Fallon NAS had lined 16,419 linear feet of irrigation ditches and leveled 347 acres of fields at a cost of about $655,000. This cost was in addition to an estimated $817,000 spent on studies and pilot projects. According to the officials, the implementation of this strategy has stalled because of excessive costs and a shortage of funds. In 1998, Fallon NAS advertised a contract to line another 45,000 linear feet of ditches with concrete and level another 800 acres of fields. Fallon NAS originally estimated the cost of the additional work to be $1.4 million, but the lowest bid it received for the work was $1.9 million. According to Fallon NAS officials, because of the excessive costs, a shortage of funds, and concern that the work would save what they believed would be a relatively small amount of water, this contract was not awarded. Hence, Fallon NAS' chosen land management strategy is not currently being fully implemented.

After the completion of our field work, Fallon NAS officials took action to comply with the Fiscal Year 2000 National Defense Authorization Act, which was enacted on October 5, 1999. The act included a provision concerning water usage at Fallon NAS. To comply with their understanding of the law, Fallon NAS officials informed us that they have decided to reduce the irrigated land by about 700 acres. They will cease irrigation in areas farthest from the airfield and the runway protection zone. Fallon NAS officials expressed misgivings about this action but said that it would allow them to comply with the new law. While they pointed out that the affected land is not "technically within the runway protection zones," they were concerned that "improper management could impair operational safety and create negative environmental impacts" and that Fallon NAS may incur added costs "to properly manage the land for [foreign object damage], fire, weed and dust control." They also expressed concern about possible "long-term degradation of the land." On balance, however, they said that the strategy meets the requirement of the new law, and they also pointed out that the action will serve as "an excellent pilot study" of what happens when irrigation ceases.

Land Management Strategies Varied at Military Facilities and Commercial Airports Visited

The land management strategies varied at the seven other military facilities and commercial airports we visited. All were located in environments similar to Fallon NAS'. Two military facilities used greenbelts, while the other five did not. Officials at all seven facilities said their current land use strategies provided a safe environment for their aircraft operations. The strategies varied because of differences in land formation, history, access to established irrigation facilities, and ownership. For example, at the two Navy and one Marine Corps facilities we visited, the government owned outright the areas surrounding the airfields as it does at Fallon NAS. According to Navy officials, it has been the Navy's practice to purchase land surrounding airfields to reduce possible encroachment and, where possible, to lease this land for agricultural purposes–an activity compatible with aircraft operations. One of the two Navy facilities and the one Marine Corps facility we visited had greenbelts that were being farmed. Like Fallon NAS, Lemoore NAS in Lemoore, California, and Yuma Marine Corps Air Station in Yuma, Arizona, were constructed on land that was originally used for irrigated farming. These three facilities maintain agricultural outlease programs through which the Navy or Marine Corps leases the land adjacent to the airfields to farmers. The farmers maintain the land and grow the irrigated crops specified by the leases. The third naval location we visited, China Lake Naval Weapons Station in Ridgecrest, California, does not have a greenbelt and does not plan to have one. The station was constructed in a

desert area where crops are not grown and where the vast, sparsely populated area is considered to be an ideal location for testing weapons and conducting research and development.

Neither of the two Air Force bases nor the two commercial airports we visited had an agricultural program like the Navy and Marine Corps facilities', nor did they try to maintain green areas around their runways and taxiways. None has returned substantial acreage of well-established agricultural land to native conditions. Officials from these facilities told us that their research had not uncovered any reports equating the safety of air operations with vegetation at the end of runways. In addition, they said that the cost to maintain and water green areas in the absence of available irrigation facilities would be substantial. At present, their water usage for the runway protection zones was minimal.

Officials at the facilities we visited expressed a strong desire to hold down their water costs and believed that maintaining green areas around runways was inconsistent with this objective. For example, Sky Harbor International Airport in Phoenix, Arizona, used rock to landscape areas surrounding the airport that were once irrigated. Additionally, Sky Harbor officials have converted a significant amount of the airport's surrounding area to desert landscaping and have adopted other water conservation measures such as using a computerized irrigation system. According to the officials, these efforts helped the airport save about 70 million gallons of water during 1997. Similarly, at Nellis Air Force Base in Las Vegas, Nevada, the terrain around the runways is mostly disturbed desert (regrown native plants, thistle, or weeds). Because of the base's increased emphasis on desert landscaping, water consumption has dropped by almost half, from about 1.4 billion gallons of water in fiscal year 1996 to about 760 million gallons of water in fiscal year 1999.

The facilities we visited without green areas around their runways used several techniques to maintain their land for safety purposes. These techniques include (1) mowing their fields to maintain them as open space, (2) covering specific areas within and surrounding the airstrip with asphalt or cement, and (3) allowing their fields to go fallow and applying a soil cement sealant in strategic locations to control dust and damage to aircraft from foreign objects. Fallon NAS officials said that, while they are aware of these other land management strategies, to date they have not studied them in detail. More detailed information on the land use practices of the five military facilities and two commercial airports we visited are included in appendix I.

Conclusions

The Navy chose a land management strategy for the runway protection zone at Fallon NAS that is water intensive in an area where water is a scarce resource. Other strategies used in similar environments use less water while at the same time providing safety for air operations. Navy officials at Fallon NAS are aware of many of these other land management strategies but, to date, have not studied them in detail. Nor have they considered adopting different strategies for specific areas within and beyond the runway protection zone.

Recommendation

In light of the congressional concern over water consumption in this desert area as expressed in statute and in light of the techniques used at other desert air fields that are less water intensive, we recommend that the Navy consider these techniques for Fallon NAS. Specifically, the Navy should consider its earlier identified strategies and adopt specific actions that would achieve safety and operational requirements while reducing water use at the air station. It should consider adopting different strategies that recognize the distinction between areas within the runway protection zone and those beyond the zone. The results of the Navy's decision to stop irrigating 700 acres of previously irrigated land should be closely monitored to determine whether this strategy can be successfully applied to additional land at Fallon NAS.

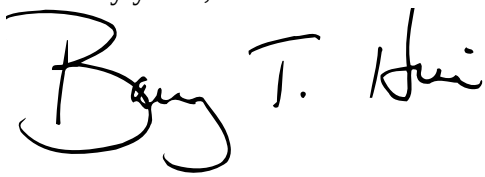
Agency Comments

We provided the Department of Defense with a draft of this report for its review and comment. DOD's written comments are in appendix II. DOD generally concurred with the draft report's recommendation. However, DOD expressed concern that the report did not accurately provide detailed information on the water usage conditions at Fallon NAS as compared with other civilian and military installations and that the report did not fully convey the specific actions taken by the Navy to comply with the requirements of congressional direction. DOD also stated that the report did not mention the value of the Navy's use of irrigation water to the local community for agriculture and to enhancement of the safety of the Navy's operations. We have provided additional information in the report to address DOD's concerns. DOD also provided technical changes, which were made as appropriate.

We performed our review from May through December 1999 in accordance with generally accepted government auditing standards. Our scope and methodology are discussed in appendix III.

We will provide copies of this report to the Honorable William Cohen, Secretary of Defense; the Honorable Richard Danzig, Secretary of the Navy; and to representatives of McCarran International Airport, Sky Harbor International Airport, and the U.S. Department of Transportation. We will also make copies available to others on request. If you or your staff have any questions, please contact me at (202) 512-3841 or Brad Hathaway at (202) 512-4329. Key contributors to this report are listed in appendix IV.

Sincerely yours,



Barry T. Hill
Associate Director, Energy,
Resources, and Science Issues

Land Use Practices at Five Military Facilities and Two Commercial Airports

Lemoore Naval Air Station, California

Land History/Ownership

The decision to construct Lemoore Naval Air Station (NAS) was made in October 1954 when it became clear that Moffett Field NAS near San Francisco could not be expanded because of urban encroachment. Lemoore was chosen because of its central location, good weather for flying, relatively inexpensive land, and nearby accommodations. At the time of this decision, the land chosen for the air station and the surrounding area was agricultural, as it remains today. Lemoore still has room to expand beyond its two parallel runways, and Navy officials told us that, if necessary, they could add another runway and an additional 265 F/A-18 aircraft to the 252 now stationed there.

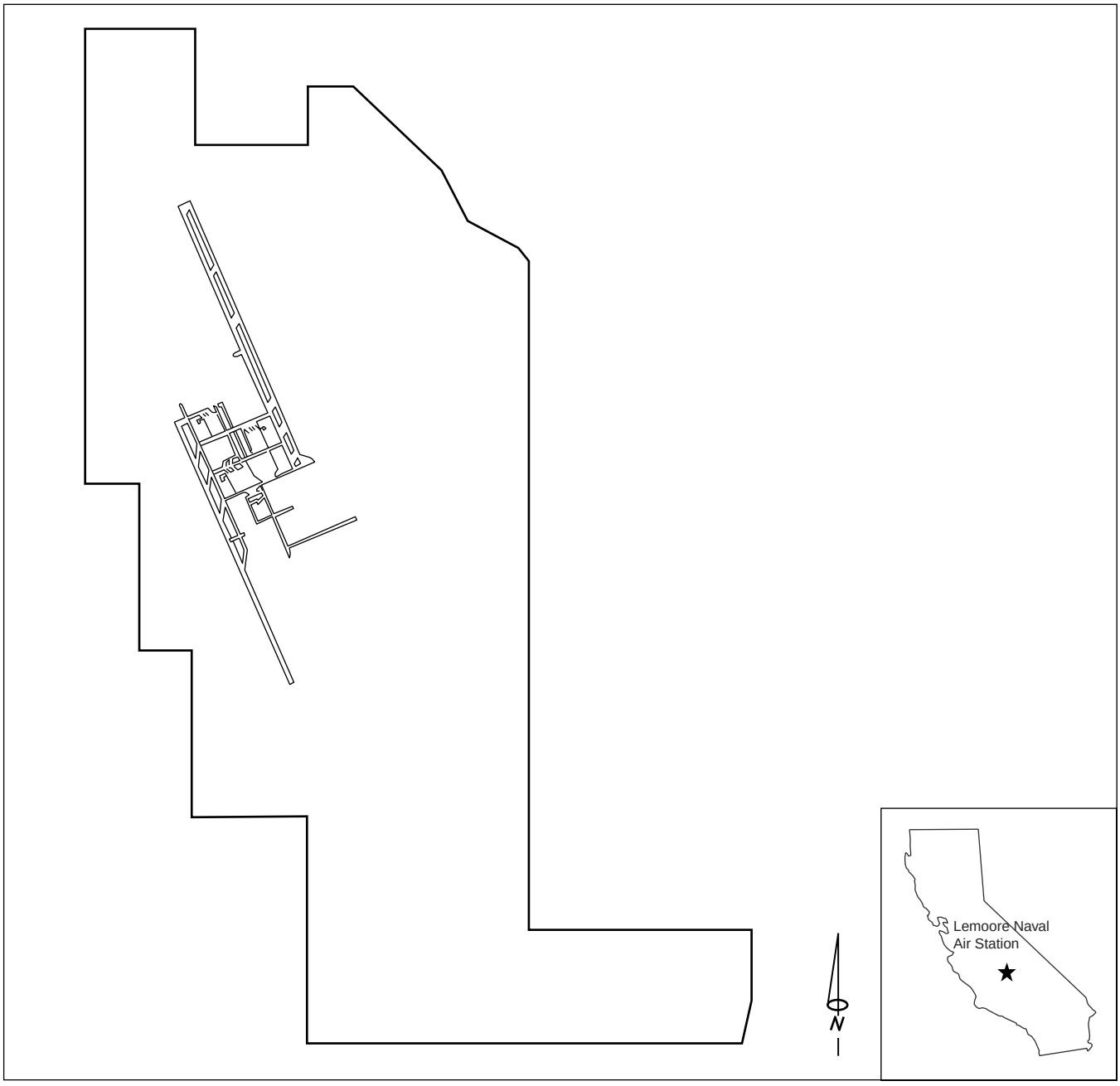
Land Use

Reeves Field at Lemoore NAS has two parallel 13,500-foot runways that are 4,600 feet apart. (See fig. 2.) According to Navy officials, the runways are offset, with hangars, fueling, fire stations, towers, and parking located between them. The shoulders of the runways are paved. Outside of the paved areas is a 10-foot-wide strip that is periodically sprayed with herbicide to control vegetation. At the end of each of the two runways is a 1,000-foot paved overrun and an additional 1,000-by-3,000-foot mowed grass overrun. The remainder of the areas around the airfield are described as grassland that is kept mowed. Beyond the overruns and to either side of the runways are cultivated fields. Approximately 11,000 acres of privately owned farmland to the west of the station are under airspace easement. The terrain throughout Lemoore NAS is best typified as flat or level.

Lemoore NAS has one of the largest agricultural outlease programs in the Department of Defense (DOD). It currently leases nearly 14,000 acres of agricultural land, which brings in between $1.5 million and $2.0 million annually. These funds support conservation and natural resource activities at Lemoore NAS and other Navy locations.

The water for Lemoore's domestic and agricultural uses is supplied by the Westlands Water District via the California Aqueduct, which brings water from Shasta Lake behind Shasta Dam in northern California. This water supply is generally adequate in quantity and quality. Freshwater can also be obtained from a well system on the base.

Figure 2: Map of Lemoore Naval Air Station



Yuma Marine Corps Air Station, Arizona

Land History/Ownership

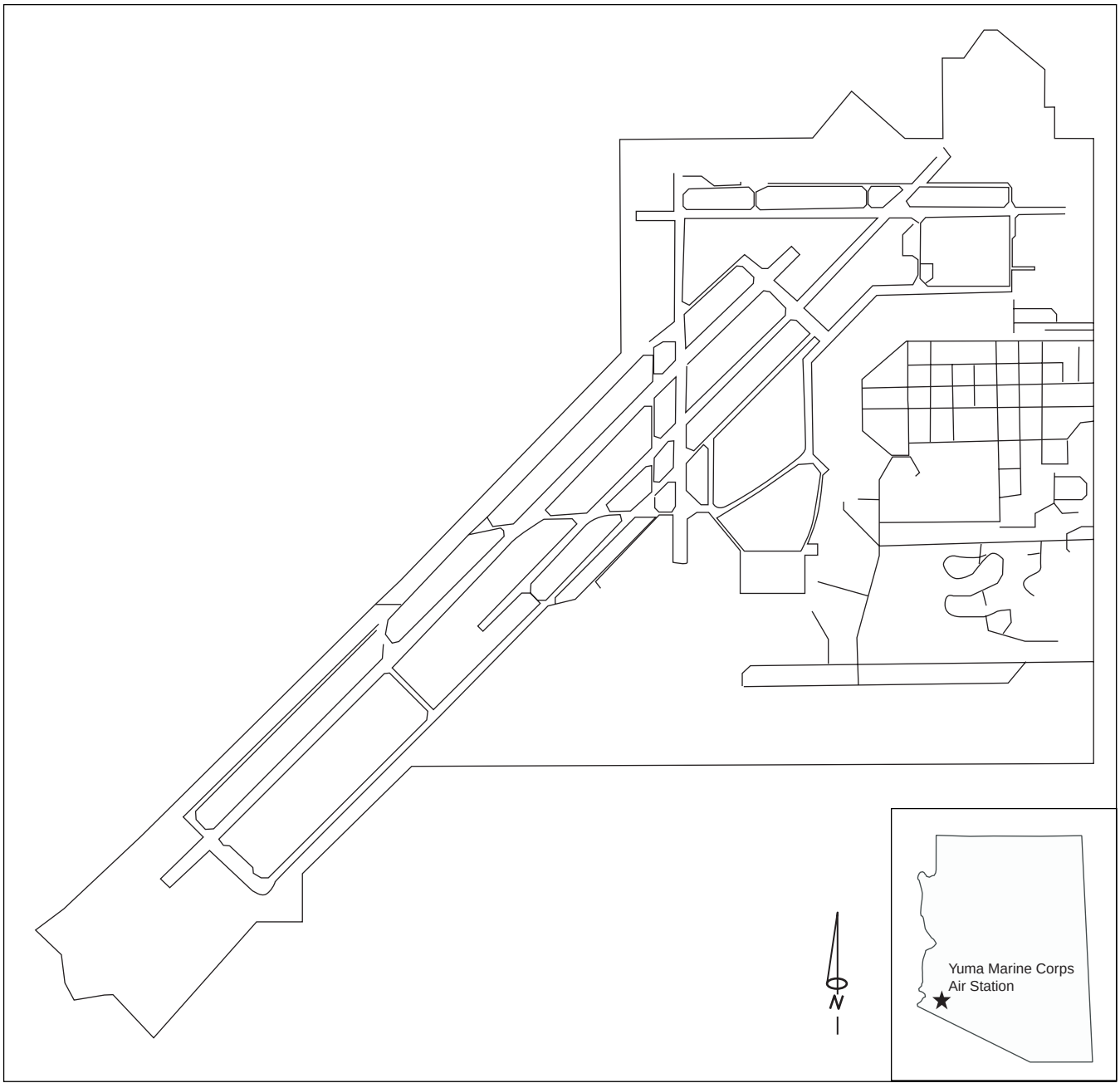
In 1928, the federal government leased land for a base from Yuma County, Arizona. When the United States entered World War II, an air base was erected. At the end of the war, all flight activity at Yuma ceased, and the area was partially reclaimed by the desert. During the period of inactivity, the base was controlled successively by the War Assets Administration, the U.S. Corps of Engineers, and the Department of the Interior's Bureau of Land Reclamation, which used it as a headquarters for its irrigation projects. In 1951, the Air Force reactivated the base. The facility was signed over to the Navy in 1959 and was designated a Marine Corps Auxiliary Air Station. In 1962, the designation was changed to Marine Corps Air Station.

Land Use

At the Yuma Marine Corps Air Station, the Corps owns the land, which encompasses four runways, and has granted permission to the City of Yuma to operate a civilian international airport in conjunction with the air activities of the military. (See fig. 3.) Land use documents for 1994 (the latest available) indicate that military air operations were nearly two-thirds (about 95,000) of the total of 149,485 takeoffs and landings at the facility.

The areas just adjacent and between the runways are maintained using different methods. The land just adjacent to the runway is mowed. In addition, there is some use of herbicide to destroy weeds. The land between the two original 1943 runways is covered with a very light coat of asphalt. The land between the newer runways built in 1962 is maintained mainly by mowing and using herbicides. The air station is located on the southern side of Yuma and is surrounded mainly by agricultural fields, with smaller sections of open space (disturbed and undisturbed desert) and business areas containing commercial and industrial facilities. Marine Corps and city officials have agreed to use the surrounding land for agricultural production or light industry because of the compatibility of those uses with the operations of the air station. The Marine Corps leases about 90 acres of this land to local farmers. Leases for this land provide between $18,000 and $60,000 in revenues annually. The city and the air station receive their water from the neighboring Colorado River.

Figure 3: Map ofYuma Marine Corps Air Station



China Lake Naval Air Weapons Station, California

Land History/Ownership

In 1943, adequate facilities were needed for the testing and evaluation of rockets being developed for the Navy by the California Institute of Technology. The Navy also needed a new proving ground for all aviation ordnance. The Naval Ordnance Test Station (NOTS) was established in response to those needs in November 1943, forming the foundations of China Lake Naval Air Weapons Station near Ridgecrest, California.

An auxiliary field was established near Inyokern, and the first facilities for China Lake were established there while the main field was being constructed. Weapons testing began at China Lake less than a month after the station's formal establishment, and by mid-1945, NOTS' aviation assets had been transferred to the new airfield, Armitage Field, located at China Lake. The vast, sparsely populated desert around China Lake and Inyokern, with near-perfect flying weather year-round and practically unlimited visibility, was considered to be an ideal location for testing weapons and for research and development purposes.

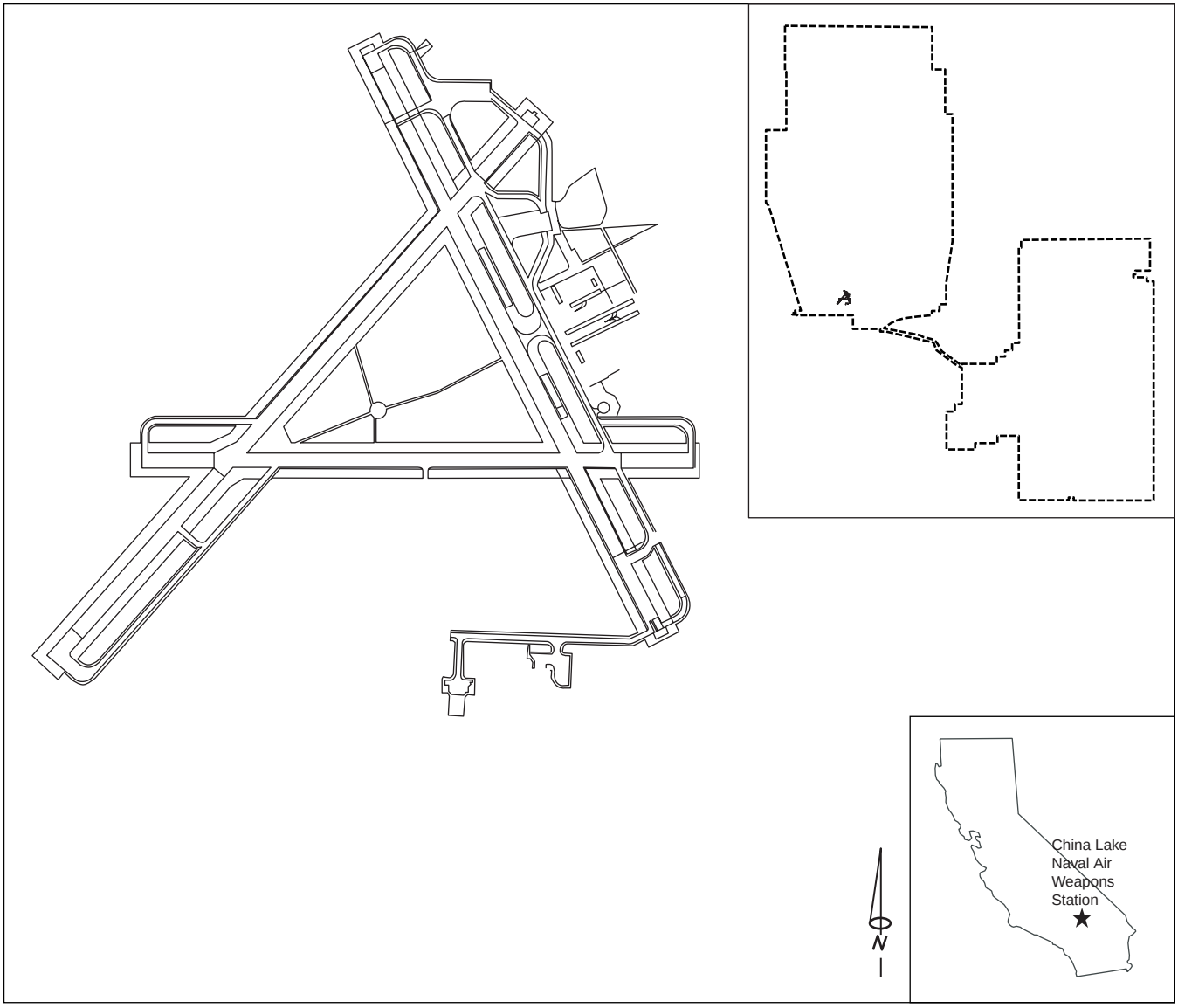
Land Use

The China Lake Naval Air Weapons Station operates its airstrips in desert terrain. At the end of each of China Lake's three runways is a 1,000-foot clear zone. (See fig. 4.) The runways are approximately 9,100 feet long. The land between the runways is paved. The clear zones are not paved but are plowed. Beyond the clear zones and along the sides of the runways, the land is disturbed desert (regrown native desert plants) with undisturbed native desert beyond.

The land surrounding China Lake's airfield has always been desert and is not watered. Navy officials at China Lake are satisfied with the type of terrain that exists at the end of the runways and in the zones under the flight paths. One of the advantages of this land is that the natural desert vegetation controls dust and does not attract birds. Navy officials believe the desert terrain allows personnel to respond more quickly to a crash site than if the area had vegetation.

All water used at China Lake comes from wells. The base's golf course is watered with treated effluent.

Figure 4: Map of China Lake Naval Air Weapons Station



Nellis Air Force Base, Nevada

Land History/Ownership

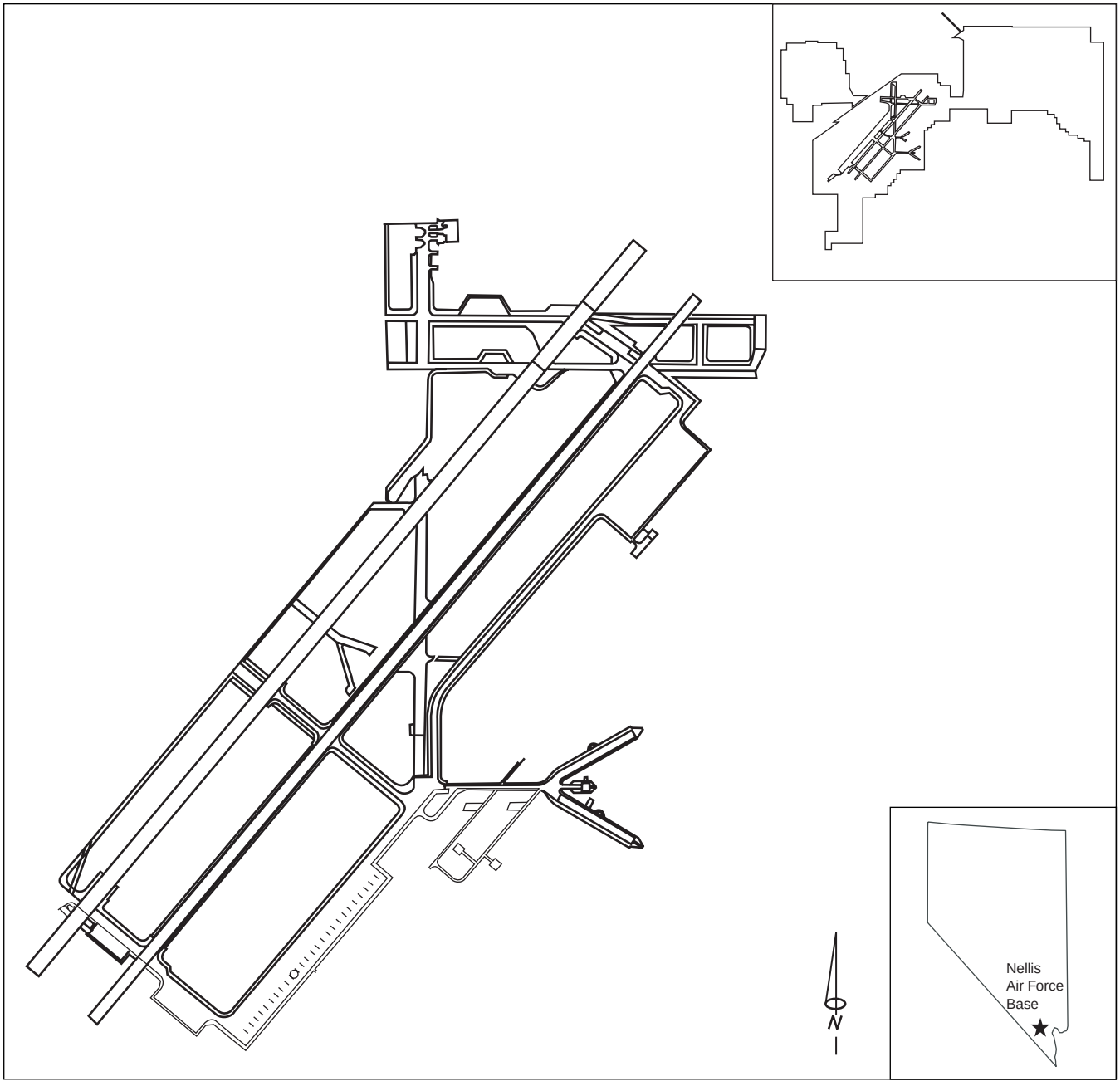
Nellis Air Force Base is located in the Great Basin area of southern Nevada, about 10 miles northwest of Lake Mead and 8 miles northeast of Las Vegas. In 1941, the property was signed over by the City of Las Vegas to the U.S. Army Quartermaster Corps for the development of a gunnery school for the Army Air Corps. Locating the school there had many advantages. Flying weather was practically ideal year-round; more than 90 percent of the area to the north was wasteland in the public domain and available at $1 per acre; the strategic inland location was excellent; rocky hills approximately 6 miles from the base afforded a natural backdrop for cannon and machine gun firing; and dry lake beds were available for emergency landings. In 1948, the base became Las Vegas Air Force Base and hosted a pilot training wing. In 1950, the base was renamed Nellis Air Force Base.

Land Use

Nellis Air Force Base has two parallel runways and 2.2 million square yards of airfield pavement. (See fig. 5.) The land surrounding the base consists mostly of disturbed and undisturbed native desert. The disturbed areas have regrown native plants, thistle, and weeds. The undisturbed areas consist of sagebrush. Some areas contain eroded natural flood channels. Within the areas at the end of the runways are roads and parts of a golf course. Soil cement is applied at aircraft turning points as a method of controlling dust and damage to aircraft from foreign objects. Foreign objects and dust on the runways and taxiways are controlled using flightline vacuum sweepers and having personnel walk through the area to find and pick up any lose objects. Vegetation is being removed from between the runways, and soil cement will be applied in these areas. The base has no plans for clearing vegetation from the runway protection zones.

Water is provided by the Southern Nevada Water Authority, the City of North Las Vegas, and potable water wells on the base. Because of an increased emphasis on using a desert environment rather than watered-plant landscaping, water consumption dropped by almost half from about 1.4 billion gallons of water in fiscal year 1996 to about 760 million gallons in fiscal year 1999.

Figure 5: Map of Nellis Air Force Base



Luke Air Force Base, Arizona

Land History/Ownership

In 1940, the U.S. Army choose a site in Arizona for an Army Air Corps field for advanced training in conventional aircraft. The City of Phoenix bought 1,440 acres of land and leased it to the government for $1 a year, and in March 1941, construction began for what was then known as Litchfield Park Air Base. The first class of 45 students arrived in June 1941 to begin advanced flight training. During World War II, the field was the largest fighter training base in the Air Corps. By 1946, the number of pilots being trained had dropped significantly, and the base was deactivated. However, after combat developed in Korea, the field was reactivated on February 1, 1951, as Luke Air Force Base.

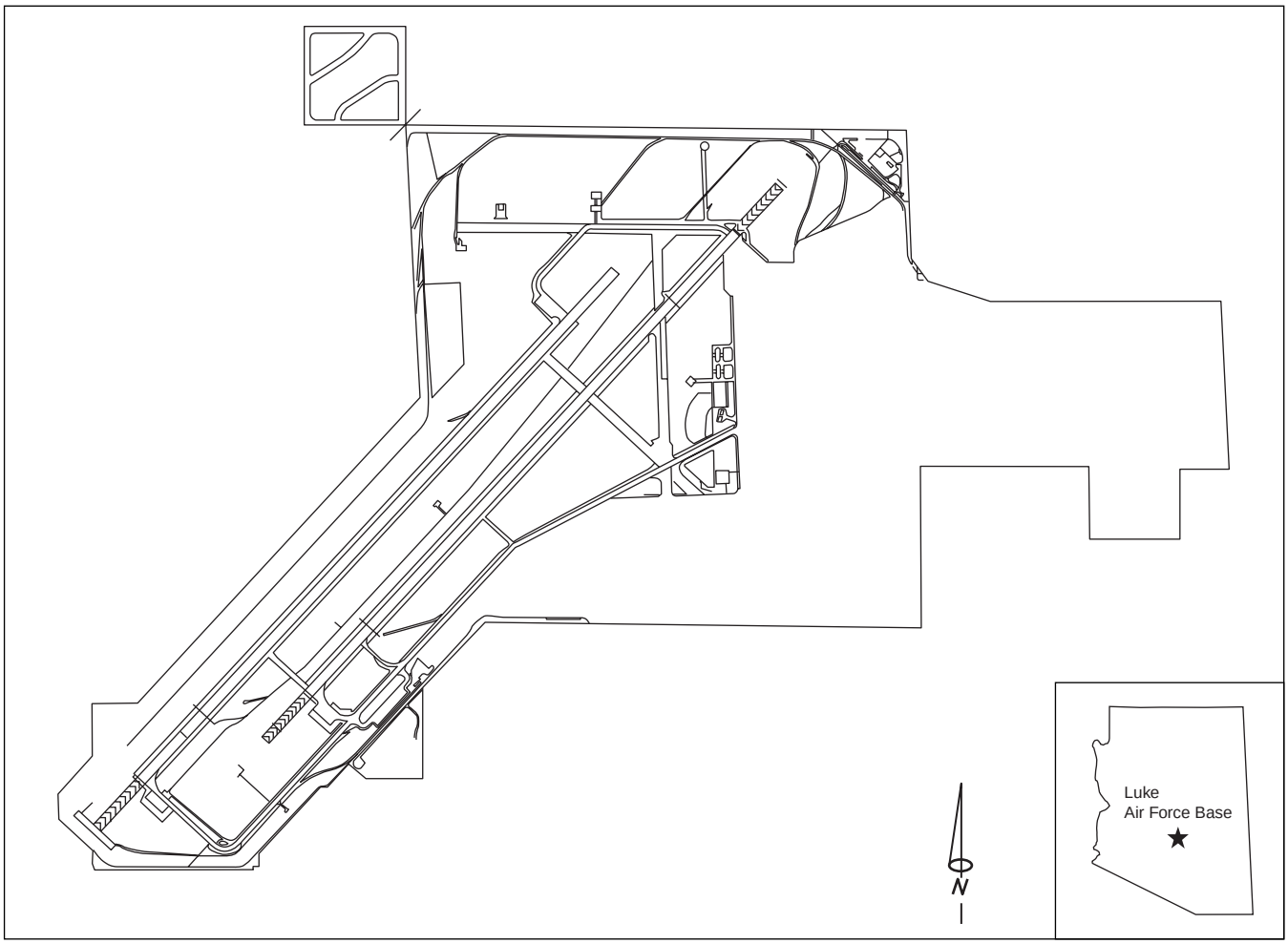
Land Use

Luke Air Force Base has two runways. Both runways are 150 feet wide; the primary runway is 10,000 feet long, while the secondary runway is 9, 910 feet long. (See fig. 6.) Luke owns 2,200 acres outright and has another 2,000 acres in easement. The base is within the city of Glendale and in the jurisdiction of Maricopa County. According to the base's land use documents, there is little land available for expansion or development. The land west of Luke is primarily agricultural, as is some of the land to the east and southeast. Residential, industrial, and commercial areas are located north, south, and east of the base. Approximately 190 F-16 aircraft are housed at Luke.

The runways are surrounded by the base's infrastructure on the east and part of the south and by roads, fences, golf courses (both civilian and military), and agricultural land where flowers and vegetables are grown on the north, west, and the remainder of the south. The vegetation growing immediately around the runways is mostly weeds. The area between the runways is a combination of old asphalt and disturbed desert. The unused portions of the airfield have gone untreated, and as a result, weeds are growing in the cracks. Air Force officials at Luke have a program to mow the vegetation so that it does not exceed 14 inches in height. Sections of the airstrip have been sprayed with a soil sealant that helps control dust and foreign objects.

The irrigation of the green areas maintained on the base for aesthetic purposes, such as recreation areas and at base housing, uses treated effluent from the base's wastewater treatment plant piped to automatic sprinkler systems. A new golf course will be irrigated using a similar system. Potable water for the base is supplied by seven groundwater wells on the base.

Figure 6: Map of Luke Air Force Base



McCarran International Airport, Nevada

Land History/Ownership

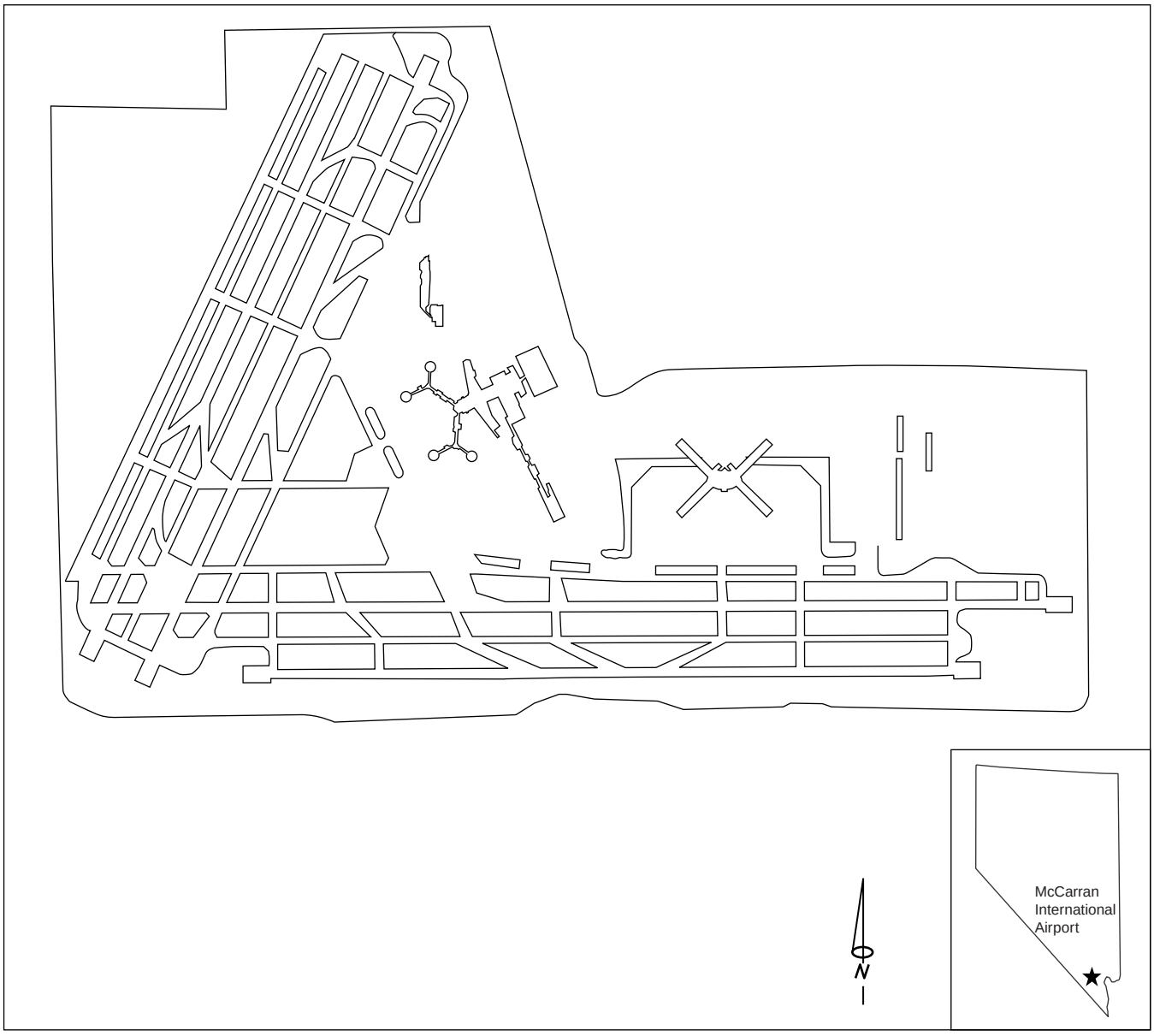
McCarran International Airport in Las Vegas, Nevada, is 51 years old. In 1948, Clark County purchased an existing airfield on Las Vegas Boulevard and established the Clark County Public Airport. All commercial activities were moved from an existing field to this new site, which was renamed McCarran Field. Initially, the airport served four airlines–Bonanza, Western, United, and TWA–and averaged 12 flights a day. Clark County, through its Department of Aviation, now owns and operates five airports, including McCarran.

Land Use

McCarran has four runways; the surrounding area is desert habitat. On average, the runways are 14,500 feet long and about 150 feet wide. (See fig. 7.) McCarran has both disturbed and undisturbed desert areas. Most of the airport's terrain has been disturbed by grading, rolling, and watering. Airport officials have attempted to control weed growth by spraying herbicides. The undisturbed areas are native sage and cactus terrain. The area between the runways is paved. The runway protection zones are graded dirt. The surrounding land encompasses a golf driving range, a golf course, a cemetery, vacant land, and industrial property.

McCarran officials have studied a number of methods of controlling airport dust, including soil cement. A study on dust control, conducted by a contractor for McCarran, highlighted measures that McCarran should consider, among them mulches, rock, and native vegetation for non-traffic areas and salts, coatings, and pavement for traffic areas. Watering in both the non-traffic and traffic areas was also suggested for consideration. McCarran receives its water through the City of Las Vegas from Lake Mead.

Figure 7: Map of McCarran International Airport



Sky Harbor International Airport, Arizona

Land History/Ownership

In 1935, the City of Phoenix purchased what became Sky Harbor International Airport. At that time, Sky Harbor was 258 acres of isolated and rural land. Today, the airport consists of 2,232 acres of land. The City of Phoenix operates Phoenix Sky Harbor International Airport through its Aviation Department.

Land Use

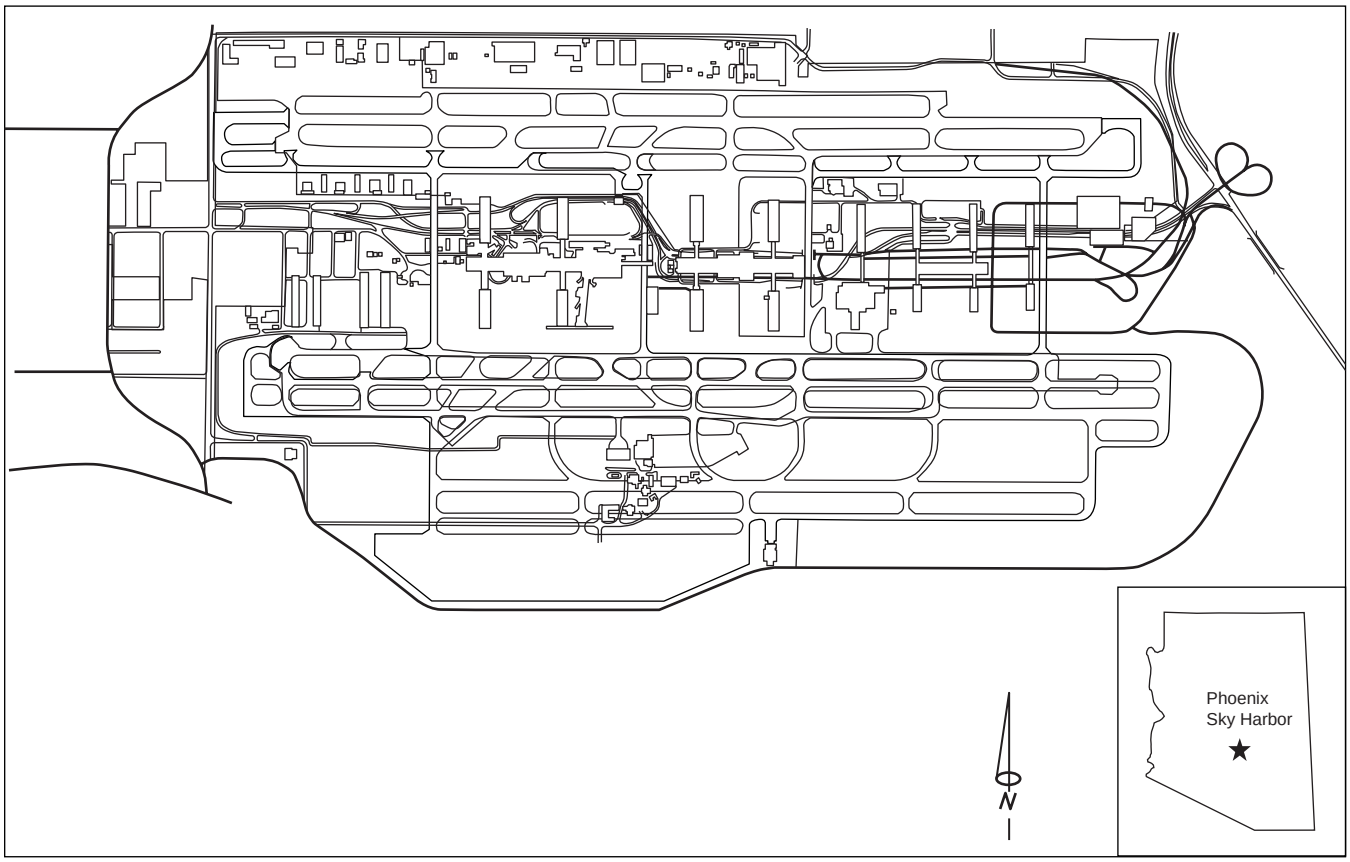
Sky Harbor International Airport has two runways, one 11,000 feet long and the other 10,300 feet long. (See fig. 8.) Both runways are 150 feet wide. A third runway being completed is to be about 7,800 feet long. Land use surrounding the airport varies. On the west end of the airport is an industrial park. Weeds are growing on some of the vacant lots near the airport, and these weeds are mowed when needed. However, workers first water and roll the area to keep down the dust. Workers also apply small amounts of herbicide on these areas to kill weeds.

To conserve water, Sky Harbor used rocks to landscape areas surrounding the airport that were once irrigated. Additionally, Sky Harbor officials have converted a significant amount of the airport's surrounding area to desert landscaping and have adopted other water conservation measures, such as using a computerized irrigation system. According to airport officials, these efforts helped save the airport about 70 million gallons of water during 1997.

Terminals and concrete can be found between the runways. To meet Federal Aviation Administration and Environmental Protection Agency regulations, Sky Harbor implemented a plan to control dust and to reduce damage to aircraft from foreign objects. The substance that proved to be the most environmentally safe and the most durable was a product called “Soil Sement,” an acrylic polymer type of liquid sealer. This sealer was applied using two separate methods–topical and soil stabilization. The topical application process consisted of applying the sealer to the undisturbed soil, while the stabilization application, which is more concentrated, was plowed into the top 6 inches of the surface of the soil.

Sky Harbor receives its water from the City of Phoenix Water Service Department.

Figure 8: Map of Sky Harbor International Airport



Comments From the Department of Defense

OFFICE OF THE UNDER SECRETARY OF DEFENSE

3000 DEFENSE PENTAGON
WASHINGTON DC 20301-3000

DEC. 09 1999

Mr. Barry Hill
Associate Director
Energy, Resources, and Science Issues
Resource, Community, and Economic Development Division
U.S. General Accounting Office
Washington, D.C. 20548

Dear Mr.Hill:

This is the Department of Defense (DoD) response to the GAO draft report, "FEDERAL FACILITIES: Alternative Land Uses Could Save Water at Fallon Naval Air Station, Nevada," dated November 12, 1999 (GAO Code 141337/OSD Case 1918)."

Although DoD generally concurs with the recommendation (see enclosure), we have some concerns that the report did not accurately give the all the details of the conditions at NAS Fallon. We have summarized our general comments below.

The draft report does not give a complete picture of the Navy's specific actions taken in compliance with the requirements of P.L. 101-618. The report mentions several times that the Navy conducted detailed study of only three land management strategies. In fact, the Navy considered eleven strategies, but quickly found that eight did not fully meet all of their requirements. The law does not permit the Navy to choose a strategy that impairs safety. Therefore, because eight of these strategies either did not meet safety or other Navy requirements, the Navy studied only the remaining three strategies in detail. The primary requirement for the Navy was to select a land management strategy that would best support the goal of zero aviation mishaps, while saving irrigation water. The greenbelt and agricultural outlease program offered very high levels of operational safety, along with sound land management practices and other benefits to the local community. Thus, all the options studied in detail included continued irrigation measures. The Navy has expended considerable resources (over $1.5M) to comply with the letter and spirit of P.L. 101-618. The Navy executed the studies specifically required by law, and has since been implementing the recommendations of those land management studies. Thus, no further study on the eliminated strategies has been required.

The draft compares irrigation water usage (untreated surface waters), to the NAS potable water system usage (treated groundwater), without discussing the vast differences in the source, quality, and function of these waters. There are also repeated comparisons throughout the draft report to other civilian and military installations. What is not mentioned, is which (if any) of these other installations hold water-righted lands in an established irrigation district, as does

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NAS Fallon. The report should correctly identify these entirely different water sources and uses, to avoid confusion or inappropriate conclusions in comparing alternatives.

The draft report mentions water savings achieved where the terrain is disturbed native desert environment. Disturbed native desert soil can return to a native desert relatively quickly and easily. In comparison however, NAS Fallon's greenbelt includes land farmed and irrigated for approximately 100 years. When irrigation and farming discontinue on agricultural land, the results are foreign object damage (FOD), fire, weed, and dust control requirements. Without proper management, to simply stop irrigation practices on these rich farmlands may result in severe FOD, fire, weed and dust control problems, as well as risk long term degradation of the land. This conversion of agricultural land to a desert environment is not a quick process and more study is needed.

The draft report does not mention the value of the Navy's use of irrigation waters for agriculture. The entire Newlands project of 1902 was conceived and constructed for the very purpose of agriculture. Access to and use of irrigation water is a literal property right, associated with land the Navy owns. NAS Fallon is exercising a right of ownership by using irrigation waters for agriculture and thereby enhancing the safety of operations. The Navy executes this agriculture through the outlease program, which further offers numerous economic and other benefits to the local community. The value of irrigation waters to the local community did not appear in the draft report. The City of Fallon and Churchill County are concerned about any reduction in NAS Fallon surface water. This reduction could have a negative impact on the recharging of the Basalt aquifer, manifestation of noxious weeds to neighboring ranches and farms, and the economics of the current lessees (9 ranchers). These concerns further add to the importance of irrigation waters at NAS Fallon.

I ask that you consider our comments in the development of the final report. Under separate cover we will forward to you some additional technical concerns. Thank you for the opportunity to comment on the subject draft report. If there are any questions, please call Mr. Ed Miller at (703) 604-1765.

Very truly yours,

Sherri W. Goodman
Deputy Under Seccretary of Defense
(Environmental Security)

Enclosure:
As stated

ENCLOSURE

**GAO DRAFT REPORT – DATED NOVEMBER 12, 1999
(GAO CODE 141337) OSD CASE 1918**

"FEDERAL FACILITIES: ALTERNATIVE LANDS USES COULD SAVE WATER AT FALLON NAVAL AIR STATION, NEVADA"

RECOMMENDATION

RECOMMENDATION: The GAO noted that in light of the congressional concern over water consumption in this desert area as expressed in statute and in light of the techniques being utilized at other desert air fields that are less water intensive, the GAO recommended that the Navy consider these techniques. Specifically, the Navy should consider its earlier identified strategies and adopt specific actions that would achieve safety and operational requirements while reducing water use. It should consider adopting different strategies that recognize the distinction between areas within the runway protection zone and those beyond the zone (pp. 10/GAO Draft Report)

Now on p. 9.

DoD RESPONSE: DoD generally concurs with the recommendation. P.L. 101-618 set forth the goal of returning irrigated farmlands in the Newlands project back to the stable, native desert environment. The Navy funded a $217,000 demonstration project that concluded it may be possible to return farmlands to a stable and native desert condition, using limited watering. NAS Fallon will begin a 5-year pilot program of removing water from about 700 acres of irrigated lands. This is in response to congressional interest and a mandate contained in the FY 2000 National Defense Authorization Act. The pilot program will consider operational safety, potential land degradation, cost, and other long term impacts, and if successful, could result for future reductions in irrigation water usage. Also, the NAS Fallon will continue to implement the land management strategy options developed under P.L. 101-618 and explore the potential for achieving further reductions in water usage consistent with the need to fully maintain operational safety.

Objectives, Scope, and Methodology

After receiving a letter from Senator Harry Reid of Nevada, we visited Fallon NAS for background briefings and information on the air station's actions in response to Public Law 101-618. After follow-up discussions with Navy officials and with Senator Reid's office, we undertook this review to provide information on (1) the aviation safety and operational requirements for the runway protection zone at Fallon NAS, (2) the alternative land use strategies Fallon NAS identified in response to congressional direction and how it evaluated them, and (3) the current land use strategies at five military facilities and two commercial airports that operate in similar environments.

To determine aviation safety and operational requirements, we obtained the regulations on runway protection zones issued by the Federal Aviation Administration, the Department of Defense, and the military services. We also obtained other regulations on airport safety and land requirements at military and commercial airports. We obtained extracts of Fallon NAS' air installation compatible use plans on runway protection zones. We interviewed commercial airport, Air Force, Navy, and Marine Corps officials.

To determine the land use strategies Fallon NAS identified and how it evaluated them in selecting the greenbelt approach, we obtained Fallon NAS' Natural Resources Management Plan, its Environmental Assessment for Management of the Greenbelt Area, and a study by the U.S. Department of Agriculture's Natural Resources Conservation Service, “Plant Materials Trials on Revegetation of Abandoned Farmland.” We interviewed Fallon NAS and Conservation Service officials on the results of these studies. We analyzed the efforts of Fallon NAS officials in evaluating the land use strategies.

To determine the current land use practices at military and commercial airports that operate in desert-like environments and the impacts these practices have on water usage, we visited seven airports–five military (Navy, Air Force, and Marine Corps) and two commercial facilities:

- Lemoore Naval Air Station, California;
- Yuma Marine Corps Air Station, Arizona;
- China Lake Naval Air Weapons Station, California;
- Nellis Air Force Base, Nevada;
- Luke Air Force Base, Arizona;
- McCarran International Airport, Nevada; and
- Sky Harbor International Airport, Arizona.

We obtained land use documents at the seven locations and their documents on water use and consumption. We also interviewed safety and operations officials at the seven locations.

GAO Contact and Staff Acknowledgments

GAO Contact

Brad Hathaway, (202) 512-4329

Acknowledgments

In addition, Rudolfo G. Payan, Uldis Adamsons, Richard W. Meeks, Doreen S. Feldman, and Kathleen A. Gilhooly made key contributions to this report.

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