Stephen

DEPARTMENT OF THE AIR FORCE
HEADQUARTERS 49TH FIGHTER WING (ACC)
HOLLOMAN AIR FORCE BASE, NEW MEXICO

26 JUN 1996

MEMORANDUM FOR NEW MEXICO ENVIRONMENT DEPARTMENT
Hazardous and Radioactive Materials Bureau
RCRA Permits Program
Attn: Dr. Barbara Hoditschek, Manager
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P.O. Box 26110
Santa Fe NM 87502-6110

RECEIVED
[redacted] -T 1996

FROM: 49 CES/CD
550 Tabosa Ave
Holloman AFB NM 88330-8458

SUBJECT: Holloman AFB (HAFB) Sewage Lagoons Closure Plan

1. Enclosed please find an updated Closure Plan that replaces all previous plans submitted to your office or to the US Environmental Protection Agency. This new document replaces the Closure Plan submitted in May 1995 using information from the Site Characterization Report (June 1995) and the Risk Assessment Addendum (March 1996) to develop specific plans for closure of the lagoons. Included as an Appendix is the Corrective Measures Study that evaluates several alternatives for closure and provides justification for the selected alternative. A Biological Resources Report that evaluates the effects of the closure alternatives on threatened and endangered species is simultaneously being distributed to the US Fish and Wildlife Service and is available upon request.

2. Please direct any questions to Dr. Fred Fisher of the 49th Civil Engineer Squadron Environmental Flight, 49 CES/CEV, (505) 475-3931/5062.

Howard E. Moffitt
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Enclosure:
Sewage Lagoons Closure Plan

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PURPOSE OF DOCUMENT

A. This report assesses the effects of closing Holloman Air Force Base's sewage lagoons to selected threatened, endangered, and sensitive species that have been sighted near the area or are known to be attracted to the area. In all, 21 animal and 2 plant species were evaluated.

B. The report describes the five habitat types provided by the sewage lagoon system: 1) upland grassland; 2) brackish marshes/ wetlands; 3) playas; 4) riparian habitat; and 5) surface water habitat.

C. This report presents the proposed actions and a series of alternatives for closing the sewage lagoons. Each action is assessed to determine the effect of closure on plant and animal species in the area.

D. This report is a supplement to the *Sewage Lagoons Closure Plan* submitted in June 1996.

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JUL 1 1996

RCN: 670-008-03

BIOLOGICAL RESOURCES REPORT

SEWAGE LAGOONS CLOSURE PROJECT

Draft Final

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Holloman Air Force Base, NM

and

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U.S. Army Corps of Engineers
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June 1996

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LIST OF ACRONYMS

CMS	Corrective Measures Study
EPA	U.S. Environmental Protection Agency
FFCA	Federal Facility Compliance Agreement
HSWA	Hazardous and Solid Waste Amendments
HWMUs	Hazardous Waste Management Units
mgd	million gallons per day
NMED	New Mexico Environment Department
NMNHP	New Mexico National Heritage Program
NPDES	National Pollutant Discharge Elimination System
PCBs	Polychlorinated Biphenyls
RCRA	Resource Conservation and Recovery Act
TDS	Total dissolved solids
USAF	United States Air Force
USFWS	United States Fish and Wildlife Service
WWTP	Wastewater Treatment Plant

Section 1
INTRODUCTION

The present biological resources report has been prepared to assess the effects of closing Holloman Air Force Base's (AFB) sewage lagoons to selected threatened or endangered animal and plant species. The species selected are those that have either been sighted at the sewage lagoons or may be attracted to the area.

The objective of this document is to assess whether the loss of some or all of the sewage lagoons would constitute a loss of habitat to the animal species selected and, in turn, adversely affect their populations in the area. This document is not intended to fulfill any Resource Conservation and Recovery Act (RCRA) requirements. It is supplementary to the corrective measures study (CMS) and was written to aid in selecting alternative actions. The following sections summarize actions being considered in the project area.

1.1 Background

Holloman AFB, located near Alamogordo, New Mexico (Figure 1-1), has constructed a wastewater treatment plant (WWTP) on Base to replace the existing system and will begin operating the plant in July 1996. The existing system consists of seven sewage lagoons (Ponds A through G), a ditch, and Lakes Holloman and Stinky (Figure 1-2). The sewage lagoons are being closed per a Federal Facility Compliance Agreement (FFCA) among the U.S. Environmental Protection Agency (EPA) Region VI, the New Mexico Environment Department (NMED), and Holloman AFB. Closure of Ponds A through G will be performed under the authority of NMED in accordance with RCRA because NMED has specified that the sewage lagoons (not the lakes and ditch) should be regulated as hazardous waste management units (HWMUs). The lakes and ditch are being investigated in accordance with the RCRA Hazardous and Solid Waste Amendments (HSWA).

The existing WWTP system is scheduled to be taken out of service by July 1996. Under this system, treated water from the wastewater treatment plant was passed through a bar screen and a grit chamber and then released into a series of seven sewage lagoons, referred to as Ponds A through G. The final sewage lagoon, Pond G, discharged via a constructed ditch into Lake Holloman, which overflowed into Lake Stinky during the wet season. Lake Holloman contains water year round, whereas Lake Stinky frequently dries up. The design flow of the lagoon system was 1.4-million gal. per day (mgd). The design flow for the new WWTP is 1.5 mgd.

The new WWTP will include treatment tanks, and therefore the sewage lagoons will no longer be needed. Under the proposed action, treated water will be released through the National Pollutant Discharge Elimination System (NPDES) permitted outfalls to the north ends of Lake Holloman and Pond G.

Pond G and Lake Holloman were natural playa lakes that were dammed to hold water. Playa lakes are considered Waters of the United States and, therefore, are subject to the Clean Water Act. Under the proposed action, 120 acres of new wetlands will be constructed west of Pond G where there are jurisdictional wetlands surrounded by upland grassland habitat (Figure 1-3). Ponds A through F contribute approximately 60 acres of evaporative surface, and these constructed wetlands will help to alleviate the loss of evaporative surface as a result of the sewage lagoons being closed.

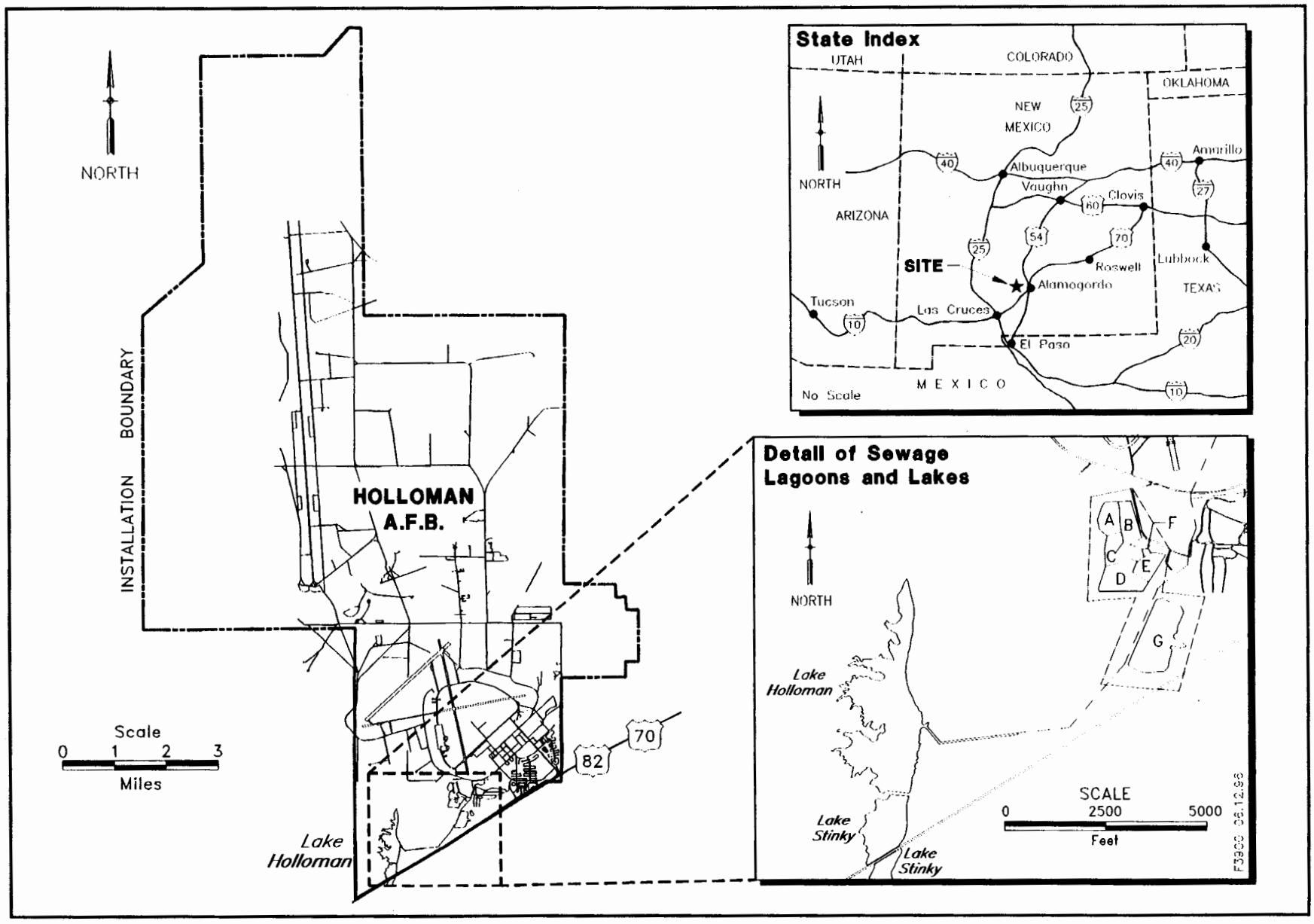

Figure 1-1. Location of Holloman AFB and the Sewage Lagoons and Lakes

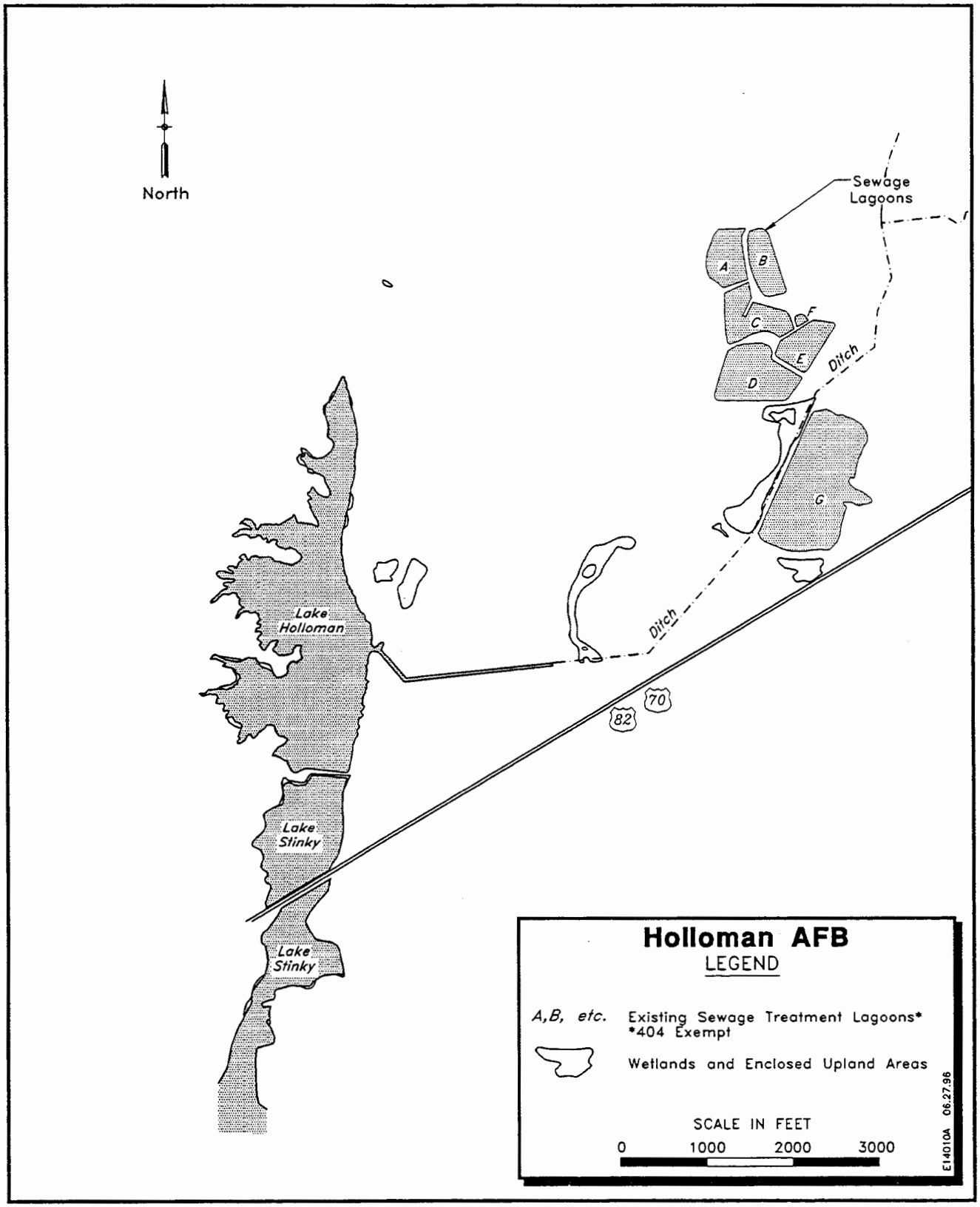

Figure 1-2. Existing Layout of the Sewage Lagoons and Lakes, and Location of Jurisdictional Wetlands Near Pond G and the Lakes (USAF, 1995)

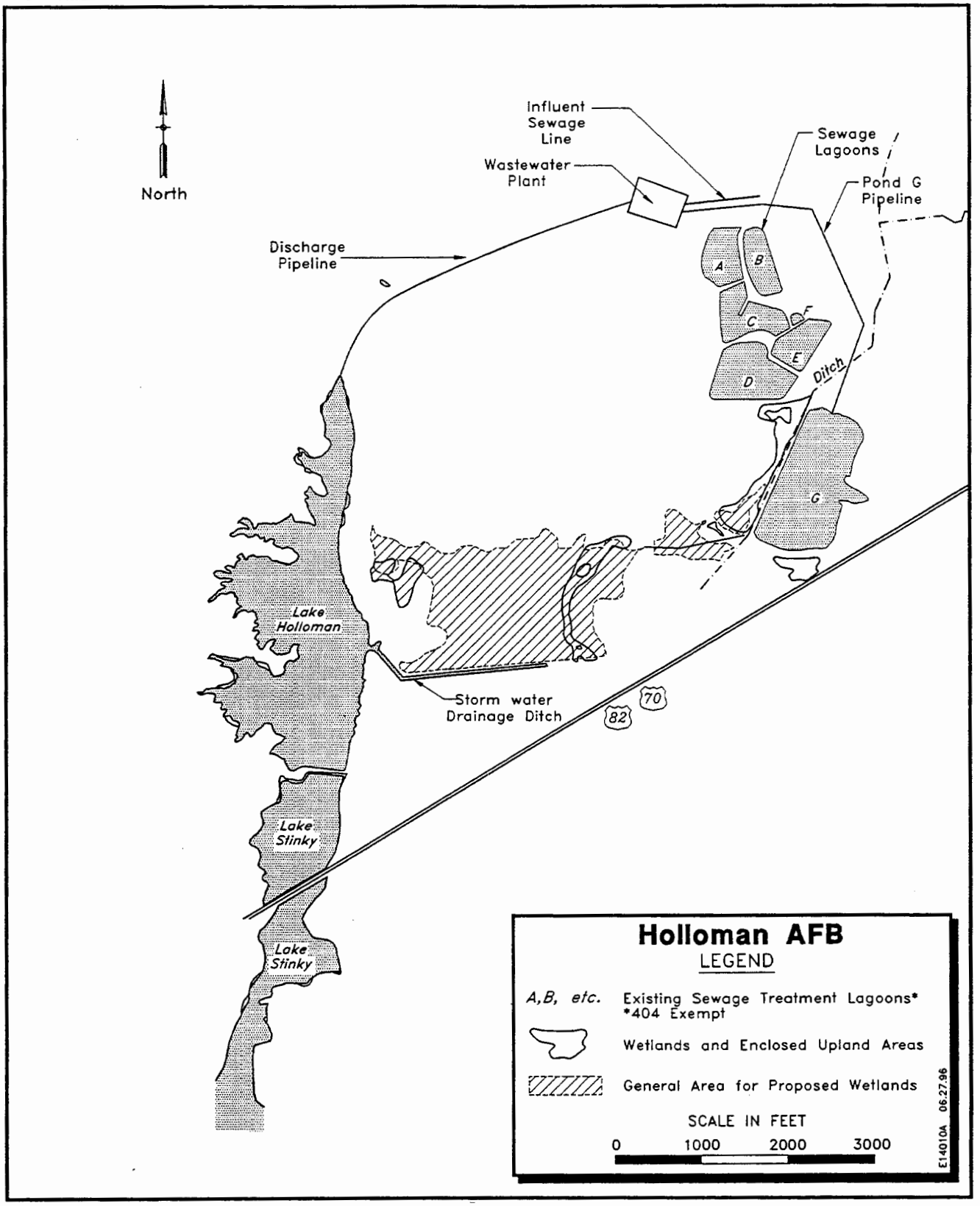

Figure 1-3. Layout of the Proposed Wetlands in Relation to the Location of the Existing Sewage Lagoons (USAF, 1995)

Lakes Holloman and Stinky, Pond G, the storm water ditch, and the wetland and riparian habitats comprise a unique ecosystem in south central New Mexico. These systems are supported primarily by wastewater effluent and storm water runoff from the Base; however, the dynamics of the system are driven by the climatic conditions of rain and drought.

A variety of animal species, including threatened, endangered, and sensitive species (those species that are candidates for listing), has become dependent on the sewage lagoons and lakes for habitat and food. In particular, water birds are dependent on this system, as is reflected in a letter from the Audubon Society asking that a portion of the system (Pond G) be left open (see Appendix A). The presence of this large expanse of water in a desert location attracts migrating birds and other animals. The low water levels tend to provide shoreline to species using the lakes. Lakes Holloman and Stinky are, therefore, recognized by federal and state agencies as a high visibility natural area and a valuable bird viewing area. Since this system has become an important habitat area for a variety of bird species, a list of bird species was compiled on the basis of a year of monthly field observations by the New Mexico Natural Heritage Program, as well as reported observations by the Mesilla Valley Audubon Society. Also included in this list are selected mammal, fish, and plant species listed as threatened, endangered, or candidate that may occur in the project area (Appendix A) as derived by Dr. Hildy Reiser (Base Biologist) and U.S. Fish and Wildlife Service (USFWS).

1.2 Discussion of Proposed and Alternative Actions

In building a new WWTP at Holloman AFB, the Base plans to utilize an activated sludge system consisting of large tanks to treat the wastewater. Treated water would then be released to Lake Holloman and to Pond G, via two pipelines. As part of this proposed action, 120 acres of wetland habitat will be constructed to the west of Pond G. Approximately 14.3 acres of jurisdictional wetlands is included in this 120 acres (Figure 1-3). This constructed wetland will replace evaporative surface that will be lost with the closure of Ponds A through F. This biological resources report presents and evaluates the proposed action and examines two different alternatives, including a no action alternative. Table 1-1 presents a comparison of the alternatives evaluated in this biological resources report and those evaluated in the *Corrective Measures Study* (Radian, 1996). The following sections discuss these actions and their potential effects on the biological resources of the area. Each of the actions, with the exception of the no action alternative, assumes that 120 acres of wetland habitat will be constructed west of Pond G.

The potential exists to construct a maximum of 170 acres of wetlands. Although this option was considered, it is not carried forward in this assessment. Construction of 170 acres of wetlands would require the use of land south of the ditch that would have poorer drainage and would result in stagnant water next to Highway 70. This would not be desirable, and the construction of 120 acres is expected to be sufficient for effluent management.

1.2.1 Proposed Action: Dewater Sludge, Backfill Ponds A through F, and Construct 120 Acres of New Wetlands

The proposed action involves closing Ponds A through F dewatering the sludge and covering them with clean soil. Pond G would remain open and 120 acres of wetlands would be constructed west of Pond G (Figure 1-3).

Table 1-1
Biological Resources Report Alternatives and Corresponding Corrective Measures Study Alternatives

Biological Resources Report Alternatives	Corresponding Corrective Measures Study (CMS) Alternatives
Proposed Action: Dewater sludge, backfill Ponds A through F, and construct 120 acres of new wetlands	Ponds A through F—Alternatives AF2 and AF3
	Pond G—Alternative G1: No Action
Alternative Action Number 1: No Action	Alternatives AF1 and G1: No Action
Alternative Action Number 2: Dewater and backfill Ponds A through F, Dredge Pond G and Construct 120 acres of new wetlands	This alternative not considered in the CMS based on the recommendations of the Biological Resources Report

A pipeline would extend from the WWTP to Lake Holloman and a separate pipeline would extend from the WWTP to Pond G. The constructed wetlands would receive controlled overflow from Pond G. Lake Holloman would be allowed to overflow into Lake Stinky in the late winter as well as storm runoff from the Main Base area. This overflow would maintain wet conditions in the spring, as existed in much of the late 1970s and 1980s that were favorable for shorebird habitat.

Under this alternative, flow from the sewage lagoons would be eliminated; therefore, flow in the drainage ditch would be reduced to roughly half of its current flow. The northern portion of the ditch, south of Pond G, below the wetlands diversion, would likely dry up (Figure 1-3). The western portion of the ditch would be incorporated into the constructed wetlands and would enter Lake Holloman as it currently does.

1.2.2 Alternative Action Number 1: No Action

Under the no action alternative, water in Ponds A through F would be allowed to evaporate and the sludge, which would dry out, would be left uncovered. This alternative is not considered to be acceptable because of leaving possible disease vectors exposed. It is carried forward for analysis because a no action alternative is a useful baseline for the comparison of alternatives.

1.2.3 Alternative Action Number 2: Dewater and Backfill Ponds A through F, Dredge Pond G, and Construct 120 Acres of New Wetlands

Alternative action number 2 is identical to the proposed action except that the sludge in Pond G would be dredged and the resulting material placed in an upper lagoon. This action is consistent with the FFCA, which requires all of the sewage lagoons to be cleaned up and closed. Any dredging in Pond G would have to comply with Section 404 of the Clean Water Act.

Section 2
BIOLOGICAL RESOURCES

The sewage lagoons are located in the northernmost part of the Chihuahuan Desert province. The following is an excerpt from the *Environmental Assessment, Holloman AFB Wastewater Treatment Plant:*

> High temperatures, limited rainfall, and high evaporation favor drought-tolerant species within this province. In a few areas, isolated mountain peaks and ranges rise above the plains. Lower temperatures and higher rainfall in these areas favor oak and juniper woodlands; pines are found on the highest peaks. The northern part of the province is dominated by open stands of creosote bush (*Larrea tridentata*) or mesquite (*Prosopis glandulosa*). A variety of short grass species are found in association with the shrubs. Some areas are characterized by extensive vegetation. Many drainage basins in the area lack external outlets, which leads to soil salinization. In these locations, vegetation is limited to salt-tolerant species or the areas are virtually barren of vegetation. Surface water expression in the region is extremely limited. The Pecos and Rio Grande, together with a few of their tributaries, are the only perennial streams in the region. Perennial lakes are also limited and are primarily restricted to man-made features such as livestock watering ponds and sewage lagoons. Some low-lying areas along the Rio Grande (e.g., Bosque del Apache National Wildlife Refuge) are perennially flooded and constitute significant wetland wildlife habitat. (UFAF, 1995)

Prior to the construction of the sewage lagoons, the project area was characterized by a mixture of gypsum grasslands and intermittently flooded salt-flat grasslands (playas). The construction of the sewage lagoons changed the flow of runoff through the playa system. Consequently, there is a mixture of habitats, including upland grassland habitat, brackish marshlands, playas, and surface water features. The nature, extent, and persistence of these habitats are highly dependent on the existing discharge from the WWTP and storm water sewers of Holloman AFB.

2.1 Habitat

The USAF (1995) identified five site-specific habitat types in the sewage lagoons and lakes area at Holloman AFB: 1) upland grassland, 2) brackish marshes/wetlands, 3) playas, 4) riparian habitat, and 5) surface water habitat. The descriptions for each of these habitat types were taken from the *Environmental Assessment* report, unless cited otherwise.

2.1.1 Upland Grassland

Well-drained upland areas are dominated by upland (or gypsum) grassland. Alkali sacaton (*Sporobolus airoides*) is the dominant grass in the gypsum grassland community. Fluffgrass (*Erioneuron pulchellum*) and neally dropseed (*Sporobolus nealleyi*) are common associate grasses. Shrubs include four-wing saltbush (*Atriplex canescens*), creosote bush, and tarbush (*Flourensia cernua*). Cacti and yuccas are widely scattered throughout the gypsum grassland community. Common cacti include walkingstick cholla (*Opuntia imbricata*) and plains prickly pear (*Opuntia phaeacantha*). Soaptree yucca (*Yucca elata*) is also present. Vegetation is sparse, especially in the very highly saline soils between the existing sewage lagoons and Lake Holloman.

As many as 72% of the bird species that occur in New Mexico may be present within or near the project area (Hubbard, 1970). Those species observed during site-specific surveys in the uplands of the project area include turkey vulture (*Cathartes aura*), American kestrel (*Falco sparverius*), red-tailed hawk (*Buteo jamaicensis*), northern harrier (*Circus cyaneus*), mourning dove (*Zenaida macroura*), greater roadrunner (*Geococcyx californianus*), catus wren (*Campylorrhynchus brunneicapillus*), black-throated sparrow (*Amphispiza bilineata*), western meadowlark (*Sturnella neglecta*), and Scott's oriole (*Icterus parisorum*).

2.1.2 Brackish Marshes

Seepage from the sewage lagoons and the storm water ditch has established brackish marshes/wetlands in a number of locations throughout the project area (Figure 1-2). Water levels in these areas fluctuate seasonally with changes in rainfall, evaporation, and sewage inflow into the sewage lagoons. The largest of such areas are found along the western and southern edges of Pond G. The lower portion of the marsh tends to be dominated by desert saltgrass (*Distichlis spicata var. stricta*), with a few scattered Chinese tamarisk (*Tamarix chinensis*) and patches of alkali sacaton in the drier, higher areas.

Just east of Lake Holloman, more limited wetland areas are found at points along the drainage ditch, as well as in an abandoned borrow pit north of Lake Holloman, and along the boundaries of Lake Holloman and Lake Stinky. Many of these areas are not perennially inundated. Chinese tamarisk is dominant in these areas.

2.1.3 Playas

The area south of Lake Holloman includes an extensive (35-acre) playa known as Lake Stinky. Playas are depressional areas in the central portions of closed drainage basins that receive surface water flow from surrounding areas. Fine-grained sediments, mostly silt and clay, with some sand, are deposited in thin horizontal layers after heavy rains. Water infiltration is slow, and shallow standing water may remain for several weeks after heavy rains. Playas may contain a higher diversity of range grasses and shrubs because of the stability of the silt and clay soils. However, playas are subject to additional vegetational losses through soil compaction and salinization.

Lake Stinky represents a remnant of the original playa that existed in the project area prior to the construction of the wastewater treatment sewage lagoons. Persistent seepage from Lake Holloman is sufficient to maintain limited surface water at the north end of Lake Stinky, as well as a community of wetland vegetation (tamarisk and saltgrass) at the base of the dam separating Lake Stinky from Lake Holloman. Desert saltgrass and alkali sacaton are dominant along the edge of the playa. During most years, discharge to Lake Holloman is sufficient during the wet season to result in overflow to Lake Stinky. On these occasions Lake Stinky extends south from the dam through culverts underneath U.S. Highways 70/82 to encompass as much as an additional 26 acres. The majority of the area south of U.S. Highways 70/82 is a playa devoid of vegetation.

2.1.4 Riparian Habitat

Riparian areas (e.g., ditches, rivers, arroyos, and stream banks) are dominated by a variety of shrubs and a few low stands of trees. Extensive thickets of tamarisk line the ditches and wet areas. Saltbush and baccharis (*Baccharis pteronioides*) are scattered along the shore around Lake Holloman and Lake Stinky. Riparian drainages carved in the sandy-gravelly soils provide habitat for a greater diversity of plant species than do adjacent upland areas. Consequently, these habitats support a greater diversity of wildlife species throughout the year. The food and cover provided by vegetation along these long, narrow drainages are important to numerous wildlife species because the drainages

cross a variety of different habitats. Wildlife use riparian/arroyo areas as travel lanes (corridors) through their ranges.

Neotropical shorebirds and songbirds use shoreline and riparian habitats at Lakes Holloman and Stinky, and the riparian habitat along the storm water drainage ditch during migration and for nesting. On the basis of surveys conducted in June 1994, four neotropical birds use shoreline and riparian habitats in the project area for nesting. These birds are the American avocet (*Recurvirostra americana*) along the lake shorelines and green heron (*Butorides caerulea*), western kingbird (*Tyrannus verticalis*), and the blue grosbeak (*Guiraca caerulea*) in the riparian habitat along the ditch. The only neotropical migrants observed were several flycatchers (*Empidona sp.*) and a Wilson's warbler (*Wilsonia canadensis*).

2.1.5 Surface Water Habitat

The sewage lagoons, along with Lake Holloman and the storm water drainage ditch, are the dominant surface waters in the area. According to Dr. Gordon Ewing of the Mesilla Valley Audubon Society (personal communication), three distinct habitats associated with the surface water of the sewage lagoons and lakes can be identified in the project area: 1) saline ponds, 2) salt flats and beaches, and 3) emergent wetlands.

Lake Holloman and Pond G can be considered saline ponds. Ducks and wading birds inhabit these water bodies. The Stinky playa, as well as the fringe of the two lakes (Holloman and Stinky) can be considered salt flats/beaches. Shorebirds, including the snowy plover, use these water bodies. The area below Pond G (approximately 60 to 85 acres) can be considered emergent wetlands (irregularly to permanently flooded wetlands, usually dominated by perennial herbaceous hydrophytes). Many birds inhabit this area. Dr. Ewing also pointed out that 40 to 50 species of birds can be seen in the area almost any day of the year. The sewage lagoons and lakes are discussed in the following sections.

2.1.5.1 Lake Holloman

Lake Holloman is an unlined, 166-acre hypereutrophic, brackish lake (Figure 2-1). It was diked on the southern end to hold discharged, treated wastewater and was intended to be the final impoundment for evaporation. The lake has the capacity to hold 379 million gal. of water. Lake Holloman is the largest reservoir of permanent water in the Tularosa Valley of southern New Mexico (Cole et al., 1981). The water level is mainly controlled by evaporation, groundwater infiltration, and overflow into Lake Stinky.

The high nutrient levels of the lake result in an abundance of algae and bacteria, which attract insect populations. Dragonfly larvae, damselfly larvae, beetles, and corixids were also observed during a site investigation (Radian, 1993). Mosquito fish (*Gambusia affinis*) were found in areas where grass was overhanging the water. The bottom of the lake (depths from 4 ft to 9 ft) was covered with a layer of bacterial/algal ooze with little evidence of macroscopic life. Benthic organisms began to appear at a depth of about 3 ft where the ooze began to thin out. A population of chironomids was found in hand dredge samples taken from 1 to 3 feet of water. In the shallow north end of the lake, dense algal mats covered the bottom and, after towing a skid dredge for about 500 ft, it was filled with algae and contained only 15 chironomid larvae.

Cole et al. (1981) described Lake Holloman as hypereutrophic based on the level of primary productivity. In this study, zoobenthos, phytoplankton, zooplankton and fish (mosquito fish) were collected. The most common birds collected were coots, phalaropes, ruddy ducks, northern shovelers and avocets. Eared grebes, pied-billed grebes, least sandpipers, killdeer and yellow legs were also observed. The stomach

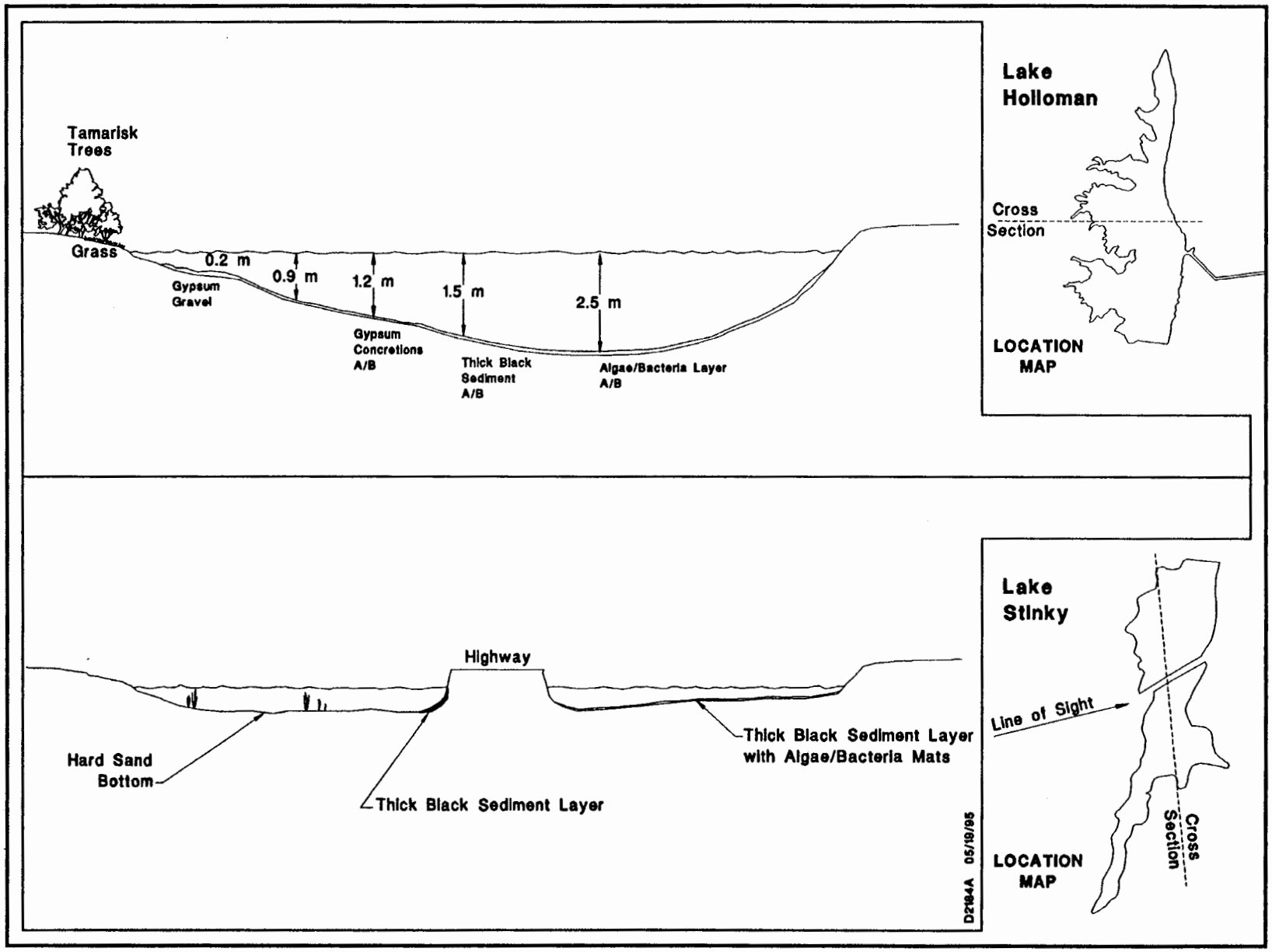

Figure 2-1. Cross Section of Lake Holloman and Lake Stinky

contents of birds feeding mostly at Lake Holloman consisted of benthic macroinvertebrates almost exclusively. Few piscivorous birds were observed routinely using Lake Holloman, with egrets being the most obvious. Dahl (1991) also described Lake Holloman as a highly productive brackish lake that was often turbid from dense growths of phytoplankton. In this study, zooplankton was abundant throughout the lake, while zoobenthos was abundant in shallow areas only.

The high productivity of the lake, as well as the insect population, attracts numerous shorebirds and waterfowl to the lake. Mallards (*Anas platyrhynchos*), Northern shovelers (*Anas clypeata*), blue-winged teal (*Anas discors*), lesser scaup (*Aythya affinis*), ring-necked ducks (*Aythya collaris*), and ruddy ducks (*Oxyura jamaicensis*) were the most common duck species observed (USAF, 1995). Ducks were observed nesting in adjacent grasslands during April 1992 and May 1994 surveys; snowy plovers (*Charadrius alexandrinus nivosus*) and American avocets were observed at Lake Holloman and Lake Stinky during May and June 1994 surveys. A variety of fish-eating species (e.g., black tern, belted kingfisher, green heron) were also present, presumably attracted by the presence of the mosquito fish. The lake is also used by large numbers of migrant Wilson's phalaropes (*Phalaropus tricolor*) (USAF, 1995).

Algal blooms during warm weather result in anoxic conditions. During this time, mosquito fish may be unable to survive in the lake. It is assumed that the lake is restocked with mosquito fish by the storm water drainage ditch or Pond G. Because of the steep bank on the east side of Lake Holloman and fluctuating water levels, there is no extensive wetland vegetation. Along the west edge, the lake has a gentle slope that allows for the growth of wetland vegetation, and some pockets of tamarisk and saltgrass have been established.

2.1.5.2 Lake Stinky

Lake Stinky is a natural playa lake (a depressional area) that is flooded under moist conditions (Figure 2-1). It receives water from Lake Holloman by persistent seepage through the earthen dam that separates the lakes or, periodically, by lake overflow through the spillway of the dam. The lake has the capacity to hold 227 million gal. of water. Lake Stinky is split by U.S. Highways 82/70 and forms two ecologically distinct lakes connected by a culvert under the highway.

Observations recorded on March 9, 1993 (Radian, 1993) show north Lake Stinky to be 20 to 24 in. deep with a soft, sludgy bottom overlaid with algal/bacterial mats. Widgeon grass was present in sparse clumps. Benthic organisms were present at very low populations. The few fish (*Gambusia affinis*) observed in north Lake Stinky were probably fugitives from Lake Holloman and not a resident population. Only a few (four or five) fish were caught in dip nets along the entire northwest shoreline in prime *Gambusia* habitat.

South Lake Stinky has a hard sandy bottom. On March 3, 1993, the lake had a plankton population much like the sewage lagoons and Lake Holloman, but somewhat less dense. Widgeon grass was beginning to grow in isolated strands on the bottom. Algal mats were present in places on the bottom. On March 24, 1993, the plankton noted on March 3 were replaced almost entirely by a population of ostracods (seed shrimp) which were distributed throughout the water column, lake bottom, and widgeon grass. Widgeon grass was growing in isolated strands and small clumps, with very little or no algae present. On April 5, 1993, south Lake Stinky was similar in appearance, with widgeon grass much more widespread, moving from the deeper water into shallower areas along the shore. A few bright red copepods with egg sacs were noted in shallow water near the shore.

Ducks were common in north and south Lake Stinky. Lake Stinky is good shorebird habitat, and the fluctuating water level and salt keep vegetation from invading the mud flats of the playa. Snowy plovers, avocets, black-necked stilts, and killdeer nest around Lake Stinky (Ewing, 1993). Lake Stinky is more actively used by snowy plovers for nesting than is Lake Holloman because of the increased shoreline habitat.

2.1.5.3 Sewage Lagoons

With the exception of Pond G, the sewage lagoons have been described as being of negligible value as wildlife habitat (USAF, 1995). Pond G tends to have better water quality, higher biological production, and, because its shorelines are unlined, plant life associated with marsh/wetland habitats. Because of this, it represents a significant wildlife habitat and resource. A site visit was conducted in 1993 and resulting sewage lagoon descriptions are included below (Radian, 1993).

Pond A—Pond A is 10.1 acres and can hold 16.1 million gal. of water (Figure 2-2). It is an aerated facultative lagoon. The edges of Pond A slope steeply and are lined to prevent bank erosion. In 1993, the liner was devoid of sediments until a depth of 18 to 24 in. is reached, where a sandy layer (apparently erosion deposits from the road/dike around the sewage lagoon) began. Sludge deposits were also mixed into this sand layer. Benthic organisms were found in relative abundance (about 10 to 20 organisms per 6 in. x 6 in. x 6 in. sample in the near surface sediments). Benthos were not present in samples taken in deeper water where there was a thick bacterial layer covering the sludge. Plankton were also present in this lagoon. The presence of benthic organisms in this pond was due largely to the fact that it did not receive wastewater in 1993. The water present at the time of sampling was due to seepage from Ponds B and C.

Ducks were observed occasionally in Pond A. Killdeer, black-necked stilts, and sanderlings were observed feeding around the edges of the sewage lagoon; barn swallows were seen in early April 1993 over the sewage lagoons. There were no fish present in Pond A.

Pond B—Pond B is 11.2 acres and can hold 16.1 million gal. of water (Figure 2-2). It is an aerated facultative lagoon. Pond B is lined and, in 1993, a sediment layer (sand from erosion of road/dike around the sewage lagoon) starting at about 9 in. deep was covered with a multicolored sludge. In the center of the lagoon, the bottom was covered with a thick (more than 6 in.), gelatinous bacterial layer. This layer appeared to grow rapidly; it covered the bottom even at the inlet from the splitter box. No benthic organisms were encountered in Pond B. Plankton in Pond B were predominantly *Chlamydomonas spp.*, a small (about 5 μm in diameter), green flagellate. Zooplankton were observed in Pond B, but fish were not present. Shorebirds were observed feeding around the edges, probably on insects and zooplankton; an occasional duck was seen on the sewage lagoon. Bats and barn swallows were seen in early April 1993 over the sewage lagoons.

Pond C—Pond C is 12.5 acres and can hold 21.3 million gal. of water (Figure 2-3). It is an aerated facultative lagoon. The edges of the lagoon are lined to prevent bank erosion, and slope steeply to a depth of 3.6 ft, thereby being less attractive for benthic-feeding shorebirds. In 1993, the liner was free of sediments except for a gravelly deposit on the west side of the sewage lagoon. Benthos (chironomid larvae) were found in this deposit as well as along the south and western shores. The bottom of the sewage lagoon at depth was covered with a bacterial layer over sludge, and no benthos were present. Dense mats of algae formed on the downwind surface at times. By the end of March 1993, there was very little zooplankton visible in Pond C and it looked very similar to Pond B. Fish were not present in Pond C. Shorebirds were observed feeding around the edges, and ducks were seen on the sewage lagoon.

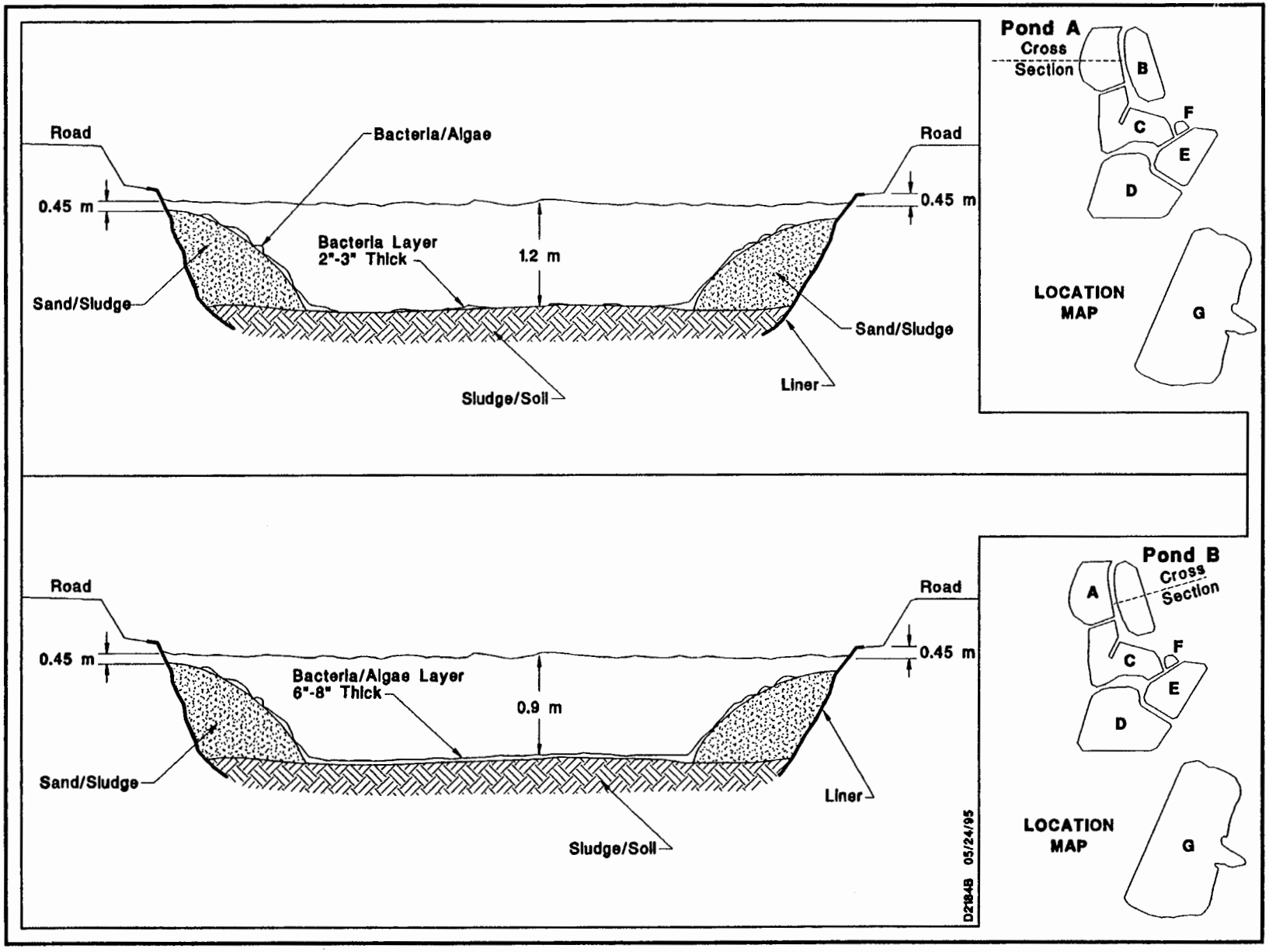

Figure 2-2. Cross Section of Pond A and Pond B

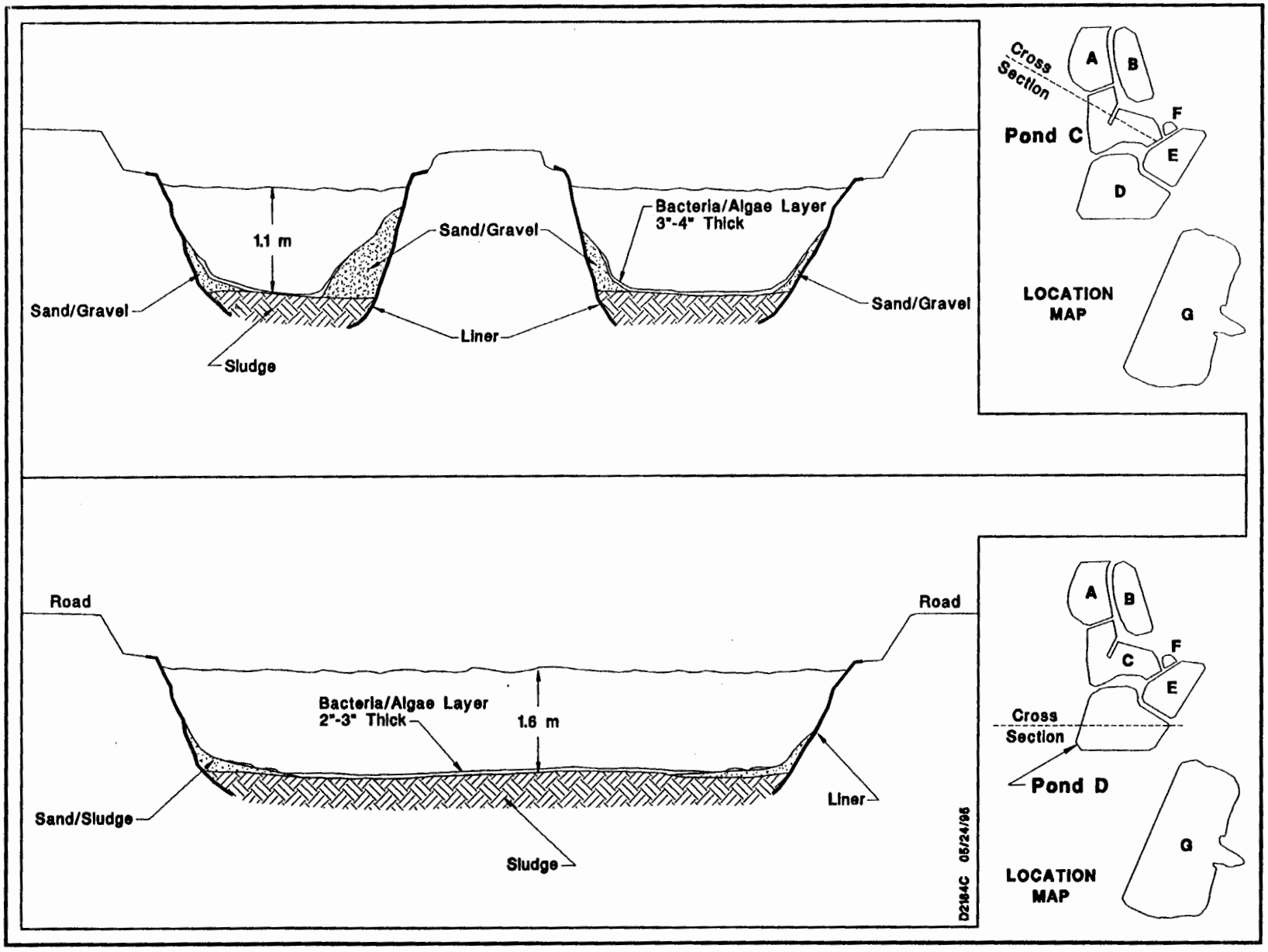

Figure 2-3. Cross Section of Pond C and Pond D

Bats and barn swallows were seen in early April 1993 over the sewage lagoon.

Pond D—Pond D is 18.7 acres and can hold 28.5 million gal. of water (Figure 2-3). It is not aerated. The edges of the sewage lagoon are lined to prevent bank erosion and slope steeply to a depth of about 5 ft, making it less attractive for benthic-feeding shorebirds. In 1993, the liner was free of sediments except for a thin layer of sand near the bottom. In addition, Pond D is built up to 10 ft above grade, making it difficult to maintain. Algal mats and bacteria were well-developed about 60 ft off shore; transition to sludge/sediment began about 40 ft off shore. A few chironomid larvae were encountered in the sandy sediments near the edge of the liner, but were not present in sufficient numbers to allow collection. No fish were present in Pond D.

Large groups of ducks are commonly seen feeding at Pond D. Shorebirds (killdeer and sanderlings) were feeding along the shoreline, apparently on flies and zooplankton that washed up along the shore. Black-necked stilts were observed picking at the water surface in 2 to 3 in. of water and along the water's edge. None of the shorebirds were probing the sediments for benthic organisms. The sediments were in deeper water than the birds were. Bats and barn swallows were observed feeding over the sewage lagoons in early April 1993.

Pond E—Pond E is 7.8 acres and can hold 12.5 million gal. of water (Figure 2-4). It is not aerated. The edges of the sewage lagoon are lined to prevent bank erosion, and slope steeply, making it less attractive for benthic-feeding shorebirds. In 1993, a sandy ledge about 30 to 40 ft wide (apparently erosion deposits from the road/dike around the sewage lagoon) surrounded the sewage lagoon. Pond E is built up to 10 ft above grade, making it difficult to maintain. In March 1993, chironomid larvae were relatively abundant in this sandy ledge (10 to 11 per 6 in. x 6 in. x 6 in. hand-dredge sample) in 18 to 24 in. of water. Larvae were much less abundant in 6 in. of water (about three per hand-dredge sample) and in deeper water (zero to three per hand-dredge sample). Adult diving bugs (*Coroxidae*) were abundant at this time (21 March 1993). A skid dredge tow caught a limited number of beetles and bugs, a large quantity of egg masses, and a good number of chironomid larvae mixed with a residue of bacteria and algae. In April 1993, the large adult coroxid population observed in March was gone, replaced by a large population of very young instars, all about the same age. Zooplankton populations were greatly reduced at this time.

Large groups of ducks are commonly seen feeding on Pond E. Shorebirds (killdeer and sanderlings) were feeding along the shoreline, apparently on flies and zooplankton that washed up along the shore. Black-necked stilts were observed picking at the water surface in 2 to 3 in. of water and along the water's edge. Bats and barn swallows were observed feeding over the sewage lagoons in early April 1993. There were no fish in Pond E.

Pond F—Pond F is 0.5 acres and can hold 1.6 million gallons of water (Figure 2-4). It is used to recirculate water from Pond E to the headworks. The edges of the sewage lagoon are lined to prevent bank erosion, and slope steeply, making it difficult for benthic-feeding shorebirds to use the sewage lagoons. In 1993, a sandy shelf containing chironomid larvae was present around the perimeter of the sewage lagoon. No fish were present in Pond F. Shorebirds were observed feeding along the edges of the sewage lagoon, probably on insects and zooplankton. Ducks were very infrequent in Pond F. Bats and barn swallows were observed feeding over the sewage lagoons in early April 1993.

Pond G—Pond G is 39.8 acres and can hold 64.6 million gal. of water (Figure 2-5). Effluent from Pond G flows to Lake Holloman. It

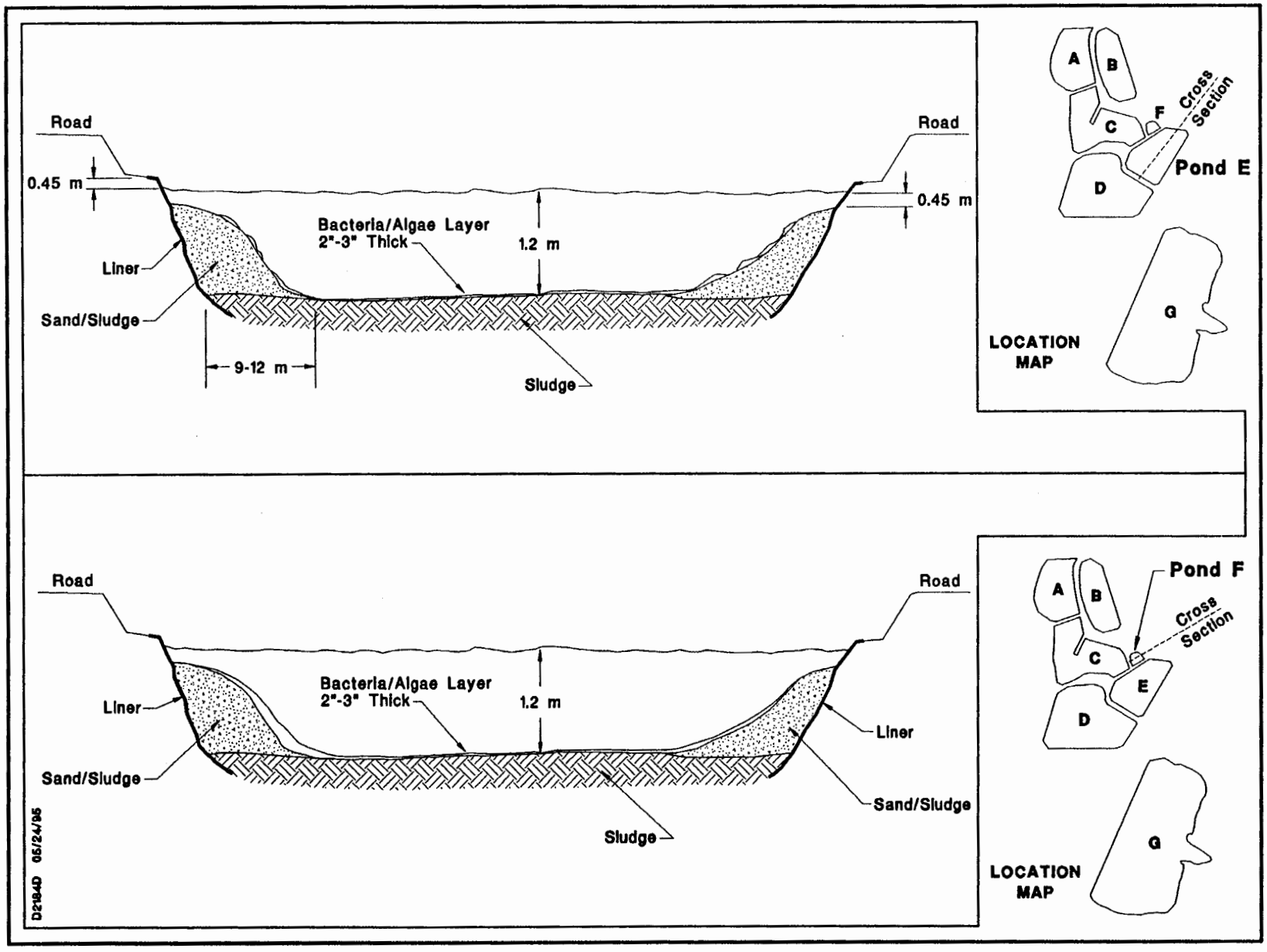

Figure 2-4. Cross Section of Pond E and Pond F

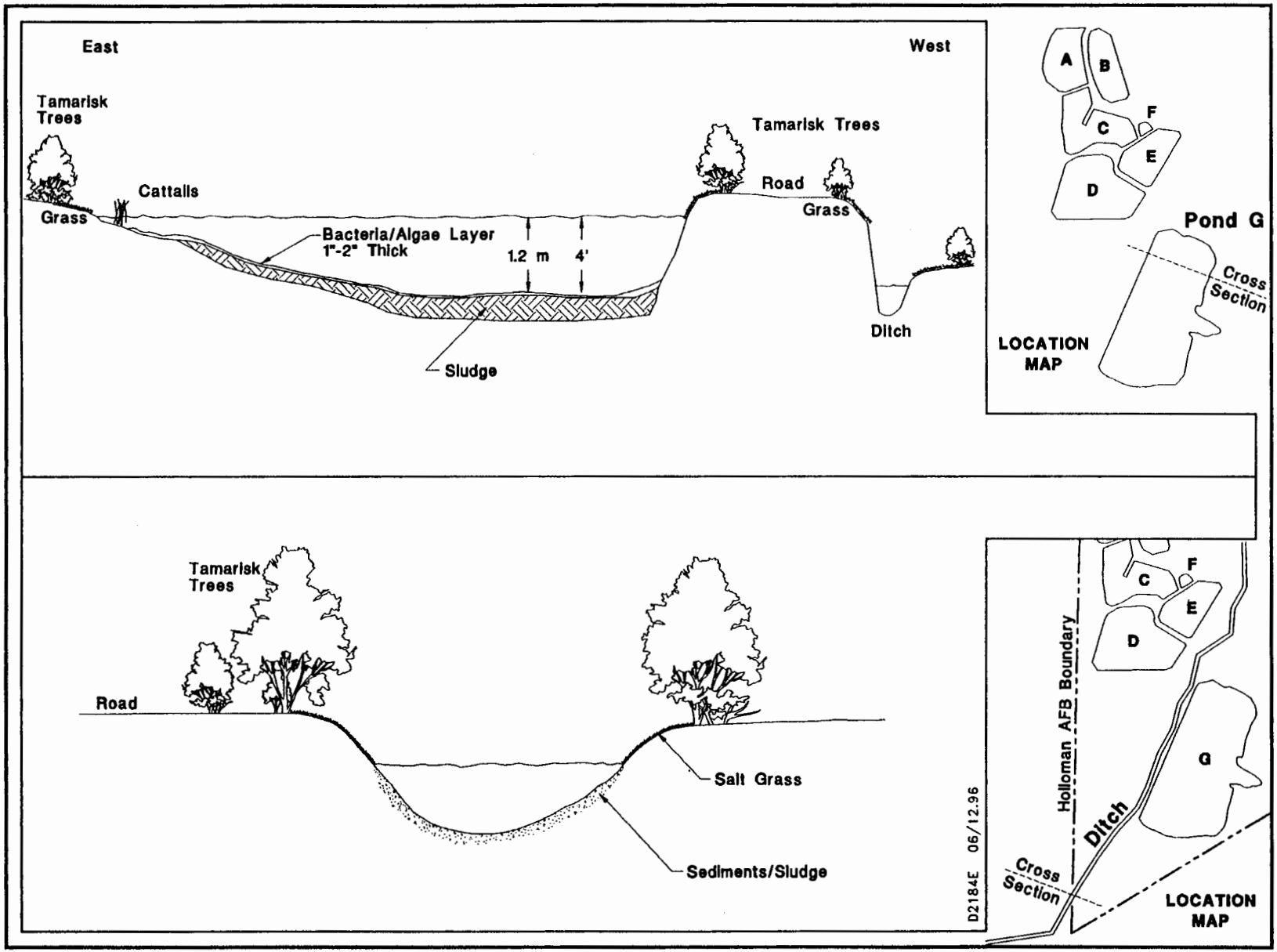

Figure 2-5. Cross-Section of Pond G and the Ditch

is surrounded by marshland/wetland and riparian habitat, and is used by waterfowl, shore birds, and landbirds. Pond G is an unlined lagoon bordered by salt grass and tamarisk trees. Cattails grow along the shallow edges. The south end of the sewage lagoon is a rubble dam with little vegetation along the waterline. The west bank is fairly steep and is overgrown with tamarisk. The steep-sloping banks inhibit significant wetland development along the banks.

In 1993, the deep part of the lagoon was covered with a 1- to 2-in. layer of bacterial/algal ooze with little evidence of macroscopic life. The south shore was covered with concrete rubble and the west shore was covered with tamarisk debris. Chironomids were present in the shallow water along the north and west banks but at relatively low population densities (seven per hand-dredge sample was the maximum concentration found). Algal growth in the sewage lagoon attracts insect populations that in turn attract numerous wetland birds. The marshlands in the low-lying areas adjacent to Pond G also attract bird species. The birds observed around Pond G are similar to those observed around Lake Holloman and Lake Stinky; however, snowy plovers do not usually use the sewage lagoons.

Fish (*Gambusia affinis*) are present in Pond G along all shores. It is suspected that Pond G acts as a reservoir that allows the mosquito fish to repopulate Lake Holloman after its seasonal anoxia (USAF, 1995).

2.1.5.4 The Storm Water Drainage Ditch

The storm water drainage ditch is unlined and receives discharge from the Base storm water sewer system northeast of the sewage lagoons (Figure 2-6). Water is present in the ditch at most times. The ditch extends southwest to the sewage lagoons, where it receives additional discharge from the sewage lagoons, and then farther southwest to discharge into Lake Holloman.

The edges of the ditch are somewhat steep. In the northern part of the ditch, vegetation is limited to tamarisk and upland grass species. Bulrush (*Scirpus maritimus*) is also abundant along part of the ditch. The banks of the ditch are somewhat eroded in some areas, allowing for discharge of water into adjacent marshlands. In these areas, saltgrass is the dominant species. This part of the stream also has an abundant population of mosquito fish. The ditch provides the type of habitat used by southwestern willow flycatchers, although they have not been sighted at the sewage lagoons and lakes.

2.2 Threatened, Endangered, and Sensitive Species

A list of bird species was compiled for use in this biological resources document based on a year of monthly field observations by the New Mexico Heritage Program and recorded observations by the Mesilla Valley Audubon Society. In addition, threatened, endangered, or candidate mammal, fish, and plant species that may occur in the project area were also selected by the Base biologist, Dr. Hildy Reiser, for evaluation based on information available as of May 1995. These animal and plant species are believed to represent the threatened, endangered, and candidate species that may use the sewage lagoons and lakes area at Holloman AFB. Tables 2-1 and 2-2 list these species.

The following sections discuss these species in greater detail. The information on species appearance, habitat, range, breeding, and limiting factors contained in these descriptions was taken directly from the *Combined Endangered Species Management Action Plan for Holloman Air Force Base, New Mexico* prepared by the New Mexico Natural Heritage Program (NMNHP, 1994) unless otherwise cited. The following sections also discuss the potential effects of the proposed and alternative actions on these species. The no action alternative represents a potential adverse effect on all species in the area since the

Table 2-1
Threatened, Endangered, and Sensitive Species of Birds

Species	Observed at Holloman AFB	Potential Habitat Use at Lagoons/Lakes	Federal Status[a]	State Status[a]
Aplomado falcon	No	Migrant/resident	Endangered	Endangered
Baird's sparrow	No	Migrant/winter resident	Category 2	Threatened
Bald eagle	Yes	Winter resident/migrant	Endangered	Endangered
Burrowing owl	No	Resident breeder	Category 2	None
Ferruginous hawk	Yes	Winter resident/migrant	Category 2	None
Interior least tern	No	Migrant	Endangered	Endangered
Loggerhead shrike	Yes	Resident breeder/migrant	Category 2	None
Neotropic (olivaceous) cormorant	No	Migrant	None	Threatened
Northern goshawk	Yes	Migrant	Category 2	None
Peregrine falcon	Yes	Migrant	Endangered	Endangered
Southwestern willow flycatcher	No	Resident/migrant	PE	Threatened
Western snowy plover	Yes	Resident breeder/migrant	Category 2	None
White-faced ibis	Yes	Migrant	Category 2	None
Whooping crane	No	Migrant	Endangered	Endangered

[a] Federal and State status as of May 1995.

Note: PE=Federally proposed endangered; E=Federally endangered; Category 1=Federal candidate under review; Category 2=Federal candidate under review; however, there is not enough information available to make a decision.

Table 2-2
Threatened, Endangered, and Sensitive Mammal, Fish, and Plant Species

Species	Observed in Project Area?	Potential Habitat Use at Lagoons/Lakes	Federal Status[a]	State Status[a]
MAMMALS				
Greater western mastiff bat	No	Forages over water for insects	Category 2	None
New Mexico jumping mouse	No	Wetland habitats and permanent ditches	Category 1	Threatened
Occult little brown bat	No	Forages over water for insects	Category 2	None
Small footed bat	No	Forages over water for insects	Category 2	None
Swift fox	No	Open desert and grassland	Category 2	None
FISH AND REPTILES				
Texas horned lizard	No	Desert grasslands/shrub lands, and playas	Category 2	None
White Sands pupfish	No	Alkaline springs, seeps, pools, and streams in Tularosa Basin	Category 2	Threatened
PLANTS				
Grama grass cactus	Yes	Relatively well-drained soils with alkali sacaton	Category 2	Endangered
Gypsum scalebroom	No	Alkali/gypsum playas in southern Otero County	Category 2	Endangered

[a] Federal and State status as of May 1995.

Note: PE=Federally proposed endangered; E=Federally endangered; Category 1=Federal candidate under review; Category 2=Federal candidate under review; however, there is not enough information available to make a decision.

sludge in Ponds A through F would be left open to the atmosphere. Although it is not in the scope of this project to determine risk levels, it is assumed that since the sludge has been shown to contain low levels of contaminants, there may be direct or indirect (food chain) health risks—for instance, polychlorinated biphenyls (PCBs) and DDT have been detected in Ponds A and B—to species in the area. This adverse effect is not repeated in every section below; however, it is assumed to be the case for all species.

2.2.1 Birds

2.2.1.1 Northern Aplomado Falcon

The northern aplomado falcon (*Falco femoralis septentrionalis*) is federally and state listed as endangered. This species declined radically in the United States during the 1900s and was considered to be extirpated from the Southwest by the 1960s. It has been sighted recently in southern New Mexico and west Texas, indicating that it may be making a recovery. Two recent sightings were reported near Holloman AFB (White Sands Missile Range and west of Carrizozo), and the Mesilla Valley Audubon Society reported sighting the bird at the sewage lagoons and lakes area.

The aplomado falcon is a slender, long-tailed raptor of medium size. It prefers open habitats, including coastal plains, grasslands, tropical savannah, and open woodlands. In New Mexico, this species requires open yucca grassland and adjacent scrubby habitats at lower elevations. It tends to prefer fairly open areas, with trees and shrubs spaced far apart. It formerly occurred as a breeding summer resident in the southern part of the state. A stable breeding population has been identified in Chihuahua, Mexico, which borders Texas and New Mexico.

Aplomado falcons feed on a variety of prey, including both terrestrial and aerial arthropods and vertebrates. In one study, insects comprised 65% of prey items. They also prey on small birds and occasionally bats. The young are fed mostly birds.

This population may be making a recovery and may be reoccupying its historical range, including areas in New Mexico. Limiting factors are brushland encroachment associated with rangeland degradation and organochlorine pesticide contamination of prey species. NMNHP (1994) concluded that is it necessary to determine whether the aplomado falcon is present at Holloman AFB, and if so, identify its habitat usage. The aplomado falcon has a low to moderate potential of occurring in the project area. Closure of Ponds A through F is not expected to adversely affect this species. The sewage lagoons, with the exception of Pond G, provide only marginal forage and little to no habitat for shorebirds and waterfowl, which the aplomado falcons prey on. The lakes will remain a potential source of food (i.e., shorebirds and waterfowl) and the additional constructed wetlands may provide a larger foraging area for the aplomado falcon. Dredging Pond G could cause bird populations to shift to the lakes and could result in a temporary decrease in the waterfowl and shorebird populations, since some forage will be lost.

2.2.1.2 Bald Eagle

The bald eagle (*Haliaeetus leucocephalus*) is listed both state and federally as endangered. The subspecies recognized in New Mexico is *Haliaeetus leucocephalus alascanus*. With the exception of the California condor, the bald eagle is the largest bird of prey in the United States. It is strictly a North American species, occurring as far north as the treeline, from Alaska to eastern Canada, and as far south as Baja California, Arizona, and the Gulf Coast and Florida. Within this range, they are concentrated around large bodies of water and are scarce elsewhere.

In New Mexico, the bald eagle migrates and winters statewide at lower and middle elevations, mostly in wetland habitats, such as reservoirs, larger river coarses, and areas of open water. It has also been documented as a rare breeder in New Mexico, with one active nest site known. On Holloman AFB, this species should be expected in spring (late March-April) and fall (October-November). Eagles seen in December and early March are probably wintering over. In New Mexico, this species requires open water with abundant food supplies (fish) and the presence of dead snags and trees for roosting and hunting. Bald eagles feed mainly on fish, both living and dead, including carp, bullhead catfish, and gizzard shad, and waterfowl, including ducks and geese. Mammals ranging in size from squirrels and rabbits to raccoons and deer fawns are also occasionally taken. Habitat at the Holloman AFB lakes is probably suboptimal for wintering bald eagles.

Limiting factors are organochlorine pesticide contamination in prey species, wetland habitat loss and degradation, and illegal shooting. The bald eagle has a moderate potential of occurring at the subject site, and the Mesilla Valley Audubon Society reports sighting it near the sewage lagoons and lakes. NMNHP (1994) concluded that it is necessary to take a census of the bald eagle populations at Holloman AFB in migration and winter, and to describe their habitat usage and foraging patterns. NMNHP's plan also indicated that wetlands on Holloman AFB should be preserved and any large dead or dying trees near the Holloman AFB lakes should be left in place for nesting and roosting. Ponds A through F are not wetland areas and none of the sewage lagoons or the lakes support fish other than mosquito fish. Most of the waterfowl and shorebirds use Pond G and the lakes, although large numbers of ducks have been observed using Ponds D and E. Because Ponds A through F are contaminated and provide only marginal forage and little to no habitat for birds in the area, loss of these sewage lagoons is not expected to negatively affect the bald eagle population. Pond G has wetland areas associated with it and has better water quality, as well as a better developed ecosystem. On the basis of this, dredging Pond G could temporarily affect other bird populations and, in turn, affect the bald eagle population. The addition of 120 acres of constructed wetland habitat west of Pond G will ultimately be a positive effect on this species.

2.2.1.3 Baird's Sparrow

The Baird's sparrow (*Ammodramus Bairdii*) is listed as a Category 2 species by the USFWS and as a threatened species by the State. It occurs in New Mexico as a migrant, and possibly as a wintering bird. Owing to its increasing rarity and inconspicuous nature, it has seldom been reported in the state in recent years, with most records coming from fall migration.

The Baird's sparrow is a very shy, secretive bird breeding primarily in the northern mixed-grass prairie. The species seems to prefer dense vegetation of medium to tall height. In dry years, or in drier portions of its range, the Baird's sparrow breeds in grassy slough bottoms, alkali flats, and depressions in low lying grasslands. It is not usually associated with a high density of shrubs. In New Mexico, the Baird's sparrow is considered a rare migrant in low elevation grassland habitats, with only one confirmed winter record. It has been recorded in a variety of grassland habitats, including desert grasslands in the south, prairies in the northeast, and mountain meadows in the northern highlands. At present, this species is most likely to occur in relatively undisturbed shrubby, shortgrass habitats at low elevations in eastern and extreme southern New Mexico. The species winters from southeastern Arizona and southern New Mexico, to northern New Mexico and southern Texas. It does not breed in New Mexico.

Nestling Baird's sparrows are fed an exclusive diet of insects. The adult diet changes

substantially between seasons. In the winter, spring, and fall, they eat mostly seeds. During the breeding season, the adults eat spiders, leafhoppers, grasshoppers, moths, and small seeds.

The major predators are small mammals and birds. The major threat is probably loss of habitat to cultivation and drainage of wetlands. Determining whether this species is using Holloman AFB grassland areas during migration or winter has been identified as a conservation goal by the NMNHP (1994), as well as the construction of a management plan for preservation or upgrading of these areas if they are so used. The Baird's sparrow has a low potential for occurring in the project area, but the Mesilla Valley Audubon Society has reported sighting this bird at the lagoons and lakes area. Closure of Ponds A through F and/or dredging Pond G is not expected to negatively affect the Baird's sparrow since it does not depend on these systems for food or cover. If additional wetlands are developed west of Pond G, grassland habitat may be lost, however. Since grasslands are fairly common in this area, the loss of 120 acres of grassland is not considered significant, especially in light of the benefit that the additional wetlands will have on other species in the area. In addition, the grasslands between Pond G and Lake Holloman are not considered to be of high quality because of the high salinity of the soil and sparse vegetation.

2.2.1.4 Burrowing Owl

The burrowing owl is a federal Category 2 candidate for listing. Recent decline of the burrowing owl has been attributed to the control of burrowing animals and loss of habitat to cultivation (Rich, 1986). The burrowing owl is a small, robin-sized terrestrial owl, 9 in. tall. It is short-tailed and long-legged with yellow eyes and no ear-tufts. The owl's face is framed in white with a blackish collar.

The burrowing owl is ground dwelling and the most diurnal of all owls. The burrowing owl's preferred habitat is on plains, deserts, fields, farmland, and airports. It lives in burrows that typically have been abandoned by prairie dogs or badgers; however, the owl can dig its own burrows if required. During breeding it prefers small rock outcrops for nesting sites, since they afford protection from badgers and other predators (Rich, 1986). This species breeds from Canada's southern prairie provinces south to Southern California and Texas and winters in southwestern states. The burrowing owl is resident in central and southern Florida (Audubon, 1993).

The burrowing owl's diet consists of 14.3% vertebrates and 85.7% invertebrates (Brown, 1980). It feeds mainly on grasshoppers, beetles, and sometimes lizards, snakes, mice, rats, and birds (Harrison, 1993).

The major threat to the burrowing owl is probably the loss of habitat to cultivation because many owls prefer to hunt and breed in farmland (Rich, 1986). The burrowing owl is moderately likely to occur since it has been observed on Base less than one mile away. This species was not covered in the *Endangered Species Management Action Plan* (NMNHP, 1994) for Holloman AFB and has not been sighted by the Mesilla Valley Audubon Society. Closure of Ponds A through F and/or dredging Pond G is not expected to negatively affect the burrowing owl, since it does not depend on these systems for food or cover. The upland grassland habitat provided around the airport and around the ponds and lakes will still be available for use by the burrowing owl. Upland grassland habitat between Pond G and Lake Holloman may be lost if wetlands are constructed in this area. However, the loss of 120 acres of upland grassland is not a significant loss since grasslands are common in this area. In addition, the grassland west of Pond G is not considered to be of high quality.

2.2.1.5 Ferruginous Hawk

The ferruginous hawk (*Buteo regalis*) is listed as a Category 2 species by the USFWS. It is the largest and heaviest member of the genus and, when flying overhead, is sometimes confused with eagles or osprey.

The ferruginous hawk's breeding range spans from the Canadian prairie provinces south and west from North and South Dakota across to Washington and Nevada. Utah, Wyoming, Nebraska, Colorado, Arizona, and New Mexico constitute the year-round range. Winter range also includes California, southern Arizona and New Mexico, southwestern Texas, and into much of Mexico. It is resident in both summer and winter statewide in New Mexico, although rare to uncommon. Nesting records from the 1980s suggest that breeding ferruginous hawks are more common in New Mexico than elsewhere in the Southwest. However, it has become less common as a breeder and relatively common as a wintering species. On Holloman AFB, the hawks would be most abundant in winter or in migration, and most likely to appear in open area grasslands using short trees, power poles, and fence posts for hunting perches.

The ferruginous hawk occurs in arid and semiarid deserts and grassland regions along level and rolling terrain and foothills, avoiding high elevations, forest interiors, narrow canyons, and cliff areas. It prefers open grassland and is likely to be outcompeted in taller, denser vegetation.

The diet of these hawks may contain 85% mammals, 10.5% birds, 2.6% reptiles, occasional amphibians, and 1.7% insects. Young rabbits and hares, pocket gophers, ground squirrels, and prairie dogs are likely the mammal prey of choice in New Mexico.

The main threat to the ferruginous hawk is loss of open grassland habitat. NMNHP (1994) identified maintaining healthy, potentially reproducing ferruginous hawks in the relatively undisturbed grassland habitats of Holloman AFB as a conservation goal. It also recommended taking a census of the population and habitat. This species has a moderate to high potential of occurring at the subject site, and the Mesilla Valley Audubon Society reports sighting the hawk in the pond and lakes area. Closure of Ponds A through F and/or dredging Pond G is not expected to have a long-term adverse effect on the ferruginous hawk population since it does not depend on these systems for forage or cover. The development of additional wetlands west of Pond G would result in a loss of upland grassland habitat; however, this is not expected to adversely affect this species since the grassland to the west of Pond G is not considered to be of high quality and does not provide significant food or cover.

2.2.1.6 Interior Least Tern

The interior species of the least tern (*Sterna antillarum athalassos*) is listed federally and by the State of New Mexico as endangered. This species breeds in the state only in a very small colony near Bitter Lakes N.W.R. on the Pecos River. This colony has declined drastically in recent years, and is considered to be critically imperiled. The least tern occurs as a rare vagrant in other wetland habitats in New Mexico, including Lake Holloman and Lake Stinky.

The interior least tern is the smallest of the North American terns at 8.5 to 9.5 in. and is one of three subspecies in North America. It breeds along the Mississippi River drainage basin, the Colorado River, and the Rio Grande, from central North Dakota, Iowa, and Indiana south to eastern New Mexico, Texas, Mississippi, and Tennessee.

The habitat of the coastal nesting least terns has been characterized as broad, flat, open, sandy, cobbly type beaches, with scant vegetation. It has been determined that they need water for feeding, a pebble substrate for egg camouflage, and sparse vegetation to provide chick shelter. It

is important that vegetation be sparse and not in an advanced stage of succession so that the terns can see predators prior to attack. The interior least tern nests mainly on riverine sandbars or salt flats that become exposed during periods of low water. They require no cover during the breeding season. Chicks use sparse vegetation and debris for shade and protection.

Terns feed in shallow waters, usually less than 13 ft deep. They feed mainly on small fish, some crustaceans, and occasionally on insects. A colony of 100 or more pairs is considered of excellent quality, 50 to 99 pairs of good quality, and 14 to 49 pairs of fair quality.

Threats to the least tern include extensive recreation and development along coastal beaches, mammalian and avian predation, damming and alteration of river systems, oil spills, and severe weather conditions. The NMNHP (1994) recommends preserving the lakes on Holloman AFB as migrational habitat for the least tern. Least terns have been sighted by the Mesilla Valley Audubon Society; however, the interior species has not been sighted and has a low to moderate potential of occurring at the subject site. Closure of Ponds A through F is not expected to adversely affect the interior least tern population. Dredging Pond G could, however, result in the loss of jurisdictional wetlands associated with this lagoon. This loss of wetland/shoreline habitat could adversely affect the least terns. However, the development of 120 acres of additional wetlands west of Pond G would eventually compensate for this loss and would benefit the terns by increasing the available wetland habitat.

2.2.1.7 Loggerhead Shrike

The migrant loggerhead shrike (*Lanius ludovicianus*) is listed as a Category 2 species by the USFWS. The species is widespread throughout most of North America, but has shown a marked decline over much of the continent. Although no significant decline has been documented in New Mexico, it has shown a sharp decline in recent years in other western states (e.g., Arizona and California).

The loggerhead shrike resembles the mockingbird in both size and plumage. Shrikes occur from deserts and prairies in the west to pastures and fields in the east. They require shrubs and low trees for nesting and perching. Nests are found 3 to 20 ft above ground. Shrikes are a strictly North American species and only in high mountains is it completely absent.

Shrikes are the only North American songbirds that regularly prey on other vertebrates and are well known for their habit of impaling mice, shrews, small birds, lizards, and snakes on thorns or barbed wire. Prey range in size up to full-grown cotton rats, but insects probably constitute the bulk of their diet.

The decline in the shrike population is believed to be a result of loss of habitat, due largely to "clean" farming, which clears shrubs and low trees, and pesticide contamination, which is believed to kill juvenile shrikes. Specific management plans for the migrant loggerhead shrike on Holloman AFB are undetermined, according to the NMNHP (1994). Although this bird population is stable in New Mexico, populations elsewhere are declining. Therefore, it is important to monitor these birds and determine whether there are any limiting factors on Holloman AFB. The loggerhead shrike is common in the project area. Closure of Ponds A through F and/or dredging Pond G is not expected to adversely affect the loggerhead shrike population since they do not depend on these systems for forage or cover. The grassland around the lagoons may be considered important habitat since it does have low shrubs and trees and does provide prey species. If additional wetlands are developed to the west of Pond G, upland grassland habitat may be lost. However, 120 acres of grassland is not considered significant, especially in view of the benefits that

these wetlands will afford to other species in the area. In addition, the grasslands to the west of Pond G are not considered to be of high quality.

2.2.1.8 Neotropic Cormorant

The neotropic (olivaceous) cormorant (*Phalacrocorax brasilianus*) is listed as a threatened species by the State. This is a dark, moderately large, long-necked water bird that averages 600 to 720 mm (24 to 28 in.) in length and 1 m (39 in.) in wing span.

The neotropic cormorant occurs from the extreme Southwest and Louisiana south through Central America and the Caribbean region to southern South America. Generally, neotropic cormorants are considered residents where they occur, but they do wander. This species breeds and is a variable resident in the southern Rio Grande valley, from Bosque Del Apache National Wildlife Refuge south, and in the lower Gila valley of southwestern New Mexico. It may occur as a rare vagrant in wetland habitats in other areas of southern New Mexico and would occur only as a vagrant at Lake Holloman at any time of the year.

Neotropic cormorants occur in wetlands, but seem to prefer freshwater. They need trees and dead snags near water for breeding. They construct strong stick nests; nesting occurs from late April through June in New Mexico. The diet of this species consists mainly of fish and frogs.

Potential threats include limited availability of nest sites in the Rio Grande valley, persecution as a fish eater, and fluctuation in food supply. The NMNHP (1994) recommends that areas of open water on Holloman AFB be preserved. The double-crested cormorant has been observed by the Mesilla Valley Audubon Society, however the neotropic species has not been sighted. It is unlikely that the proposed action would significantly affect the neotropic cormorant population since they rarely, if ever, occur in the project area. Ponds A through E do not provide forage or cover for the cormorants. Pond G and the lakes provide very limited forage, but are sources of open water for vagrant cormorants. Since Pond G does not provide significant forage, dredging the lagoon would probably not result in a long-term adverse effect on this particular species. The addition of wetlands west of Pond G may be attractive to vagrant cormorants and may provide additional forage. The loss of grasslands from the development of additional wetlands should not adversely affect the cormorant population.

2.2.1.9 Northern Goshawk

The northern goshawk (*Accipiter gentilis*) is listed as a federal candidate Category 2 species. It has recently begun extending its range to the south and now breeds in small numbers in coniferous forests (Audubon, 1993).

The northern goshawk is 20 to 26 in. long, with a long, narrow tail, short-rounded wings, and bold, white eyebrows. The adults are blue-gray above, with a black crown and pale underparts finely barred with gray. The juveniles have large spots on the breast (Audubon, 1993; Harrison, 1993).

The northern goshawk breeds primarily from western Alaska to southern New Mexico. It inhabits moderately to highly dense, mature coniferous forests with minimal understory. Nest sites are found in forest stands with a high density of large trees and canopy closure. They winter in farmland, woodland edges, and open country (Audubon, 1993). Northern goshawks periodically invade lowland areas when there are food shortages (USAF, 1995). They hunt in the forest, at the forest edge, and adjoining areas. Their main prey are birds in flight, including crows, jays, pigeons, thrushes, grouse, and pheasants. Ground-dwelling prey include rabbits and squirrels (Harrison, 1993).

The northern goshawk was not included in the NMNHP (1994) for Holloman AFB, and it is

unlikely to occur since suitable nesting habitat is not present in the project area. The Mesilla Valley Audubon Society reports sighting the northern goshawk in the project area; however, frequency and bird activity were not reported. Closure of Ponds A through F and/or dredging Pond G is not expected to have a long-term adverse affect on the northern goshawk population since they do not depend on these systems for forage or cover. The surrounding grassland may provide winter forage in time of food shortages, but it does not appear to be critical habitat for the northern goshawk. Therefore, the loss of 120 acres of upland grassland west of Pond G should not adversely affect this species.

2.2.1.10 Peregrine Falcon

The peregrine falcon (*Falco peregrinus*) is listed federally and by the State as endangered. The species occurs as a regular migrant at the lakes on Holloman AFB, where it preys on shorebirds and waterfowl.

The peregrine falcon is a medium-sized bird of prey, slightly larger than a crow. Its key habitat requirements are cliffs for nesting and open country for hunting. It ranges from coastal regions to mountains and from plains and tundra to forested areas, provided there are prey that fly above the tree tops. It also occurs in cities where there is an abundance of both artificial "cliffs" and prey in the form of pigeons, starlings, and other urban wildlife.

Nests are typically located on high ledges with a good view of the surrounding terrain. Cliffs are the normal sites chosen. Winter habitat is often identical to that used for breeding, but open areas such as coastal dune and marsh habitats are also used, especially where there are large concentrations of wintering waterfowl and shorebirds, important prey species of the peregrine. In New Mexico, migrant and wintering peregrines use low elevation wetland habitats such as mud flats, marshes, and ponds where large numbers of migrating waterfowl and shorbirds congregate. These habitats are scarce in the arid southwest and constitute important "stop overs" for falcons that breed in New Mexico as well as those that migrate through the state.

The home range of the peregrine varies in size from 0.25 to 120 square miles, depending on the availability of food. The hunting range typically extends out 10 miles from the nest. Peregrines feed mainly on birds, taking species ranging in size from warblers to ducks. In inland sites, pigeons, flickers, jays, and meadowlarks are commonly taken. Shorebirds and seabirds are taken along the coast. They may also eat mammals, such as mice or woodchucks, or even insects.

Habitat loss, particularly of wetland areas that support large populations of prey species, is among the human-related threats to the peregrine. Also in this category are shootings, rock climbing, and DDT contamination. The only other serious enemy of the peregrine is the great horned owl, which takes the young or usurps nesting sites.

During migration and winter, this species requires wetland habitats where large concentrations of migrant shorebirds and waterfowl are present. The NMNHP (1994) for Holloman AFB identifies preservation of the Holloman AFB lakes wetlands as a management objective for the peregrine falcon. The Mesilla Valley Audubon Society has reported sighting the peregrine in the project area and it is highly likely to occur in the project area. Closure of Ponds A through F is not expected to adversely affect the peregrine population, however, dredging Pond G would result in the loss of adjacent jurisdictional wetlands, as well as some forage. Pond G and the lakes probably provide adequate forage for the peregrines (i.e., shorebirds and ducks), and the development of additional wetlands west of Pond G would provide additional foraging area.

2.2.1.11 Southwestern Willow Flycatcher

The southwestern willow flycatcher (*Empidonax traillii extimus*) is a federally proposed endangered species and is state listed in New Mexico as threatened. It occurs throughout the Southwest as a migrant and/or nester.

The southern willow flycatcher is indistinguishable from the alder flycatcher except through differences in voice. This insectivore is 5 to 6 in. tall, and is dull gray-green above, and whitish below, with two dull-white wing bars and narrow white eye rings (Audubon, 1993).

The southwest willow flycatchers inhabit thickets in riparian and other wetland habitats. They prefer areas dominated by willows, baccharis, tamarisk, or Russian olive. They use areas of moderate to abundant ground vegetative cover (Sedgewick, 1992). They also occur in old, abandoned orchards (Audubon, 1993). Loss of riparian habitat and brood parasitism by brown-necked cowbirds are the major threats to the species.

The southwestern willow flycatcher was not included in the NMNHP (1994) for Holloman AFB and is unlikely to occur in the project area. The Mesilla Valley Audubon Society has not reported any sightings of this bird in the project area. Riparian habitat is present at the drainage ditch; however, the sewage ponds provide little habitat. They are all lined and steeply sloped with the exception of Pond G. Pond G does offer limited shoreline, but this species has not been sighted here. Therefore, closure of Ponds A through F and/or dredging Pond G is not expected to adversely affect (long term) the southwestern willow flycatcher population. The development of additional wetlands west of Pond G may increase their habitat area and, therefore, benefit this population.

2.2.1.12 Western Snowy Plover

The Snowy Plover (*Charadrius alexandrinus*) is listed as a Category 2 species by the U.S. FWS. It is a cosmopolitan species, with at least seven recognized subspecies that breed on all continents except Antarctica. The *nivosus* subspecies breeds in the western United States, including Holloman AFB, and is referred to as the western snowy plover.

The snowy plover is a small, pale shorebird that averages about 6 in. in length. It breeds along the Pacific coast, north to Washington, and locally in the interior of the western United States, and eastward to west Texas and Kansas. Although some coastal populations are nonmigratory, interior breeding birds migrate to coastal areas in the tropics. It is known to breed in areas of southern New Mexico, including the Holloman AFB lakes. They arrive in New Mexico in late March, and breed in late April and May. Populations should peak in April through early May, and again in August through early September. It may occasionally occur at the Holloman AFB lakes in the winter.

Snowy plovers breed on sandy beaches, flats, and shores near water. During migration, they prefer similar habitats, but will also use areas unsuitable for breeding, such as mudflats. In New Mexico, this species breeds locally on barren alkali lake beds and playas near water. They prefer areas where vegetation is sparse. The diet of the snowy plover consists mainly of small aquatic invertebrates, insects, worms, and small fish. Inland populations feed more heavily on insects such as beetles and flies.

Limiting factors for the snowy plover are groundwater withdrawal, water level fluctuations during breeding, and human disturbance (i.e., off-road vehicles). The NMNHP (1994) recommends maintaining optimal snowy plover breeding habitat at the Holloman AFB lakes by preventing fluctuations in water levels that may destroy nests

and restricting off-road vehicle use in the vicinity of the lakes. The NMNHP reported many sightings of the plovers in 1994, including 95 plovers in April, 162 in May, 131 in June, 13 in July, and 23 in August. It is unknown whether the birds were observed during other months of the year. The snowy plovers have not been observed using the sewage lagoons, since the sewage lagoons do not provide suitable habitat. Therefore, closure of Ponds A through F and/or dredging Pond G is not expected to negatively affect the snowy plover population (long term) unless water levels in the lakes were to increase as a result of this loss. An increased water level would reduce shoreline habitat and adversely affect the plovers. One breeding pair was observed at the north end of Lake Holloman; however, this may be a result of an unusually dry year that resulted in mudflats at this end of the lake. They are more commonly seen on Lake Stinky. The development of additional wetlands west of Pond G could result in additional nesting habitat for these birds and would help to prevent uncontrolled excess overflow into Lake Stinky. In addition, the water level in Lake Holloman could be lowered to increase shoreline habitat.

2.2.1.13 White-faced Ibis

The White-faced ibis (*Plegadis chihi*) is listed as a Category 2 species by the USFWS. It is a long-legged, long-necked, wading bird that averages 22 to 25 in. in length.

The White-faced ibis breeds in the interior of the western United States, locally from central California, eastern Oregon, Southern Idaho, Montana, southern North Dakota south to Texas, and with a few isolated colonies in Mexico. The species winters from southern California and Texas into Central America, and also occurs in South America. In New Mexico, it occurs statewide during migration (April to May and August to October) and in wetland habitats. It has been documented as breeding in Tucumcari. Nonbreeding birds sometimes winter in the state. At the Holloman AFB lakes, this species is a regular migrant in spring (April to May) and fall (August to October), and should be occasional in the summer.

The White-faced ibis is generally associated with low-elevation wetland habitats in the western United States. In particular, the species prefers marshy areas that border open water. Vegetation in these habitats usually consists of cattails and rushes, which provide cover. The species also occurs in more open areas such as mud flats and flooded agricultural fields. It spends much of its time wading and foraging in shallow water near shoreline. The White-faced ibis prefers to feed in fresh water marshes where it eats aquatic invertebrates, insects, earthworms, small fish, and small vertebrates.

In general, the White-faced ibis is threatened by loss of wetland habitat and organochlorine pesticide contamination. The NMNHP (1994) states that the wetland areas on Holloman AFB should be preserved to support the White-faced ibis during its southward and northward migration. The NMNHP reported sighting the White-faced ibis in April (62 birds) and August (27 birds) of 1994. Closure of Ponds A through F is not expected to adversely affect the White-faced ibis population since they provide little in the way of forage and they provide no cover. Dredging Pond G could temporarily adversely affect the migrant birds since jurisdictional wetlands are associated with this lagoon and it contains some small minnows (mosquito fish) for forage. The development of additional wetlands west of Pond G could result in additional habitat for the ibis population, as well as help to maintain water levels in Lakes Holloman and Stinky. Without additional evaporative surface to replace that lost by closing some or all of the lagoons, the increased water levels in the lakes may adversely affect these birds.

2.2.1.14 Whooping Crane

The whooping crane (*Grus americana*) is listed federally and by the State as endangered. The whooping crane was once very close to extinction and is now making a comeback, thanks to conservation efforts over the last few decades. The whooping crane winters in New Mexico (USFWS, 1995).

At 5 ft tall, the whooping crane is the tallest bird in North America, and has a long, sinuous neck and long legs. It has snowy-white body feathers accented by jet-black wingtips and a red and black head with a long, pointed beak. The wings measure about 7 ft across. Whooping cranes fly with slow wingbeats and with the necks and legs fully extended (USFWS, 1995).

Whooping cranes breed in northern freshwater bogs of Wood Buffalo National Park on the Alberta-Mackenzie border, and winter on the Gulf Coast at Aransas National Wildlife Refuge. Fall migration begins in September, and whooping cranes normally migrate in small flocks of fewer than 10. They arrive at Aransas National Wildlife Refuge in Texas between late October and mid-November, where they spend about six months. In April, the birds make the 2600-mile trip back to Wood Buffalo National Park in Canada (USFWS, 1995). A second flock was recently introduced, and they breed at Gray Lake National Wildlife Refuge in Idaho and winter at Bosque del Apache National Wildlife Refuge in New Mexico (Audubon, 1993).

Whooping cranes nest in marshy areas among bulrushes, cattails, and sedges that provide protection from predators as well as food. Their diet consists of insects, minnows, crabs, clams, crayfish, frogs, rodents, small birds, and berries.

This population is making a recovery; however, several factors contribute to their fragility as a species. Many cranes have died from collisions with power lines, and some have died from avian tuberculosis, avian cholera, and lead poisoning. Owing to their long migration route, whooping cranes are also vulnerable to natural disasters such as hail storms or drought. The whooping crane's delayed breeding maturity and small clutch size make the population as a whole less capable of rebounding from these threats (USFWS, 1995).

Whooping cranes were not included in the NMNHP (1994) for Holloman AFB. They have some potential for occurring in the winter since they winter in New Mexico. However, the whooping crane has not been sighted in the project area. The sewage lagoons are not expected to provide adequate forage for the whooping cranes. Ponds A through F do not have fish; Pond G and the lakes have only small minnow populations. Migrating cranes may be able to forage on small birds, rodents, and insects in the sewage lagoons and lake area; however, it is suspected that these sources would not be adequate to support a wintering population. Therefore, closure of Ponds A through F and/or dredging Pond G is not expected to adversely affect the whooping crane population over the long term. The construction of 120 additional acres of wetland habitat west of Pond G may increase their habitat area, but it is unknown whether it would increase their forage requirements (minnows, crabs, clams, crayfish, frogs and berries) substantially.

2.2.2 Mammals

2.2.2.1 Greater Western Mastiff Bat

The greater western mastiff bat (*Eumops perotis*) is listed as a Category 2 species by the USFWS. It is the largest of all bats in the United States at 5.5 to 7.5 in. long. This bat is sparsely furred over a dark gray or brownish gray body with a white base. Large ears protrude over the forehead and nearly conceal the eyes (Audubon, 1989; Barbour and Davis, 1969).

The greater western mastiff bat ranges from San Francisco Bay across southern California, southern Nevada, southern Arizona, extreme southwestern New Mexico, and into the Big Bend region of Texas. During the day, bats form small colonies of fewer than 100 bats. Their preferred habitat are rocky cliffs, canyons, and buildings. Day roosts are as common in buildings as in natural crevices. Because these bats are quite large with long wings, they require considerable space to launch into flight (at least 10 ft of vertical drop). Roosting sites generally have moderately large openings that could be entered from above or below. This bat is most active in the early morning and late afternoon. The bats usually leave the roost after sunset to forage over water on aquatic insects (Audubon, 1989; Barbour and Davis, 1969).

The greater western mastiff bat is unlikely to occur in the project area and the range of this bat does not include the project area. Closure of Ponds A through F may represent a loss of forage to the bat population; however, the addition of wetlands to the west of Pond G would serve to replace this food source once the wetlands are established. Dredging Pond G is not expected to have a long-term adverse effect. The lakes provide a large amount of insect life and should be protected. The loss of grassland from the development of additional wetlands is not expected to adversely affect the bat population.

2.2.2.2 New Mexico Jumping Mouse

The New Mexico jumping mouse (*Zapus hudsonius luteus*) is listed as a Category 1 species by the USFWS, and it is listed by the State as threatened. It is a small (203 to 239 mm body length) mouse with elongated hind legs, a long tail (123 to 144 mm length) and is not heavily haired.

This species occurs in New Mexico and Arizona. In New Mexico, it occurs in the Rio Grande Valley and the Sacramento, Sangre de Cristo, and Jemez Mountains. The Sacramento Mountains are adjacent to Holloman AFB and individuals have been caught there.

These mice prefer habitats close to permanent, free-flowing water with diverse vegetative cover and close proximity to higher, dry ground that provides nesting and hibernation sites. They hibernate in burrows, but it is not known if they are located just above the high water mark of streams or marshes or in more upland, drier sites. They are generally associated with riparian habitats and wet meadows associated with a major waterway.

Breeding times vary depending on climate. Some of these populations are only active four to five months, produce one litter, and hibernate the rest of the year, while other populations produce two litters and may not hibernate at all. Jumping mice are active after dark and are herbivorous, foraging along stream and pond banks. Garter snakes and weasels are the main predators of these mice.

Loss of habitat with permanent running water and diverse vegetative cover is a threat to the jumping mouse in New Mexico. Destruction of habitat by grazing and urbanization are continuing threats. The Endangered Species Management Action Plan recommends that suitable habitat be preserved. It states that it is unlikely that the jumping mouse occurs on Holloman AFB and that research should be conducted to verify this. Although the ditch provides suitable habitat, this species has a low potential of occurring in the project area since the project area is an isolated pocket of habitat, and the jumping mouse requires long corridors of habitat leading to open water. The proposed action and alternative action number 2 are not expected to adversely affect the jumping mouse population since they are not suspected of occurring in the project area.

2.2.2.3 Occult Little Brown Bat

The occult little brown bat (*Myotis lucifugus occultus*) is a federal Category 2 Notice-of-Review species for listing as endangered or threatened. It is a small, brown bat, about 2 inches long from the nose to base of tail, and weighs between 5 and 14 grams (less than one-half ounce).

This subspecies of bat is limited to southern California, most of Arizona, western and central New Mexico, the very western tip of Texas, and along central Mexico. Bats are generally found in habitats with a nearby water source. They prefer to forage in the evenings over water where there is an abundance of aquatic insects. In southern New Mexico, on Holloman AFB, this bat may occur in areas of mixed shrub association or wetland type habitat. Day and night roosting sites include buildings, trees, under rocks, in wood piles, and occasionally in caves. The occult little brown bat is active from early spring around March until October or November and hibernates the rest of the time.

Predators include house cats, birds, mice and snakes. Populations sizes are limited by availability of roosts more than by food supply. Exposure to pesticides either directly, or indirectly (e.g., ingestion of contaminated insects), causes mortality in bats. Direct poisoning of bats by humans is also a threat. The Endangered Species Management Action Plan states that it is unknown if this bat occurs locally, and no specific management strategy exists. It recommends that the public be educated on the benefits of bats eating garden or crop pest insects and that occupied hibernation locations be located and protected from human disturbance. The occult little brown bat has a moderate to high potential of occurring in the project area. Closure of Ponds A through F may represent a significant loss of forage to the bat population; however, the addition of wetlands to the west of Pond G would serve to replace this food source once the wetlands are established. The lakes provide a large amount of insect life and should be protected. Dredging Pond G and the loss of grassland due to the development of additional wetlands is not expected to adversely affect the bat population over the long term.

2.2.2.4 Small Footed Bat

The small footed bat (Myotis ciliolabrum) is listed as Category 2 species by the USFWS and occurs from West Texas into New Mexico. In the winter, this bat hibernates in caves and sinkholes, and in the summer is found in rocky habitats. The small footed bat is 77 millimeters (about 3 inches) long with a golden brown dorsal color, and a pointed tragus, small feet, and blackish ears (Barbour, 1969).

This species has been sighted at other areas on the Base and, therefore, has a high potential for occurring at the sewage lagoons and lakes. Closure of Ponds A through F may represent a loss of forage; however, with the addition of 120 acres of wetlands to the west of Pond G, potential food sources for this species (insects) will be available to replace that lost when the sewage lagoons are closed. Dredging Pond G and the loss of upland grassland habitat where the wetlands will be constructed will not negatively affect the species over the long term.

2.2.2.5 Swift Fox

The swift fox (*Vulpes velox*) is listed as a Category 2 species by the USFWS. This species occurs from south Alberta, Saskatchewan and Manitoba, south through Montana into New Mexico (Audubon 1989).

The swift fox is 23 to 31 inches long, buff yellowish above and whitish below. The tail is black-tipped with a black spot at the base. The feet are light-colored with tracks similar to the gray fox and the ears are large and triangular with dark spots below.

This fox prefers shortgrass prairies and arid habitats. Dens are underground with three to

four entrances 8 inches wide. This species mates in January and February, usually for life, with the young born in March and April. (Audubon 1989). Their diet consists of mammals (49%), followed by insects (27%), and birds (6%), particularly, prairie dogs, grasshoppers, and beetles. The swift fox is mostly nocturnal and can run up to 25 miles per hour for short distances. (Audubon, 1989).

The swift fox population is declining as a result of loss of natural prairie habitat, predator and rodent control programs, and excessive hunting and trapping. The swift fox has a moderate to high potential of occurring since it prefers shortgrass prairie habitats and can find forage around the wetlands. Closing Ponds A through F and/or dredging Pond G is not expected to negatively affect the swift fox population since they do not rely on these systems for food or cover. The addition of wetlands would be a positive effect since this may increase foraging areas for the fox.

2.2.3 Fish and Reptiles

2.2.3.1 Texas Horned Lizard

The Texas horned lizard (*Phrynosoma cornutum*) is listed as a Category 2 species by the USFWS; however, it may be delisted in the future since it appears to be widespread and common throughout its range. Horned lizards have broad and flattened bodies and short tails. Their pointed, modified scales are often very long and sharp, and thus give them their descriptive name.

The species occurs in shortgrass prairie, mesquite-grasslands, shrublands (catclaw/tobosa, mesquite-huisache-blackrush), desert scrub, and desert grasslands. Typical grasslands are interspersed with cacti, yucca, mesquite and other assorted woody shrubs and small trees. In New Mexico, soils vary from sandy-loams of alluvial fans, playas, and playa-lakes, to coarse gravels, conglomerates and desert pavements of bajadas and mesa tops. The lizard often buries itself when waiting for prey or resting, and therefore requires some loose soil.

Horned lizards may be active from late March to around October or November. During the winter months, they hibernate about 6 to 12 inches below the soil surface. Ants may comprise up to 69% of their diet. They also eat beetles, grasshoppers, and other small insects. They obtain water from food and by licking wet rocks or water from their own backs.

Predators in New Mexico include raptors, the loggerhead shrike, snakes, and predatory lizards. Other threats are pesticides, particularly those used to kill ants; however, this does not appear to be a problem at Holloman AFB. The Endangered Species Management Action Plan recommends that present habitat be preserved so as to limit major structural or chemical alterations. It states that a healthy population probably occurs on the Base and should be maintained. The Texas horned lizard has not been observed in the project area, but has a moderate potential for occurring here since it does not occur in other areas on the installation. Closing Ponds A through F and/or dredging Pond G will not affect the horned lizard population since they do not rely on this habitat. The loss of upland grassland habitat resulting from the construction of wetlands may present a loss of potential habitat for this lizard. However, the population of the Texas horned lizard on the installation is believed to be healthy, and the loss of this habitat should not present a threat to its continued survival on the Base.

2.2.3.2 White Sands Pupfish

The White Sands pupfish (*Cyprinodon tularosa*) is listed as a Category 2 species by the USFWS. Pupfish are short, deep-bodied fish that are stout anteriorly and more compressed posteriorly. The maximum standard length of the White Sands pupfish is typically 38mm (about 1.5 inches).

The White Sands pupfish is endemic to the endorheic Tularosa Basin of southern New Mexico and does not occur outside of a limited range in the basin. The current range is approximately 15 by 60 km (9 by 37 miles) portions of Lake Otero, Tularosa Basin. This species occurs in Salt Creek (Sierra County); in Malpais Spring and its associated outflow (Otero County); and in Mound Springs (Lincoln County). A fourth population occurs in about 5 km (3 miles) of Lost River and Malone Draw (Otero County), which is managed by Holloman AFB and White Sands National Monument. The pupfish is the only fish to naturally inhabit the closed Tularosa Basin.

This species inhabits fine mud-silt and sand-gravel bottoms of clear, shallow, strongly alkaline pools, springs, and streams in the Tularosa Valley. The springs are moderately brackish (about 4000 mg/L total dissolved solids, TDS), whereas Salt Creek is about 2000 to 27,000 mg/L and Lost River ranges from about 9,000 to greater than 100,000 mg/L. Pupfish feed on adult mosquitos and larvae, invertebrates, algae, and sometimes juvenile pupfish.

Threats to the pupfish include loss of water, pollution, habitat alteration, and the introduction of potential predators and competitors. On Holloman AFB, water loss in the Lost River habitat is the greatest threat. Potential predators and competitors include all fish and some amphibians. Mosquito fish have been reported to reduce or eradicate native pupfish in other habitats. The Endangered Species Management Action Plan recommends that water levels in the Lost River drainage be managed so that, even during drier weather, it remains habitable by the pupfish. It also recommends that the introduction of predator or competitor species be prevented. Pupfish do not occur in any of the sewage lagoons or lakes in the project area; therefore, closing Ponds A through F and/or dredging Pond G would not adversely affect this species over the long term. Although pupfish may be able to survive in the saline water of the lakes and ponds, the presence of mosquito fish, a known predator, would probably preclude their success in this habitat.

2.2.4 Plant Species

2.2.4.1 Grama Grass Cactus

The grama grass cactus (*Toumeya papyracanthus*) is a Federal Category (C2) candidate for listing and it is listed as a state endangered species in New Mexico. It is a small, cylindrical stem succulent. There is usually only one stem per plant; however, up to 12 stems have been observed. The cactus is characterized by its long upper central spines, which curve upward to form a tangled mass of papery spines which resemble a tuft of dried blue grama grass.

This cactus occurs in a wide range of grasslands, woodlands, and scrublands in Arizona and New Mexico. In New Mexico, it has been found in a wide north-south band following the Rio Grande drainage from the Colorado border on the north, to the Texas border on the south. It occurs in the north-central part of the state in sagebrush scrubland and pinyon-jupiter woodland, southward through sagebrush-juniper-grassland mix to mid-central New Mexico, and then southeastward through desert grassland and mesquite scrublands. It is found along the edge of the White Sands dunes complex in Southern New Mexico and terminates about a hundred yards across the Texas border. Two large populations have been located on Holloman AFB. One of these surrounds Lake Holloman and is reported to have 30+ individual plants.

The southern populations, such as those near the White Sands dunes complex and those on Holloman AFB, grow in grasslands and scrublands. They are found in soils derived from calcareous and/or gypsiferous sediments, including the slightly alkaline Yesum-Holloman sandy clay loam that is the major soil type on Holloman AFB.

They are very dependent on nurse plants, usually grasses, for protection and camouflage. The southern populations depend almost exclusively on senescent clumps of alkali sacaton (*Sporobolus airoides*).

Buds appear in March and April and flowering occurs from mid-April through early June. Fruit is set from May through the end of June and fruits continue to mature through July. It is believed that rodents may eat the fruit and spread undigested seeds in clumps of grass. The seedlings are dependent on grass cover to become established.

Grama grass cactus is widespread, but occurs in low densities and is rare. Declines in the species may be attributed mainly to habitat destruction due to over urbanization and overgrazing, as well as overcollection for commercial and ornamental uses. The recent location of new populations has led researchers to believe that the populations are probably more dense and extensive than previously recorded. The population located around Lake Holloman may be threatened by future development and planting of cottonwood trees to attract nesting birds. The Endangered Species Management Action Plan recommends that the two known populations on Holloman AFB be maintained and monitored so that loss of individual plants is minimized. Closing Ponds A through F and/or dredging Pond G would not be expected to affect this species over the long term. The addition of wetlands west of Pond G may result in a loss of grassland habitat for the cactus; however, the cactus has not been observed to be growing in this area. Therefore, the addition of wetlands should not affect the existing population of cactus.

2.2.4.2 Gypsum Scalebroom

The Gypsum Scalebroom (Lepidospartum burgessi) is listed as an endangered species in New Mexico, and as a Category 2 species by the USFWS. The gypsum scalebroom is a silvery-white shrub up to 70 cm (about 28 inches) tall, with stout stems and needle-like leaves. This shrub is highly branched with dense white matted feltlike hairs out of which protrude numerous small blisters filled with thick oily substances.

The gypsum scalebroom is very rare, but ranges from southern Otero County in New Mexico into Texas. Its preferred habitat is on small alkaline playas, gypseous ridges and flats.

Since the gypsum scalebroom is extremely rare, it is susceptible to local extirpation due to the destruction of its habitat. The gypsum scalebroom has a moderate potential of occurring in the project area; however, a survey to determine its occurrence will be conducted. Closing Ponds A through F and/or dredging Pond G is not expected to affect the playas as long as overflow is controlled in the lakes. Overflow from Lake Holloman into Lake Stinky could flood the alkaline playas and adversely affect the Gypsum Scalebroom habitat, if not controlled.

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Section 3
DISCUSSION

This section briefly reviews the risk assessment results for the sewage lagoons and the lakes, and discusses usage of this ecosystem by waterfowl and the potential effects of the proposed and alternative actions.

3.1 Previous Risk Assessment Results

It has been determined that although the sewage lagoons provide minimal forage, they contain constituents that may present unacceptable risk to wildlife in the area. In 1993, an ecological risk assessment was conducted for the sewage lagoons and lakes (Radian, 1993). In this assessment, it was estimated that there could be a potential for unacceptable risk to fish in each of the sewage lagoons, with the exception of Pond F, and a potential risk to birds in Pond E (although the risk assessment analyzed effects on fish, they are not present in Ponds A through F). Owing to uncertainties identified in the analytical data, the ecological risk assessment was completely revised and an addendum to the 1993 risk assessment was conducted for Pond G, the ditch, and the lakes (Radian and Foster Wheeler, 1996). The addendum uses the supportable data from the 1993 report, as well as new data collected in 1994.

According to the risk assessment addendum for Pond G, the ditch, and the lakes, risk resulting from modeling contaminants through the food chain was acceptable (the ecological quotient was <1.0) in the indicator species (mallards, killdeer, and mergansers). However, body-burden analyses of tissues from black-necked stilts and mallards indicated a low potential for adverse effects due to the presence of 4,4-DDE in Pond G, the ditch and Lakes Holloman and Stinky. The ecological quotients for young of year's avian species were less than 8 for DDE in the mallard and stilt body-burden tissue. In response to concerns raised by the USFWS during the Holloman AFB Sewage Lagoons Stakeholder Closure Meeting on April 3, 1996, a literature search was conducted to determine whether these tissue levels would be likely to result in reproductive effects (i.e., egg shell thinning) (Foster Wheeler, 1996). The literature search indicated that "waterfowl carcass concentrations similar to those reported for Holloman AFB would not be expected to be related to, nor cause, concentrations in eggs that could be considered detrimental to reproductive success."

None of the risk estimates calculated on the basis of ingestion of mosquito fish were unacceptable for Pond G, the ditch, or the lakes. Because the results from modeling did not show risk, it is possible that the DDE present in the tissue was from another source. The global widespread use of DDT, combined with its persistence in the environment, has resulted in DDT and its metabolites becoming virtually ubiquitous in the environment.

Note that DDT is no longer used at the Base. The concentrations of DDT and its derivatives DDD and DDE in the sewage lagoons decreased by an order of magnitude between 1992 and 1994, as documented in the *Site Characterization Report* (Radian and Foster Wheeler, 1995). Thus, even though the ecological risk assessment indicated that there may be potential risk from these constituents, the concentrations of these constituents appear to have already decreased to a level that does not threaten the survivorship or productivity of aquatic food chains in the sewage lagoons and lakes.

On the basis of the risk assessment results alone, there is no need to remediate Pond G. The only contaminant causing unacceptable risk was DDE, which is naturally attenuating.

However, any unacceptable risk, no matter how small, should be weighed and considered with potential alternatives. It is in the best interest of the species present to provide the healthiest environment possible. Ponds A through F, which are not classified as wetland areas and are not critical habitat to the species present, were not evaluated in the addendum, but do contain most of the same constituents as Pond G. In addition, PCBs were detected in Ponds A and B. Because of this, it would be appropriate to close these sewage lagoons and shift the bird populations to Pond G and the lakes, as well as to potential constructed wetlands. Since the Base is required to close the sewage lagoons under FFCA, alternatives for closure have been suggested and are discussed in the following section.

3.2 Usage Patterns and Potential Effects of Closing the Sewage Lagoons

The objective of this document is to assess whether the loss of the sewage lagoons and the construction of wetlands at Holloman AFB would constitute a loss of sensitive habitat to selected animal species and, in turn, adversely affect their populations. Lake Holloman and, to a lesser extent, Lake Stinky, have been discussed in detail in several documents, including a limnology study (Weigmann and Hayes, 1981) and a thesis dissertation (Dahl, 1991). For further discussion of the aquatic characteristics and foraging behavior of migrating birds at Lake Holloman, the reader is referred to these references.

For wetland birds migrating through south-central New Mexico, Lake Holloman provides a major permanent body of water that has a high productivity, primarily consisting of zooplankton and phytoplankton (Weigmann and Hayes, 1981). In the diurnal foraging behavior study, it was determined that if northern shovelers feed on both zooplankton, as well as phytoplankton, productivity at Lake Holloman may be sufficient to support these birds. In the same study, it was concluded that ruddy ducks and coots were probably not using Lake Holloman as a primary foraging ground, but that they must go elsewhere for food (it was also reported that variation in lagoon surface area, shoreline development, and percent basin slope had little effect on duck use). On the basis of this study and on observations of the use of the sewage lagoons and lakes by ducks, it would appear that ducks may be more affected by the loss of the sewage lagoons than other species present in the ecosystem. However, alterations in water levels that decrease shorelines may affect species that forage along the edges of the lakes.

The closure of Ponds A through F would result in the loss of approximately 60 acres of aquatic habitat. West of Pond G, 120 acres of wetland habitat will be constructed as part of the new WWTP. The wetland areas would be contoured to provide a variety of depths (an average depth of 6 in.) with small islands to allow for a diversity of vegetation (USAF, 1995). Discharge would be regulated by a series of control structures. Constructed wetlands would help to alleviate the loss of evaporative surface that will result when the sewage lagoons are closed. Evaporative surface is needed to prevent overflow in Lake Holloman from flooding U.S. Highway 70 and areas south of the highway, including lands administered by the Department of the Interior.

This ecosystem is unique and the dynamics are very complex. If Ponds A through F were closed and wetlands were not constructed, water flow to the lakes would be increased to the point that the lake morphologies would be altered (the proportion of different water depths would be changed) and bird species requiring relatively narrow ranges of water depths for feeding and nesting may be displaced. Therefore, it is in the best interest of the species to maintain the conditions that currently exist. Alterations in lake morphology and in water quality would probably result in a shift in the types of species present in the area. Although this is not clearly an adverse

effect, it may result in the loss of certain species such as the snowy plover, which rely on the lower water levels and shoreline habitat at Lake Stinky. The addition of wetlands would help to maintain water levels at their current locations and would provide additional habitat for existing species, as well as potentially provide habitat for new species.

The ditch, which carries storm water runoff from the Base and treated water from the WWTP to Pond G, would be incorporated into constructed wetlands. The portion of the ditch west of Pond G, which previously diverted water out of jurisdictional wetlands, would be blocked off. The portion of the ditch that currently enters Lake Holloman will remain intact, but will carry water from the constructed wetlands to Lake Holloman instead of from Pond G to Lake Holloman.

The ditch provides riparian habitat surrounded by tamarisk thickets that provide the type of habitat used by southwestern willow flycatchers. Because this riparian habitat is unique to the area, it is important to preserve the southern portion of the ditch. This area will be enhanced with native species, such as cottonwood and willows, if possible, to provide additional habitat for songbirds. Tamarisk will not be planted, since it is not native to the area and has a very high rate of evapotranspiration.

Finally, with the construction of wetlands, upland grassland habitat will be converted to wetland habitat. The grassland in the area between Pond G and Lake Holloman is of poor quality. The soil tends to be highly saline, plants are sparse, and it is not considered sensitive habitat. There are approximately 45,000 acres of grassland habitat on the installation; therefore, the loss of 106 acres of grassland is not expected to adversely affect grassland species. Fourteen of the 120 acres is currently jurisdictional wetland.

3.2.1 Effects of the Proposed Action

Dewatering the sludge and backfilling Ponds A through F would result in a loss of approximately 60 acres of aquatic habitat. Under the proposed action, 120 acres of wetland habitat will be developed west of Pond G. Approximately 14.3 acres of jurisdictional wetlands currently exist in this upland grassland habitat. As mentioned previously, without the construction of new wetlands to help alleviate the loss of evaporative surface that will result when the sewage lagoons are closed, Lake Holloman would overflow into and potentially flood the area south of Lake Holloman (U.S. Highway 70, Lake Stinky and lands administered by the Department of Interior).

Because Pond G comprises nearly 40 acres of aquatic habitat and provides water to adjacent wetland areas that should be protected, it would be beneficial to the bird species present to leave this lagoon open. Pond G is more protected than Lake Holloman and the shoreline is generally more vegetated. In addition, it has deeper water year round than the wetlands will have. The shoreline habitat offered by Pond G is important since Lake Holloman, when full, does not provide a lot of shallow shoreline habitat owing to its steep banks. Under this alternative, the water level in Lake Holloman could be lowered to allow for more vegetation within the lake and increased shoreline habitat around the lake.

Overflow from Lake Holloman to Lake Stinky would be allowed to occur in late winter. This limited overflow can be beneficial by providing or maintaining foraging areas for shorebirds (Parsons Engineering Science, Inc., 1995). Because of the nature of playa soils, thin layers of fine-grained silty, clayey, sandy sediments, water infiltration is slow and standing water can remain for relatively long periods of time. If overflow to Lake Stinky were to occur on a regular basis, as might happen if wetlands were not constructed or if overflow from Lake Holloman were not controlled, it could result in an

elimination of snowy plover nesting sites and possibly an overall change in the biota that utilize the playa.

The development of 120 acres of wetland habitat could also be beneficial to shallow-water birds if shorelines were adequately developed and plant species were planted to help propagate the wetland. Under this action, the portion of the drainage ditch directly connected to the southern end of Pond G that is jurisdictional wetland will be incorporated into the new wetlands. The southern portion of the ditch would enter Lake Holloman where it currently does.

3.2.2 Effects of Alternative Action Number 1: No Action

Under this alternative, the sewage lagoons would be allowed to dry up and the sludge would remain exposed to the environment. This alternative is not considered to be acceptable because of possible exposure to disease vectors from the sewage sludge. It is carried forward in this analysis for comparison purposes.

Leaving the dried sludge open to the environment could expose wildlife to contamination (for instance, low concentrations of PCBs are known to be present in Ponds A and B). Ecological risks to the contaminants in Ponds A through F were not evaluated; however, owing to the presence of contamination, even at low levels, it would be beneficial to cover the lagoons, as discussed in the proposed action and alternative action number 2.

3.2.3 Effects of Alternative Action Number 2: Dewater and Backfill Ponds A through F, Dredge Pond G, and Construct 120 Acres of New Wetlands

Potential effects resulting from this alternative are identical to the proposed action with the exception of those incurred from dredging Pond G. Under this alternative, the sludge in Pond G would be dredged and placed in one of the upper lagoons, which would then be covered with clean soil.

Dredging Pond G would result in the removal of plants and animals (invertebrates) living in the sediments, as well as associated nutrients. Plant and invertebrate populations inhabiting Pond G would have to be reestablished, and it is unknown how long it would take for the lagoon to return to suitable avian habitat. This action is expected to have temporary adverse effects on the wildlife utilizing this lagoon for forage or cover. In addition, there are jurisdictional wetlands associated with Pond G that would be damaged by the dredging activity. Any such activities must comply with Section 404 of the Clean Water Act.

In the risk assessment, modeled results for Pond G did not result in unacceptable risk to waterfowl. However, body-burden analysis of tissue from black-necked stilts did indicate that marginal (ecological quotient <8.0) adverse effects may occur from DDE concentrations. As discussed in Section 3.1, further literature review of the effects of DDE indicated that the concentrations detected at Pond G would not result in reproductive failure, which is a critical effect of DDE exposure. In addition, it is suspected that the birds were exposed to DDE in the upper lagoons, not just in Pond G. Therefore, on the basis of modeling results and literature review, the removal of sludge from Pond G does not appear to be necessary, particularly since the level of DDE has already decreased an order of magnitude between 1992 and 1994.

Section 4
CONCLUSIONS

In conclusion, 21 animal and 2 plant species were selected to determine whether the proposed action at Holloman AFB would result in the loss of sensitive habitat for endangered, threatened, and sensitive species. Of the 23 species assessed, only 8 have actually been sighted in the project area (refer to Tables 2-1 and 2-2); 3 of these occur as migrants. The remaining 15 species were assessed since they are either listed or are candidates for listing, or because the project area may provide the proper habitat or forage for the species (5 of these 15 occur at other areas on the installation; refer to Tables 2-1 and 2-2). Table 4-1 summarizes species occurrence and potential effects of the proposed and alternative actions. By focusing on endangered, threatened, and sensitive species, the evaluation in this report should be conservative and result in the protection of the ecosystem as a whole.

Holloman AFB is obligated to close the sewage lagoons under the FFCA. Therefore, the no action alternative was carried forward for comparison purposes only. The loss of Ponds A through F does not constitute the loss of sensitive habitat. Ponds A through F do not provide significant forage or cover and they are not capable of supporting fish life. In addition, Ponds D and E are constructed well above grade, and as they currently exist, require a significant amount of maintenance. The closure of Ponds A through F and the construction of new wetlands west of Pond G would be beneficial to the ecosystem as a whole.

On the basis of the results of the risk assessment, contaminants in Pond G are not causing unacceptable risk to human or ecological receptors. However, ducks may have increased levels of DDE in their tissues, either as a result of foraging in the lagoons and lakes or because DDT and its breakdown products, DDE and DDD, have become a common contaminant in the ecosystem as a whole. Because constituents are present in the lagoons, albeit at low levels, it would be optimal to close Ponds A through F and construct wetlands west of Pond G to replace surface water that would be lost. It is very important to note that Pond G, an impounded playa, is a larger and more ecologically valuable lagoon and thus should remain open. Pond G provides sensitive habitat to some of the bird species and also supports associated wetlands. The Mesilla Valley Audubon Society has lobbied to keep this lagoon open. Although the sludge in Pond G contains constituents at low levels, a risk assessment has determined that the risk is not unacceptable. Dredging Pond G would result in the removal of the low concentrations of constituents in the sludge, however; it would also temporarily destroy the plant and animal life in the lagoon and associated wetlands.

The species observed in the project area do not depend heavily on Ponds A through F for forage or cover. However, without the development of additional water bodies to replace these sewage lagoons, species abundance may decrease with the loss of forage. In addition, the loss of evaporative surface would result in increased water levels in the lakes and decreased shoreline areas. Under the proposed action, Holloman AFB plans to construct at least 120 acres of wetland habitat west of Pond G to compensate for this loss. The additional wetlands would provide a cleaner, healthier aquatic system and would result in increased forage and cover.

The development of wetlands will result in a loss of upland grassland habitat, which may affect the species identified as using this habitat. However, 120 acres is not considered significant, and the benefits derived from the additional wetlands should outweigh the loss of the grass-

Table 4-1
Species Occurrence and Potential Effects of the Proposed and Alternative Actions

Species	Occurrence in New Mexico	Occurrence at Holloman AFB Sewage Lagoons	Proposed Action: Close Ponds A-F and Construct Wetlands[1]	Alternative Action: Close Ponds A-F, Dredge Pond G and Construct Wetlands[1]	Alternative Action: No Action (Allow Ponds A-F to dry out, leave Pond G and construct wetlands)[1,2]
Northern Aplomado Falcon	One sighting in 1952 near Deming, NM; One sighting in 1994 near Tularosa, NM.	Low to moderate potential since forage is present.	No adverse effect [3]	Potential adverse effect [3,4]	Potential adverse effect
Bald Eagle	May be present in areas where there is open water and large dead trees for roosting.	Moderate potential since forage is present.	No adverse effect [3,5]	Potential adverse effect [3,5]	Potential adverse effect
Baird's Sparrow	Occurs as a migrant and possibly as a wintering bird. Most records are from fall migration.	Low potential of occurring since this bird may migrate through the area; however, it prefers areas of dense vegetation of medium to tall height.	No adverse effect [5]	No adverse effect [5]	Potential adverse effect
Burrowing Owl	Breeds from Canada's southern prairie provinces south to southern California and Texas. Winters in southwestern states.	Moderate potential of occurring since grassland habitat is present and the owl has been sighted on Base <1 mi. away .	No adverse effect [5]	No adverse effect [5]	Potential adverse effect

Table 4-1
(Continued)

Species	Occurrence in New Mexico	Occurrence at Holloman AFB Sewage Lagoons	Proposed Action: Close Ponds A-F and Construct Wetlands; Pond G Left Open[1]	Alternate Action: Close Ponds A-F, Dredge Pond G and construct wetlands[1]	Alternate Action: No Action (Allow Ponds A-F to dry out, leave Pond G and construct wetlands)[1,2]
Ferruginous Hawk	Sighted casually throughout the year in Otero County.	Moderate to high potential of occurring as migrants.	No adverse effect [5]	No adverse effect [5]	Potential adverse effect
Interior Least Tern	Breeds near Bitter Lakes N.W.R. on the Pecos River in NM. It is a rare vagrant at the Holloman lakes.	Low to moderate potential of occurring at the lakes during migration since wetland habitat is available.	Positive effect [3]	Potential adverse effect [3,4]	Potential adverse effect
Loggerhead Shrike	Population is stable in NM, though declining elsewhere.	High potential of occurring since habitat and food source is available.	No adverse effect [5]	No adverse effect [5]	Potential adverse effect
Neotropic Cormorant	Breeds and is a variable resident in southern NM.	Low potential of occurring; may occur as a vagrant.	Positive effect [3]	Positive effect [3]	Potential adverse effect
Northern Goshawk	Breeds in southern NM.	Low potential of occurring since suitable nesting habitat is not present.	No adverse effect [5]	No adverse effect [5]	Potential adverse effect

Table 4-1
(Continued)

Species	Occurrence in New Mexico	Occurrence at Holloman AFB Sewage Lagoons	Proposed Action: Close Ponds A-F and construct wetlands; Pond G left open[1]	Alternate Action: Close Ponds A-F, Dredge Pond G and construct wetlands[1]	Alternate Action: No Action (Allow Ponds A-F to dry out, leave Pond G and construct wetlands)[1,2]
Peregrine Falcon	Migrant and wintering peregrines use low elevation wetland habitats, especially where there are shorebirds and waterfowl.	High potential of occurring; has been sighted.	Positive effect [3]	Potential adverse effect [3,4]	Potential adverse effect
Southwestern Willow Flycatcher	Occurs throughout the southwest as a migrant and/or nester.	Low potential of occurring since potentially suitable habitat (tamarisk thickets) is present.	Positive effect [3]	Positive effect [3]	Potential adverse effect
Western Snowy Plover	Breeds in NM, including Holloman AFB.	High probability of occurring; has been sighted.	Positive effect [3]	Positive effect [3]	Potential adverse effect
Whooping Crane	Winter in Bosque del Apache National Wildlife Refuge, NM.	Low potential of occurring because of close proximity of wintering grounds.	Positive effect [3]	Positive effect [3]	Potential adverse effect

Table 4-1
(Continued)

Species	Occurrence in New Mexico	Occurrence at Holloman AFB Sewage Lagoons	Proposed Action: Close Ponds A-F and construct wetlands; Pond G left open[1]	Alternate Action: Close Ponds A-F, Dredge Pond G and construct wetlands[1]	Alternate Action: No Action (Allow Ponds A-F to dry out, leave Pond G and construct wetlands)[1,2]
White-Faced Ibis	Isolated breeding colonies occur in NM and it occurs statewide during migration and in wetland habitats. It is a regular migrant in the spring and fall at the Holloman Lakes.	High potential of occurring; has been sighted.	Positive effect [3]	Potential adverse effect [3,4]	Potential adverse effect
MAMMALS					
Greater Western Mastiff Bat	Occurs in extreme southern NM.	Low potential of occurring because of the species range.	No adverse effect [3]	No adverse effect [3]	Potential adverse effect
New Mexico Jumping Mouse	Occurs in Rio Grande Valley and the Sacramento, Sangre de Cristo and Jemez mountains.	Low potential of occurring since the project area is an isolated strip of habitat.	No adverse effect	No adverse effect	Potential adverse effect
Occult Little Brown Bat	Occurs in western and central New Mexico.	Moderate to high potential of occurring since forage is available.	No adverse effect [3]	No adverse effect [3]	Potential adverse effect

Table 4-1
(Continued)

Species	Occurrence in New Mexico	Occurrence at Holloman AFB Sewage Lagoons	Proposed Action: Close Ponds A-F and construct wetlands; Pond G left open[1]	Alternate Action: Close Ponds A-F, Dredge Pond G and construct wetlands[1]	Alternate Action: No Action (Allow Ponds A-F to dry out, leave Pond G and construct wetlands)[1,2]
Small Footed Bat	Occurs from West Texas into New Mexico.	High potential of occurring since this bat is present at other areas on the Base.	No adverse effect [3]	No adverse effect [3]	Potential adverse effect
Swift Fox	Occurs in NM in shortgrass prairies, and arid habitat.	Moderate to high potential of occurring since forage is available.	Positive effect [3]	Positive effect [3]	Potential adverse effect
FISH AND REPTILES					
Texas Horned Lizard	Occurs in NM in shortgrass prairies, grasslands, and desert scrub.	Moderate potential of occurring since the species occur at other areas on the Base; however, soil type is not optimal.	No adverse effect [5]	No adverse effect [5]	Potential adverse effect
White-Sands Pupfish	Endemic to the Tularosa Basin and does not occur outside of a limited range in the basin.	Does not occur in project area.	No adverse effect	No adverse effect	No adverse effect

Table 4-1
(Continued)

Species	Occurrence in New Mexico	Occurrence at Holloman AFB Sewage Lagoons	Proposed Action: Close Ponds A-F and construct wetlands; Pond G left open[1]	Alternate Action: Close Ponds A-F, Dredge Pond G and construct wetlands[1]	Alternate Action: No Action (Allow Ponds A-F to dry out, leave Pond G and construct wetlands)[1,2]
PLANTS					
Grama Grass Cactus	Occurs in a wide north-south band in NM in grasslands, woodlands, and scrublands.	Occurs in project area.	No adverse effects [5]	No adverse effects [5]	No adverse effects
Gypsum Scalebroom Grass	Ranges from Southern Otero County, NM, into Texas.	Low potential of occurring near the Lake Stinky playas.	No adverse effects [5]	No adverse effects [2]	No adverse effects

NOTES

1 With the construction of wetlands west of Pond G, waterflow will be controlled so that current levels can be maintained in Pond G and the lakes.

2 Allowing Ponds A through F to dry out without providing a soil cover would expose sediment contamination to the atmosphere. The potential exists for wildlife in the area to come in direct or indirect (food chain) contact with these contaminants, leading to possible health risks.

3 The addition of wetlands west of Pond G is expected to have a positive effect on this species by increasing the available wetland and shoreline habitat that provides food (i.e., plants, insects, etc.) or cover for the species.

4 Dredging the sludge out of Pond G would result in the loss of vegetation and invertebrates throughout the lagoon. These populations would have to be reestablished over time and there would be a temporary loss of forage, presumably for at least a year, to some species in the area. Since Ponds A through F will be closed at the same time, this could result in inadequate forage for migratory, as well as resident species.

5 The loss of 120 acres of upland grassland between Pond G and Lake Holloman is not considered to be a significant loss. There are approximately 45,000 acres of upland grassland on the installation alone. In addition, the grassland between Pond G and Lake Holloman is of poor quality due to the high salinity of the soil and sparse vegetation.

lands that are abundant in the area. In addition, once the sewage lagoons are closed and backfilled, the land in that area will be returned to grassland habitat.

Therefore, it appears to be in the best interest of the species now present to close Ponds A through F, leave Pond G open without dredging, and to develop additional wetlands west of Pond G. The construction of 120 acres of wetlands would help to alleviate potential flooding; however, controlled overflow, which is beneficial to the environment, would still be allowed to occur.

Section 5
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APPENDIX A

11 Dec 1994

Brig. General John F Miller, Commander
49 FW/CC
490 First Street, Suite 1700
Holloman AFB, NM 88330-8277

Dear General Miller

We of the Mesilla Valley Audubon Society have read with interest your reply to Catherine Sandell's letter for the New Mexico Audubon Council. As the local Audubon Society that is most concerned with the Lake Holloman area, we would like to add a few comments.

We are in full support of the waste water treatment plant. Also we do not want to increase the likelihood of collisions between birds and aircraft. Finally, we believe that restoring the emergent wetland between Lagoon G and Lake Holloman offers many advantages over constructing evaporating ponds while we are aware of no real advantages presented by the evaporation ponds. Here are our reasons for favoring the emergent wetlands:

a. Restoring the wetlands should be much less expensive than constructing the evaporative ponds.

b. Evaporative ponds will require the distruction of over 300 acres of desert, an unnessary environmental scar.

c. The proposed wetlands are further from runways than the evaporative ponds, which should tend to lower the chances of collisions with birds.

d. Emergent wetlands are more efficient than open ponds both for evaporation and removal of excess nutrients. The water entering Lake Holloman from the wetland would be of a higher quality, except for some increase in salt, than water coming directly from the treatment plant.

e. Emergent wetlands represent a small fraction of the wetlands now present in the Lake Holloman area. Increasing the area occupied by emergent wetlands would increase the diversity of wildlife in this area.

We appreciate your willingness to keep us informed and to listen to our comments.

Sincerely

Gordon J Ewing,
MVAS Conservation Committee

The New Mexico Audubon Council
P.O. Box 3127
Las Cruces, NM 88003

21 Sept 1994

Brig. General John F. Miller, Commander
49 FW/CC
490 First Street, Suite 1700
Holloman Air Force Base, NM 88330-8277

Dear General Miller

Since Holloman Lake and the surrounding area comprise the most important wetland in South-Central New Mexico, the Audubon Societies of New Mexico are concerned about its preservation and improvement. We were very happy to hear that HAFB was planning to build a tertiary waste water treatment plant. We felt that improving the water quality at Lake Holloman and Stinky Playa (usually called Lake Stinky) would make the wetlands an even better habitat for shorebirds and waterfowl.

We understand that part of the construction plan calls for about 300 acres of lined evaporation ponds. We see this as a mostly unnecessary cost and a serious step backward for the wetland. The lagoon system at HAFB has about 300 acres of water surface where evaporation now occurs. This seems more than adequate for the system. During the last two years, Stinky Playa has been almost dry and Lake Holloman currently is only about half full. These two entities make up two thirds of the current 300 acres of evaporative surface. Both will be part of the new system so 200 new acres of evaporative ponds seems unnecessary.

We had hoped that Lagoon G would be preserved, although we were aware of the pollution problems in the sediment. This pond furnishes another 40 acres of evaporative surface. It is unlined and currently is heavily used by both shorebirds and waterfowl. Between Lagoon G and Lake Holloman, where a drain has been excavated, is a flat low area that was once an intermittent wetland. Just below Lagoon G, to the south and especially to the west, can be seen emergent wetlands that could be extended in a broad band all the way to Lake Holloman. The current drain would have to be refilled and possibly a low dyke constructed at the lower end to keep the water flowing into Lake Holloman instead of going directly into the Stinky Playa. This could add 50 to 100 acres of emergent wetland which is more efficient for water clean-up and evaporation that a pond of similar area. Nearly 300 acres of evaporative surface could be obtained without building a single evaporation pond. If Lagoon G can be saved over 300 acres are possible.

Fred Fisher says 95 acres!

We hope that it is not to late to consider this modification.

The Mesilla Valley Audubon Society because it is nearby will be happy to contribute volunteer help in any projects that could use hand labor. Salt Cedar removal is a possibility.

A more detailed statement of the things that we would like to see done in the Lake Holloman area is attached.

Sincerely

Catherine D. Sandell

Catherine Sandell
President, New Mexico Audubon Council

cc:
Brig. General Bryan G. Hawley, Langley AFB
Mr. Roy Barker, Langley AFB
Hildy Reiser, Holloman AFB
Clent Bailey, US Fish & Wildlife Service
Tom Wootten, Mesilla Valley Audubon Society

ATTACHMENT

Holloman Lake and the surrounding area is the most important wetland in Otero County. Historically this area was a natural wetland but in more recent years the wetlands have been extended and incorporated as the major portion of a series of lagoons used to treat and store waste water from Holloman Air Force Base. The main wetlands of the area (Lake Holloman an Stinky Playa) were managed by the Bureau of Land Management and in August of 1986 Mesilla Valley Audubon Society (MVAS) entered into a Cooperative Management Agreement with BLM and have kept records of sightings in the area since then.

Holloman Lake and the surrounding area is to be withdrawn for military purposes and will come under the management of Holloman AFB and Holloman AFB is about to start building a new waste water treatment plant. Gordon Ewing has had extensive discussions and correspondence with personnel from HAFB and with the US Fish and Wildlife Service to develop a well conceived plan to accommodate the needs of the treatment plant and wildlife. A plan was being developed which, we believe, has the support of the US F&WS and HAFB. Certainly it has the support of the base Environmental Department. MVAS has found much to support in the plan. We understand the HAFB is being required to move ahead with another plan for construction of the waste water treatment plant. This plan calls for the construction of 12 lined evaporative ponds (300 acres) and will eliminate Lagoon G and the possibility of restoring the wetlands in the area between Lagoon G and Holloman Lake. We are aware that Lagoon G has some contamination problems that would have to be addressed if it were saved, but that may be cheaper than building so many evaporative ponds. LATER CHANGED TO UNLINED

Though the MVAS is concerned about all forms of life in this area, we will primarily concern ourselves with birds in this letter. Birds live in the Lake Holloman complex during all seasons but it is most important as a refueling stop for some birds during migration and as a wintering area for others. Forty or fifty species can be seen in the area almost any day of the year. Over a thousand individuals of a single species can be seen (for example Wilson's Phalaropes in the late summer or Northern Shovelers in the winter). The sewage effluent is rich (to rich) in nutrients making the water very productive. Large numbers of waterfowl are supported there.

Three distinct types of wetland habitat can be identified in this area:

1. Saline Ponds - Lake Holloman and Lagoon G. Diving, dabbling and some wading birds inhabit these lakes. Lake Holloman is about half as salty as seawater.

2. Salt flats and beaches. Mostly found in the Stinky Playa along with the fringe of the two lakes. Inhabited mainly by shorebirds. The Snowy Plover, a candidate for listing as endangered, nests here in substantial numbers.

3. Emergent Wetlands. A small area below Lagoon G is the best example of this. A wide variety of birds are found here. These wetlands were much larger prior to the excavation of the drain between Lagoon G and Holloman Lake

We, who are members of various Audubon Societies, are concerned that all of these types of habitat be preserved and even enhanced with the construction of a new waste water treatment plant at HAFB. Here is a list of specific things that we hope can be accomplished.

A. Decrease the nutrient level in Lake Holloman and in Lagoon G (assuming that Lagoon G can be preserved). This would decrease the tendency for developing anaerobic conditions and lessen algal and bacterial blooms, and, by allowing sunlight to reach the bottom, would likely permit bottom dwelling plants to become established. The waste water treatment plant should assist greatly in achieving these conditions.

B. Keep the water levels in Lake Holloman and Lagoon G relatively stable at current spillway levels. With more or less continuous drainage, the salinity of the lakes will be kept relatively constant and low, and the tendency for anaerobic conditions will be decreased. Both "A" and "B" will provide better habitat for dabbling and diving waterbirds. Mosquito fish die-offs that now occur during the summer when the lakes go anaerobic would be mostly avoided. The loss of shorebird habitat that will result from the high water level will be more than made up in the Stinky Playa (see item C).

C. Some water should spill into Stinky Playa most of the time and the playa should be flooded annually at least to Highway 70. This active playa would provide much more habitat for shorebirds than the fringes of the two lakes. The playa will also collect the salt that would otherwise build up in Lake Holloman.

D. "Protected" areas should be available for ground-nesting birds. Snowy Plovers nest out on the playa salt flats and are relatively safe there. On the other hand, Avocets, Black-necked Stilts, Killdeers and several species of ducks nest along the shore where predators can easily destroy the nests. Evidence for this destruction can be seen by walking around Lake Holloman in the spring or early summer. To give some protection to these ground nesters, a large island could be created in Lake Holloman by cutting a channel at the neck

of one of the several peninsulas that extend out from the west shore of the lake.

E. Emergent Wetlands could be established in the natural drainage between Lagoon G and Holloman Lake. This area was once a wetland or at least an intermittent wetland and could be reestablished at relatively low cost. The drain that was excavated between the two lakes could easily be refilled and salt cedar eradication might be relatively inexpensive if conservation groups (such as MVAS) were called on to help. Probably over 50 acres of emergent wetlands could be reestablished. This would not only be utilized by wildlife, but the area would remove nutrients from the water as well as providing for substantial evaporation. Water from the waste water treatment plant might be piped to Lagoon G or, if G is to be eliminated, the pipe could open into the wetlands just below where Lagoon G now is located.

F. Try to replace salt cedars with cottonwoods and willows. In an experimental planting this spring, a few willow and cottonwood poles were planted. The trees all started well with green leaves evident well into June, but late planting coupled with the hottest summer on record seems to have killed all of the trees. Winter planting of cottonwood and willow poles should be tried again and with some cooperation from the weather the trees might be established. It should be noted that native cottonwoods grow in the dunes at White Sands National Monument only 4 or 5 miles west of Lake Holloman.

Most of these suggestions could be carried out at relatively low cost. The clean-up of Lagoon G and the removal of salt cedars are likely to be the most expensive. Lagoon G, the proposed wetland below it, Holloman Lake and Stinky Playa should yield at least 300 acres of evaporation surface which should mean that most of the proposed evaporation ponds need not be constructed. The money saved in not constructing some of the evaporation ponds should more than pay for the conservation work proposed above.

Exhibit 1

Conservation Committee
Mesilla Valley Audubon Society
PO Box 3127 UPB
Las Cruces, NM 88003

7 April 1993

Frederick M Fisher, PhD
49 CES/CEV
Holloman AFB, NM 88330-5000

Dear Dr Fisher

Here are some comments on the HAFB Fish & Wildlife Plan. We will repeat some statements from our letter of 24 December 1992, but they should be restated to have them all in one place.

We are, of course, pleased that Holloman Air Force Base is concerned about natural resource management. You should understand that, while we take exception to some of the points in the Plan, we support a lot of what is proposed in this Plan.

Some questions arise from reading the Plan. 1) Why do you want the population of coyotes to decrease? They are vital for managing the population of rodents. While they are undesirable on the runways and in the housing areas, they are an asset in all undeveloped areas. 2) A decrease in the population of mosquito fish is also mentioned. The only reason that we can see for decreasing the population of mosquito fish would be to increase the population of pupfish. This would necessitate a complete elimination of the mosquito fish and it is highly doubtful that this could be accomplished without serious damage to other forms of wildlife. Ignore the mosquito fish, just do not introduce it into areas where the pupfish now resides. 3) What is the purpose of the rubble island and the floating platforms? Are these primarily planned for nesting areas for birds? If so, some plans for vegetation growing on them should be considered.

Now some comments on the Tertiary Objectives (page 6). 1) Before spending the money necessary to build 5 miles of chain link fence, you should carefully consider its value. What is to stop the oryx from going around such a fence. Several years ago, the White Sands National Monument was building a fence west of White Sands. This seems to have accomplished nothing. The installation of water tanks may serve to increase the oryx population in the area and if the fence is ineffective, may actually increase the number of oryx on the base. 2) Clearing vegetation and replacing it with gravel around the flight lines will not eliminate

vegetation. We are afraid that herbicides will be used in the area which could be detrimental to wildlife and native plants both down-wind and down-stream from the flight lines. 3) The development planned around Lake Holloman is of concern. Increased use by people can be a serious strain on the plants and wildlife in the area. It makes no sense, for example, to put in artificial islands at the lake and then allow boating. If, as we assume, the purpose of the islands is to provide relatively isolated nesting and resting space for birds, these islands should be off limits for all people except scientific study groups (and they should be limited). Also, boating on a sewage pond has some serious health risks. We are bewildered by the bird feeding stations. What are they to accomplish? Most shore-birds and many species of waterfowl are not attracted to artificial feeding stations. Artificial feeding will attract seed eaters such as house sparrows that are not now common at Holloman Lake. The feeding of birds will probably have little effect on the number of birds near the flight lines. The most likely result will be an increase in overall population of grain eating birds and likely increase the number of these birds all through the area. One final note, a substantial outflow from Lake Holloman to Lake Stinky will be necessary to keep the salinity of Holloman Lake from increasing.

Management Issues. 1) The comment on the American Avocet should be extended to include shore-birds generally. The problem of safe nesting spots is a significant one, but a greater problem for shore-birds is the lack of habitat in Holloman Lake. Only the north end offers any appreciable shallow water for shore-birds to feed. Killdeers, "peeps", stilts, yellowlegs, dowitchers, snowy plovers, etc. are found on the fringe of Holloman Lake, but mostly they are found in Lake Stinky. This lake is now a playa whose fluctuating water level presents feeding areas for shore-birds most of the year. Lake Stinky should be preserved much as it now is. *
2) A management issue that is not mentioned is the possibility that cottonwoods or other native trees might grow around Lake Holloman. Native cottonwoods are found in near-by White Sands and also some appear to be growing around the upper lakes of the current system of sewage ponds. Some should be planted around Lake Holloman to see if they will grow and possibly displace some of the salt cedar. This makes more sense than trying to trim the salt cedars as proposed in the Plan.
3) The status of the tiger salamander should be investigated. Many dead salamanders were seen around the edge of Holloman Lake during the summer three or four years ago. This was likely a result of anaerobic conditions developing in the lake. The construction of a sewage disposal plant would probably decrease the amount of organic matter in the water at Holloman Lake so that anaerobic conditions would be unlikely.
4) The installation of a sewage disposal plant might clear

the water enough so that bottom growing plants could live in Lake Holloman. This would improve the habitat for many vertebrates that live at Lake Holloman.

Protected Species. The Plan states that "the only threatened species of vertebrae that occurs on Holloman AFB" is the White Sands pupfish but Attachment 1 lists 5 other species. Of these, the Snowy Plover, nests in the area and the Peregrine Falcon is seen fairly frequently in the area. The nests of the Snowy Plover (mostly around lake Stinky) should be given some special protection.

The American Ornithologists' Union, in its wisdom, not only assigns acceptable common names for birds, but it also changes them periodically and specifies the order in which they should be named. We have tried to update your bird list by putting in the latest common names, some additional birds we have seen at Lake Holloman have been added, and we have adjusted the sequence to conform with the AOU checklist. The list is as follows:

Pied-billed Grebe
Horned Grebe
Eared Grebe
Western Grebe
Clark's Grebe
American White Pelican
Double-crested Cormorant
Great Blue Heron
Snowy Egret
Little Blue Heron
Cattle Egret
Green-backed Heron
Black-crowned Night-Heron
White-faced Ibis
Snow Goose
Wood Duck
Green-winged Teal
Mallard
Mexican Duck
Northern Pintail
Blue-winged Teal
Cinnamon Teal
Northern Shoveler
Gadwall
American Wigeon
Canvasback
Redhead
Ring-necked Duck
Lesser Scaup
Bufflehead
Common Merganser
Red-breasted Merganser
Turkey Vulture

Osprey
•Bald Eagle
Northern Harrier
Sharp-shinned Hawk
Cooper's Hawk
•Northern Goshawk
Swainson's Hawk
Zone-tailed Hawk
Red-tailed Hawk
•Ferruginous Hawk
Golden Eagle
American Kestrel
•Aplomado Falcon
•Peregrine Falcon
American Coot
Sandhill Crane
•Whooping Crane
Black-bellied Plover
Lesser Golden Plover
•Snowy Plover (western)
Semipalmated Plover
Killdeer
•Mountain Plover
Black-necked Stilt
American Avocet
Greater Yellowlegs
Lesser Yellowlegs
Solitary Sandpiper
Willet
Spotted Sandpiper
Long-billed Curlew
Marbled Godwit
Ruddy Turnstone
Semipalmated Sandpiper
Western Sandpiper
Least Sandpiper
Baird's Sandpiper
Pectoral Sandpiper
Dunlin
Stilt Sandpiper
Short-billed Dowitcher
Long-billed Dowitcher
Common Snipe
Wilson's Phalarope
Red-necked Phalarope
Red Phalarope
Franklin's Gull
Little Gull
Bonaparte's Gull
Ring-billed Gull
Common Tern
Forster's Tern
• Least Tern (interior is endangered)
Black Tern

Mourning Dove
Greater Roadrunner
Barn Owl
Flammulated Owl
Great Horned Owl
Spotted Owl
Long-eared Owl
Lesser Nighthawk
White-throated Swift
Belted Kingfisher
Red-naped Sapsucker
Northern Flicker
Olive-sided Flycatcher
Western Wood-Pewee
Say's Phoebe
Ash-throated Flycatcher
Cassin's Kingbird
Western Kingbird
Horned Lark
Tree Swallow
Violet-green Swallow
Northern Rough-winged Swallow
Bank Swallow
Cliff Swallow
Barn Swallow
Chihuahuan Raven
Common Raven
Verdin
Bushtit
Cactus Wren
Rock Wren
Bewick's Wren
House Wren
Ruby-crowned Kinglet
Northern Mockingbird
Crissal Thrasher
American Pipit
Loggerhead Shrike
European Starling
Bell's Vireo
Solitary Vireo
Warbling Vireo
Orange-crowned Warbler
Nashville Warbler
Virginia's Warbler
Yellow-rumped Warbler
Northern Waterthrush
MacGillivray's Warbler
Common Yellowthroat
Wilson's Warbler
Painted Redstart
Western Tanager
Blue Grosbeak
Chipping Sparrow

Clay-colored Sparrow
Brewer's Sparrow
Lark Sparrow
Black-throated Sparrow
Sage Sparrow
Lark Bunting
Savannah Sparrow
Baird's Sparrow
Song Sparrow
Lincoln's Sparrow
Swamp Sparrow
White-crowned Sparrow
Dark-eyed Junco
Chestnut-collared Longspur
Red-winged Blackbird
Eastern Meadowlark
Western Meadowlark
Yellow-headed Blackbird
Brewer's Blackbird
Great-tailed Grackle
Brown-headed Cowbird
Northern (Bullock's) Oriole
Scott's Oriole
House Finch

We hope that these comments will be helpful to you in the formulation and execution of HAFB Fish & Wildlife Plan.

Sincerely

Gordon J. Ewing
Member MVAS Conservation Committee

Exhibit 2

Totals of Bird Species recoded at Holloman Lakes, 1994 by Month

Month: 4 (april 19-23) 1994

Ruddy Duck	581
Northern Shoveler	406
American Coot	335
American Avocet	271
Wilson's Phalarope	243
Mallard	158
Gadwall	111
Snowy Plover	95
Killdeer	73
Red-winged Blackbird	68
Least Sandpiper	63
White-faced Ibis	62
Blue-winged Teal	59
Eared Grebe	49
Western Sandpiper	39
Black-necked Stilt	34
Western Kingbird	30
American Pipit	29
Lark Sparrow	26
Western Meadowlark	24
Cinnamon Teal	22
Green-winged Teal	21
Pied-billed Grebe	18
Cliff Swallow	17
Eastern Meadowlark	16
Horned Lark	16
Forster's Tern	16
Savannah Sparrow	14
Yellow-rumped Warbler	14
Long-billed Dowitcher	12
Chihuahuan Raven	12
Yellow-headed Blackbird	12
Wilson's Warbler	12

Totals of Bird Species recoded at Holloman Lakes, 1994 by Month

Month: 5 (May 15-19) 1994

Ruddy Duck	480
Wilson's Phalarope	257
Mallard	250
American Avocet	241
Snowy Plover	182
Northern Shoveler	128
American Coot	109
Green-winged Teal	98
Red-winged Blackbird	96
Killdeer	91
Eared Grebe	83
Black-necked Stilt	81
Gadwall	60
Western Kingbird	57
Least Sandpiper	44
Spotted Sandpiper	32
Eastern Meadowlark	29
Cinnamon Teal	26
White-throated Swift	23
Western Sandpiper	15
Lark Sparrow	14
Yellow-rumped Warbler	11
Horned Lark	11
Brown-headed Cowbird	11
Northern Mockingbird	11

Totals of Bird Species recoded at Holloman Lakes, 1994 by Month

Month: 6 (June 4-8) 1994

Ruddy Duck	467
American Avocet	315
Mallard	281
Black-necked Stilt	166
Snowy Plover	131
Killdeer	94
Red-winged Blackbird	61
Wilson's Phalarope	43
Western Kingbird	42
Eastern Meadowlark	38
Northern Mockingbird	36
Great-tailed Grackle	36
Blue Grosbeak	27
Cinnamon Teal	22
Gadwall	21
Horned Lark	17
Eared Grebe	16
House Finch	16
Barn Swallow	14
Brown-headed Cowbird	11

Totals of Bird Species recoded at Holloman Lakes, 1994 by Month

Month: 7 (July 26-30) 1994

Wilson's Phalarope	972
American Avocet	505
Black-necked Stilt	442
Mallard	280
Ruddy Duck	216
Killdeer	173
Lesser Yellowlegs	159
Red-winged Blackbird	142
Western Sandpiper	96
Spotted Sandpiper	95
Baird's Sandpiper	79
Least Sandpiper	69
Western Kingbird	37
Great-tailed Grackle	29
Barn Swallow	26
Brown-headed Cowbird	25
Tree Swallow	25
Yellow-headed Blackbird	22
Stilt Sandpiper	19
Blue Grosbeak	18
Brewer's Blackbird	18
Gadwall	15
Chipping Sparrow	15
Lesser Nighthawk	14
Snowy Plover	13
Green Heron	13
Eastern Meadowlark	12

Totals of Bird Species recoded at Hollomen Lakes, 1994 by Month

Month: 8 (Aug 8-12) 1994

Wilson's Phalarope	2350
American Avocet	1067
Black-necked Stilt	794
Mallard	404
Killdeer	281
Lesser Yellowlegs	135
Ruddy Duck	121
Western Sandpiper	114
Spotted Sandpiper	100
Tree Swallow	99
Baird's Sandpiper	86
Least Sandpiper	76
Green-winged Teal	58
Western Kingbird	42
Barn Swallow	42
Long-billed Dowitcher	35
Long-billed Curlew	33
Chipping Sparrow	31
White-faced Ibis	27
Stilt Sandpiper	26
Forster's Tern	25
Gadwall	23
Snowy Plover	23
Greater Yellowlegs	22
Blue Grosbeak	19
Cinnamon Teal	19
Red-winged Blackbird	19
Great-tailed Grackle	17
Great Blue Heron	17
Black Tern	15
Eastern Meadowlark	13

Totals of Bird Species recoded at Holloman Lakes, 1994 by Month

Month: 9 (September 7-11) + September (22-26) 1994

Gadwall	624
Wilson's Phalarope	601
American Avocet	366
Eared Grebe	342
Least Sandpiper	334
Mallard	312
Ruddy Duck	303
Black-necked Stilt	211
Northern Shoveler	204
Killdeer	144
Yellow-headed Blackbird	124
Western Sandpiper	114
Wilson's Warbler	66
Red-necked Phalarope	59
Green-winged Teal	56
Black Tern	51
Lesser Yellowlegs	49
Redhead	46
American Coot	46
Spotted Sandpiper	41
Savannah Sparrow	37
Bank Swallow	36
Barn Swallow	35
Violet-green Swallow	30
White-crowned Sparrow	27
Lesser Goldfinch	26
Semipalmated Plover	22
Western Kingbird	22
Ring-billed Gull	21
House Finch	21
Lark Bunting	17
Black Phoebe	17
Mourning Dove	16
Lark Sparrow	16
Tree Swallow	16
Blue-winged Teal	14
Baird's Sandpiper	14
N. Rough-winged Swallow	14
Say's Phoebe	13
Mountain Chickadee	13
Yellow-rumped Warbler	12
Orange-crowned Warbler	12
Scrub Jay	12
Northern Pintail	11
Cattle Egret	11

Totals of Bird Species recoded at Holloman Lakes, 1994 by Month

Month: 10 October (15-19) 1994

Eared Grebe	869
American Coot	230
Gadwall	186
Mallard	183
Least Sandpiper	157
Killdeer	120
Northern Shoveler	109
Ruddy Duck	76
Western Sandpiper	51
Red-winged Blackbird	41
Green-winged Teal	33
Redhead	32
Savannah Sparrow	30
Northern Pintail	28
Ring-billed Gull	25
Wilson's Phalarope	22
Ruby-crowned Kinglet	19
House Finch	17
Barn Swallow	15
Franklin's Gull	15
Yellow-rumped Warbler	15
Gadwall	14
American Pipit	13
Song Sparrow	13
American Wigeon	13
Eared Grebe	12
Least Sandpiper	12
Baird's Sandpiper	12
Northern Harrier	11
Horned Lark	11
Greater Yellowlegs	11

Exhibit 3

Gordon J Ewing
4040 Cholla Road
Las Cruces, NM 88011-7603

28 March 1995

Donald L. Koehler, PhD, Biologist
Parsons Engineering Science, Inc.
8000 Centre Park Drive, Suite 200
Austin, Texas 78754-5140

Fax: 512 719 6099

Dear Dr Koehler

Rather than write a new letter to you concerning the HAFB wetlands, I am sending copies of two letters to you. I wrote the first draft of both of these and while there is some repeating, they really express my feelings concerning the directions that Holloman should go. I'm sure Fred Fisher will not mind if I send you a copy. I will tell him what I have done.

With this cover letter, you should receive 7 sheets.

I was pleased to meet you and was happy to look over the Holloman Lake area with you this afternoon.

Sincerely

Gordon

Gordon J Ewing

Gordon J Ewing
Conservation Committee
Mesilla Valley Audubon Society
PO Box 3127 UPS
Las Cruces, NM 88001

16 August 1993

Jennifer Fowler-Propst
US Fish and Wildlife Service
Ecological Services
Suite D, 3530 Pan American HWY NE
Albuquerque, NM 87107

Dear Ms Fowler-Propst

The Mesilla Valley Audubon Society has a long-standing interest in Holloman Lake and Lake Stinky. These lakes along with the upper lagoons form the most important wetlands in Southern New Mexico, from the standpoint of bird habitat. We are very interested in the preservation of these wetlands.

While it seems a little strange to defend sewage ponds, I would like to make a special plea for the preservation of Lake Stinky. Holloman AFB, in their letter in their letter to you, dated 30 April 1993, stated that "overflow to Lake Stinky is to be eliminated." There are at least two reasons for preserving this playa. 1. It is the best (nearly the only) shorebird habitat in the complex, and 2. It currently functions to keep the salt content of Holloman Lake from getting any higher than it now is. I would like to comment on each of these two points.

1. Holloman Lake has relatively steep banks except for the extreme north end. This means that when it is full it has very little shorebird habitat. Mud flats and shallow water can be found only at the north end. Currently, Holloman Lake is about one meter below the spillway and this has temporarily exposed a lot of good shorebird habitat (the most I have ever seen). This, however, is very dependent on fluctuating water levels. Already vegetation is moving down into the exposed mud. If the level of Lake Holloman were held at the current level for a couple of years, salt cedar and salt grass that grows around the lake would migrate to the new water level and eliminate most of this new shorebird habitat. On the other hand, Lake Stinky, in typical playa fashion, is frequently flooded and just as frequently nearly dry. During a typical year, all of the surface area of the playa is good shorebird habitat and the fluctuating water level and salt keeps the vegetation from eliminating the mud flats. Snowy Plovers, Avocets, Black-necked Stilts and Killdeers all nest around Lake Stinky. The best way to insure good shorebird habitat is to keep Lake Stinky as an active playa. This can be done by having evaporative ponds

with the right surface area so that Lake Holloman overflows in times of high run-off and in times of low evaporation. Those with sensitive noses can hold their breath while driving by.

2. Lake Holloman is intermediate between fresh water and ocean water in salinity. If evaporation lagoons with sufficient surface area are built above Lake Holloman, then overflow into Lake Stinky might be nearly eliminated. This would make Holloman Lake the end of the line for the system and salt would build up in the lake radically changing the nature of the lake. At current salinity levels, the organism that can survive are limited. To maintain the diversity of life at Holloman Lake, its salinity should not be increased. A change in the environment is generally bad for what is already there.

A modern sewage treatment plant would likely be beneficial to the area. Holloman Lake has nutrient levels that are generally too high. Lowering these nutrients would lessen the tendency toward eutrophic conditions, increasing the likelihood of fish surviving in the lake (provided salt buildup is controlled) which would favor carnivorous birds. Most of the lake is so productive now that sunlight does not reach the bottom. Significant photosynthesis is now only possible in a small fraction of the water of the lake (the upper foot or two) and bottom plants cannot grow because the bottom of the lake is almost all in darkness. A sewage disposal system that removes most of the nutrients would increase the variety of life at the lake, but enough nutrients should reach the lake so that productivity is optimized. Dabbling ducks would (and currently do) profit from extensive plant growth. Limnologists and hydrologists should be consulted when the sewage treatment plant is designed to optimize the productivity of this unique area in Southern New Mexico.

The Mesilla Valley Audubon Society will be happy to help in any projects that we feel will improve the Lake Holloman area for wildlife habitat.

Sincerely

Gordon J Ewing
Mesilla Valley Audubon Society
Conservation Committee

cc:

Tom Wootten
MVAS Conservation Chairman

Scott Ludwig
Bureau of Land Management
1800 Marquess
Las Cruces NM 88005

Howard E Moffitt
49 CES/CEV
550 Tabosa Ave
Holloman AFB, NM 88330-8458

Sarter O Williams, III
Department of Game and Fish
Villagra Building
PO Box 25112
Santa Fe, NM 87504

FOSTER WHEELER ENVIRONMENTAL CORPORATION

April 22, 1996
TERC-002.005-96-008

Dr. Fred M. Fisher, Ph.D.
Water Resources Manager
49 CES/CEV
550 Tabosa Avenue
Holloman AFB, NM 88330-8458

Subject: TERC Contract DACW45-D-0003, Delivery Order 02, WAD 05
Evaluation of Duck DDT/DDE Carcass Concentrations Relative to Egg Residues

Dear Dr. Fisher:

Foster Wheeler Environmental Corporation has completed its evaluation of the significance of duck DDT/DDE carcass concentrations relative to potential egg concentrations to address concerns raised by the U.S. Fish and Wildlife Service during the Holloman Air Force Base Sewage Lagoons Stakeholder Closure Meeting on April 3, 1996.

Our files contained a study by Longcore and Stendell (1977) that related egg residues to carcass residues based on a study of DDE transfer and toxicity in black ducks. They found that DDE residues in the eggs were correlated with carcass residues of hens on a wet-weight basis ($r = 0.917$, $n = 8$, $P < 0.01$) and the relationship approached significance on a lipid-weight basis ($r = 0.693$, $n = 8$: at $P < 0.05$, $r > 0.707$). They estimated that the average egg concentration (wet weight) was about 1.8 times the average carcass concentration (wet weight). They derived the following regression equation to correlate carcass concentrations to egg concentrations:

$$\text{egg concentration (EC)} = 0.428 + (1.699 * \text{carcass})$$

Applying this equation to the waterfowl carcass data from Holloman AFB (Table F-42, Draft Final Risk Assessment Addendum) results in the following egg concentration of total DDT residues (represented as DDx):

2,4'-DDE: 0.012 mg/kg
4,4'-DDD: 0.014 mg/kg
4,4'-DDE: 0.087 mg/kg
4,4'-DDT: 0.00028 mg/kg

DDx: 0.113 mg/kg (or ppm)

143 UNION BOULEVARD, SUITE 1010, LAKEWOOD, CO 80228-1824
TEL: 303-988-2202 FAX: 303-980-3539

$$EC = 0.428 + (1.699 * \overset{0.113}{\cancel{0.620}} \text{ mg/kg})$$
$$EC = 0.620 \text{ mg/kg}$$

This estimated egg concentration is not likely to impact reproductive success in ducks at Holloman based on the results of published DDT/DDE toxicity studies. Black duck eggs (n = 36) collected in 1978 with DDE concentrations in the range 0.09 – 3.4 ppm (mean = 0.65 ppm wet weight, similar to the estimated concentration for Holloman duck egg) and mean eggshell thickness was the same as in samples collected before DDT was first produced (Haseltine *et al.* 1980). In the Longcore and Stendell study (1977), the black duck hens in the control group laid eggs (n = 4) that contained an average of 0.39 ppm DDE; the mean hatchability was 95 percent.

Additional toxicity studies have shown that for the brown pelican, considered the most sensitive avian species to the effects of DDT and its metabolites on reproduction, 3 ppm in eggs can cause near total reproductive failure in a population (Blus 1982). However, the bald eagle is considered a moderately sensitive avian species to DDT; ≤ 3 ppm in eggs led to normal reproductive success, while ≥ 16 ppm caused near complete reproductive failure (Wiemeyer *et al.* 1984).

It appears, therefore, that waterfowl carcass concentrations similar to those reported above for Holloman AFB would not be expected to be related to, nor cause, concentrations in eggs that could be considered detrimental to reproductive success.

A list containing the references cited above is attached. Please feel free to call me at (303) 980-3542 if you have any questions.

Sincerely,
Foster Wheeler Environmental Corporation

Fred M. Applehans, D.V.M.
Manager of Risk Services

FMA/lrw
Attachment

cc: M. Mercier - USACE (CEMRO-ED-EA), Omaha, NE
W. Neff - USAF, Holloman AFB
R. Michna - Radian Corp.
R. Versaw
TERC File

ATTACHMENT

REFERENCES:

Blus, L.J. 1982. Further interpretation of the relation of organochlorine residues in brown pelican eggs to reproductive success. Environ. Pollut. A28:15.

Haseltine, S.D., B.M. Mulhern, and C. Stafford. 1980. Organochlorine and heavy metal residues in black duck eggs from the Atlantic Flyway, 1978. Pestic. Monit. J. 14:53-57.

Longcore, J.R. and R.C. Stendell. 1977. Shell thinning and reproductive impairment in black ducks after cessation of DDE dosage. Arch. Environ. Contam. Toxicol. 6:293-304.

Wiemeyer, S.N., T.G. Lamont, C.M. Bunck, C.R. Sindelar, F.J. Grandich, J.D. Fraser, and M.A. Byrd. 1984. Organochlorine pesticide, polychlorobiphenyl, and mercury residues in bald eagle eggs, 1969-79, and their relationships to shell thinning and reproduction. Arch. Environ. Contam. Toxicol. 13:529.

Erratum

The first line on page 2 of the April 22, 1996 letter to Dr. Fred Fisher, *Evaluation of Duck DDT/DDE Carcass Concentrations Relative to Egg Residues*, contains a typographical error and should be corrected as follows:

EC = 0.428 + (1.699 * **0.620** mg/kg) Incorrect

EC = 0.428 + (1.699 * **0.113** mg/kg) Correct