

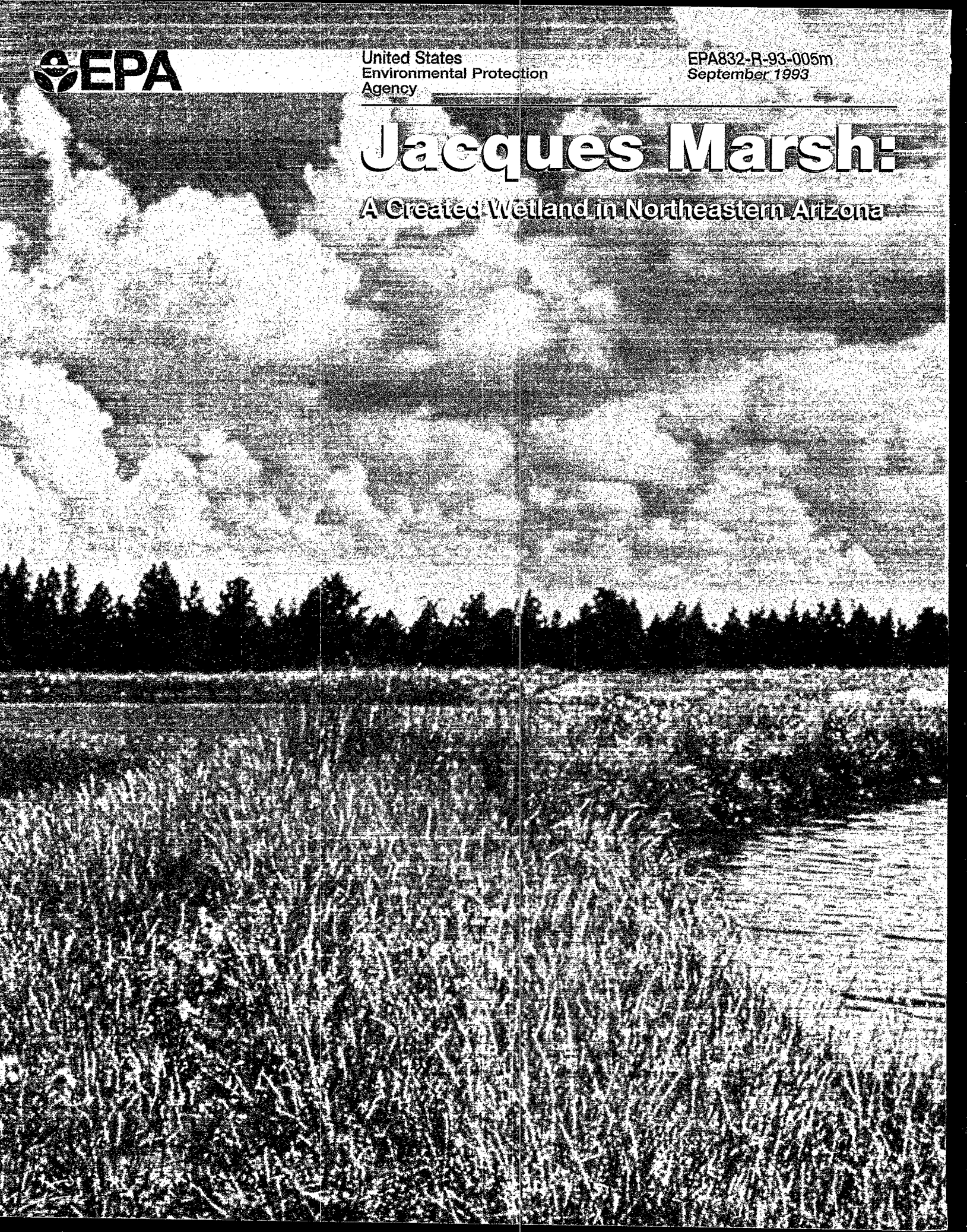


United States  
Environmental Protection  
Agency

EPA832-R-93-005m  
September 1993

# Jacques Marsh:

A Created Wetland in Northeastern Arizona



## HISTORY

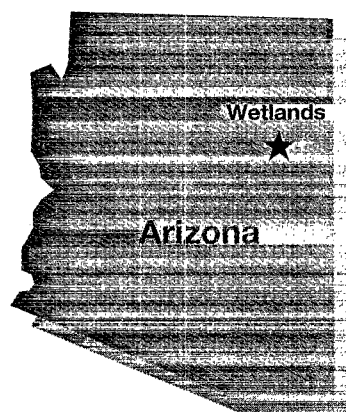
*Cooperation between public agencies and nature can have amazing results. The innovative decision to use treated municipal wastewater to create wetland wildlife habitat continues to pay off for the local community. Like a biological magnet, the new wetlands attract a wide variety of wildlife and of course people to watch them.*

**J**acques Marsh is a constructed wetland that is a component of the wastewater management system of the Pinetop-Lakeside Sanitary District. It is the result of a cooperative effort between the U.S. Forest Service, Arizona Game and Fish Department, and the Pinetop Lakeside Sanitary District. The manmade marsh was constructed on National Forest Service Lands in an area with no historical ponds, lakes or wetlands. However, once established the marsh closely represents a natural wetland in terms of plants and wildlife present at the site.

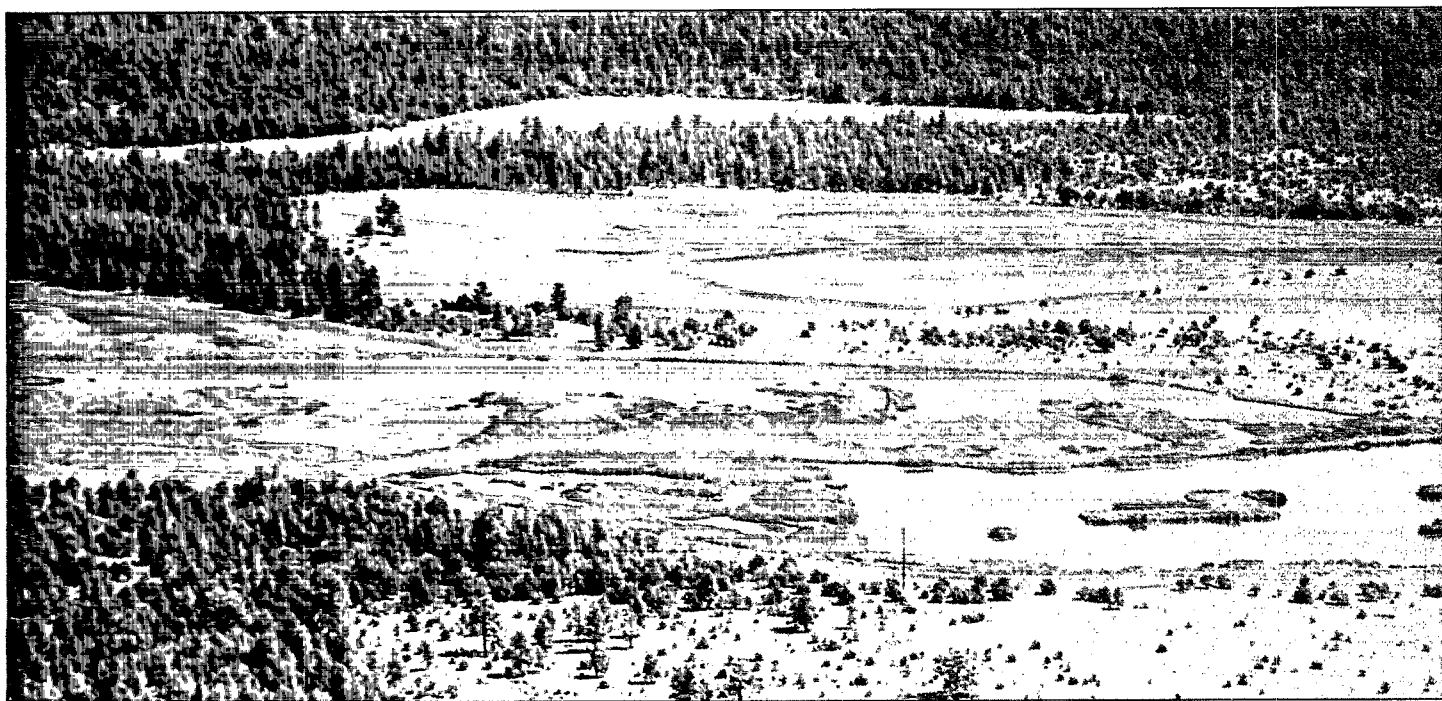
The surface and groundwaters of the community were considered to be contaminated in the 1970's and the Pinetop-Lakeside Sanitary District was formed in

1973 to clean up these waters. With assistance of an EPA construction grant the wastewater collection system, a 2 million gallon per day secondary treatment plant and Jacques Marsh were completed in 1980. The 127 acres of marsh and ponds currently receive about one million gallons of treated wastewater per day.

The community is proud of its decision to construct Jacques Marsh to recycle their reclaimed water rather than discharge effluent from the treatment plant into Billy Creek which runs through the area. Many worries about pollution and human contact were eliminated and a striking wildlife area was created. The use of Jacques Marsh for recreation, outdoor education, and wildlife has been well worth the effort.



*Jacques Marsh 1990.*





## WASTEWATER TREATMENT FACILITY

**T**he wastewater treatment plant operated by the Pinetop-Lakeside Sanitary District is a 2 million gallon per day activated sludge plant. Treatment consists of comminutors, hydrostatic screens and a vortex grit system followed by aeration in a 2 million gallon oxidation channel. Organic material in the wastewater is stabilized during this part of the process.

Following aeration for 24 hours in the channel, the flow is directed into two secondary clarifiers (sedimentation tanks) for separation of the organic solids from the treated wastewater. In the secondary clarifiers, solids are settled out by gravity and recycled to the oxidation channel, or removed. The effluent is drawn from the top of the

secondary clarifiers, chlorinated and pumped to the Jacques Wetlands Marsh System.

The sludge that is removed is pumped to an aerobic digester. Following digestion, the sludge is dewatered (concentrated) by Somat Dewatering Screws and pumped to an Eweson Co-Composting digester to be mixed with municipal solid waste. This 12 week process reduces 20 tons of material (14 tons of municipal solid waste plus 6 tons of sludge) to around 11 tons of marketable compost. Since this co-composting facility became operational, it has utilized 100% of the sludge from the wastewater treatment plant and 80% of the residential solid waste produced by the Town of Pinetop-Lakeside.



*PLSD's on-site testing lab.*

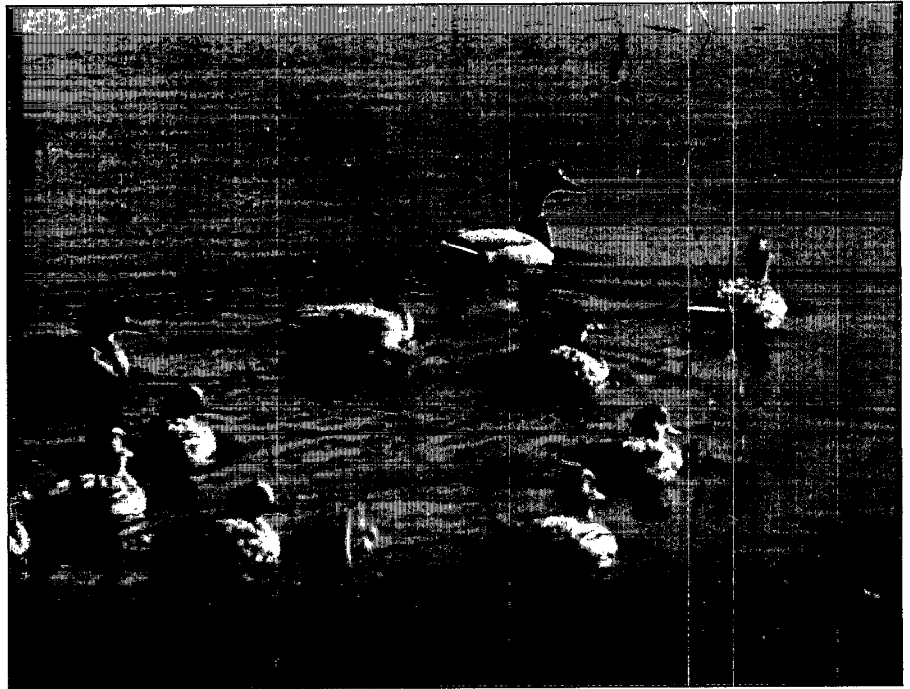
## SITE DESCRIPTION

**T**he created wetlands at Jacques Marsh are located 1 mile north of the town of Pinetop-Lakeside, Arizona. This is in the high country of northeastern Arizona. The wetlands are on National Forest Service Lands administered by the Apache/Sitgreaves National Forests.

The climate has a dominant influence on the functions of the created wetlands. This area has four definite seasons. Spring is very windy with gusts over 50 mph. This can cause severe bank erosion if vegetation isn't established. Net evaporation can exceed 7 inches per month in May and June. Summer is characterized by the onset of a monsoon type pattern with frequent showers and high humidities. Plants respond quickly to the higher night time temperatures. Fall is ushered in as the rainfall diminishes and nights get colder. The first frosts occur during the last part of September. Winter is marked by colder temperatures and the wetlands freeze over. Ice may occur for 1 to 2 months of winter. Snow depths of 6 to 16 inches are common.

The clay soils of the Jacques Marsh site are of volcanic origin. They have low permeability to water. This is a key factor in the wetland design. The natural soils were used to form the marsh basins.

The natural vegetation of the site was ponderosa pine, Utah juniper and pinyon pine. This is a very common vegetation type in this mountain area. The animals occurring in this area include rocky mountain elk, mule deer,



Merriam turkey, black bear, and coyotes. Common birds are Stellers jay, western bluebird, redshafted flicker, and raven. Waterfowl are common where water occurs. The Intermountain Biotic Province is the greatest source of waterfowl using this site.

### Weather Summary

Month	Average High Temp.	Average Low Temp.	Historic Record Low	Average Precip.
Jan	44.3°F	16.0°F	-23°F	1.92"
Feb	46.1°F	18.1°F	-18°F	1.30"
Mar	50.0°F	21.7°F	-13°F	1.91"
Apr	59.7°F	27.9°F	0°F	.93"
May	69.0°F	33.8°F	8°F	.43"
Jun	78.1°F	40.7°F	20°F	.57"
Jul	80.5°F	49.1°F	30°F	3.13"
Aug	77.5°F	48.1°F	32°F	3.40"
Sep	74.4°F	41.6°F	21°F	1.82"
Oct	65.6°F	32.6°F	6°F	1.89"
Nov	53.6°F	23.4°F	-3°F	1.34"
Dec	46.5°F	18.2°F	-18°F	1.96"





## DESIGN AND CONSTRUCTION

**J**acques Marsh is different than most constructed wetlands because it doesn't occupy a natural basin or drainageway. The relatively level site was selected because it has a clay soil of sufficient depth to provide material for dike construction and a low percolation rate.

Several hundred soil borings were made to map the size and thickness of the clay layer. Heavy earth moving equipment performed the necessary cut and fill to create the dikes and islands which form the physical features of the marsh.

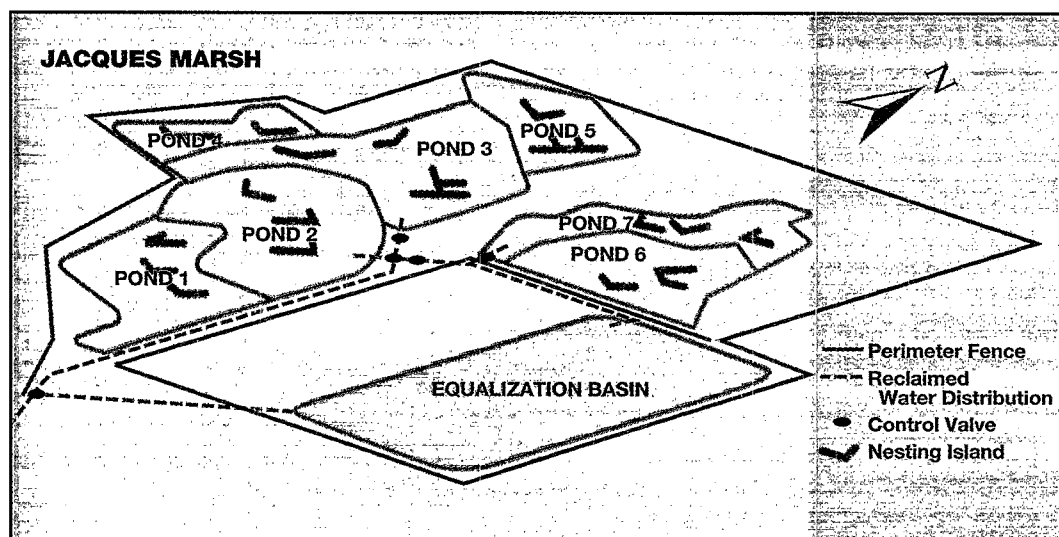
A pipeline was installed to carry the reclaimed water which is pumped up hill from the treatment plant to the marsh. Outlets allow for water to be

pumped directly into 5 of the 7 ponds. Interpond concrete structures allow water to flow from one pond into another. These structures are equipped with water boards to maintain predetermined water levels in each pond. This flexibility of managing water levels is a key factor in operating the marsh.

The "V" shaped nesting islands were designed to retard wave erosion. The points of the islands face the prevailing wind and the back sides provide back water areas for resting waterfowl. The purpose of the islands is to provide nesting sites which are safe from predators such as skunks and coyotes. The perimeter of the area was fenced to keep out domestic livestock.

### Net Evaporation

Month	Inches
Jan	+0.32
Feb	-1.33
Mar	-3.75
Apr	-6.22
May	-7.62
Jun	-8.49
Jul	-4.34
Aug	-3.29
Sep	-3.74
Oct	-2.55
Nov	-1.31
Dec	+0.57
<b>Total</b>	<b>-41.75</b>



### Pond Sizes

Pond Number	Surface Acres
1	16.36
2	21.86
3	18.56
4	4.66
5	7.70
6	10.95
7	12.08
Equalization Basin	35.0
<b>Total Acres</b>	<b>127.17</b>

## OPERATION AND MONITORING

**T**he effluent produced by the Pinetop-Lakeside Sanitary District's treatment plant has the following characteristics:

	Range	Mo. Avg.
Biological Oxygen Demand	2-3 mg/l	2.4 mg/l
Total Suspended Solids	1-13 mg/l	6.4 mg/l
Turbidity	2.1-5.4 ntu	3.6 ntu

The treated wastewater is provided to a combination of the 7 ponds each year in accordance with the habitat management plan. Waterfowl habitat needs and plant requirements are the primary factors affecting management of the ponds and marsh.

As water proceeds from one pond to another in the marsh, nitrogen and phosphorus are removed from the water. These nutrients are taken up by plants and animals and contribute to the overall productivity of the marsh. The following summarizes the removal rates for nitrogen and phosphorus for the months of February, March, April and May 1991:

	Total N (mg/l)	Total P (mg/l)
Effluent	20.35	7.90
Pond 1	6.23	4.10
Pond 2	5.35	4.75



*Aerial view of treatment facility.*

In addition to monitoring surface water quality, the Pinetop-Lakeside Sanitary District samples 3 shallow wells on a quarterly basis to insure groundwater quality is not being impacted.



## RESPONSE

**W**hat started out as a curiosity, putting wastewater to good use, has now become an attraction to many forms of life. Visitors are usually treated to a surprise package of sights and sounds provided by a vibrant marsh ecosystem.

In the winter bald eagles are a common sight and in the summer peregrine falcons are occasionally seen. The peak periods of waterfowl use occur during the spring and fall migration. The islands provide excellent duck nesting habitat. Elk are attracted to the marsh in the fall and winter where they consume the dry vegetation.

Of course the diversity of plants and animals attracts many human visitors. The area is popular with the viewing and hunting public. Jacques Marsh is a point of local pride. The residents of the cities of Pinetop and Lakeside have supported the project since it's inception.

A major side benefit of the created marshes has been the opportunity for interaction with the local schools. The marshes now function as outdoor classrooms where many environmental principles are taught including recycling and water cleanup. In 1989 a local group of 140 fourth graders were treated to the sight of a peregrine falcon hunting shore birds as they toured the wetland.

*Elk using Jacques Marsh.*



## ACKNOWLEDGEMENTS

**J**acques Marsh is the result of many agencies and individuals working toward common goals. The U.S. Environmental Protection Agency provided much of the funding under the Clean Water Act. The Pinetop-Lakeside Sanitary District provided funding and constructed the system. The Arizona Game and Fish Department agreed to maintain the wetland after construction. The Apache/Sitgreaves National Forests provided 255 acres of land and developed the habitat. The Arizona Department of Environmental Quality provided technical guidance and operational permits for the facility.

The wetland came together as a result of dedicated effort, and a vision of the future held by several people. Adrian Hill, District Forest Ranger of the Apache/Sitgreaves National Forests, and Jack O'Neil, Game Specialist for the Arizona Game and Fish Department, worked hard at garnering their respective agencies support for the project. U.S. Forest Service Wildlife Biologists Leon Fager and James McKibben provided the technical and planning support to make the project viable. The Board of Directors of the Pinetop-Lakeside Sanitary District played a key role in obtaining the support of the local communities. This group of dedicated individuals didn't permit doubt, policy, politics, or the "but it's never been done here before" attitude to stop them. Jacques Marsh is a tribute to them and to many others who followed for the past 17 years.

