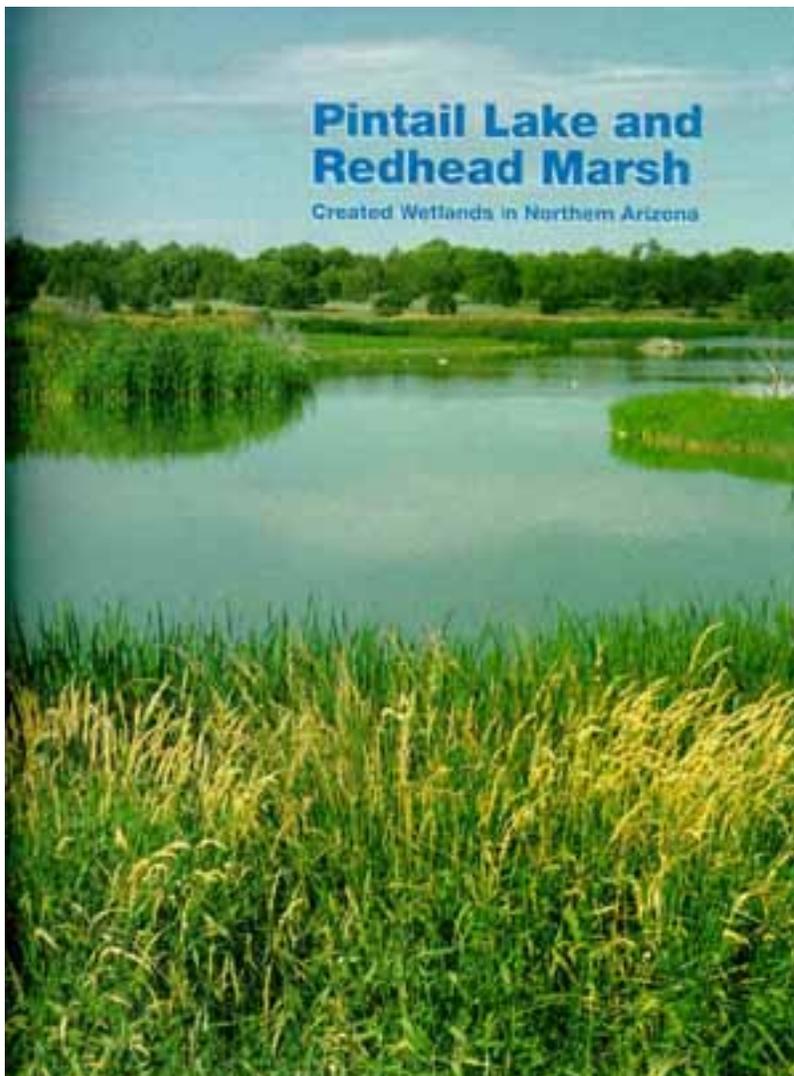




Note: This information is provided for reference purposes only. Although the information provided here was accurate and current when first created, it is now outdated.

Disclaimer: The information in this website is entirely drawn from a 1993 publication, and has not been updated since the original publication date. Users are cautioned that information reported at that time may have become outdated.

ShowLow, AZ - Pintail Lake and Redhead Marsh: Created Wetlands in Northern Arizona



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Background/History

Treated municipal wastewater is being used in N.E. Arizona to create some very interesting wetlands. Wildlife response to this new habitat has been dramatic with over 120 species of birds using them. The local community is justly proud of this example of environmental innovation and cooperation.

The City of Show Low built its first wastewater collection and treatment system in 1958. It consisted of sewer lines, serving the original townsite and contiguously built up areas of the city, and two stabilization ponds for treatment. Effluent was discharged directly into Show Low Creek, adjacent to the treatment plant, eventually reaching Fool Hollow Lake. Nutrient loading resulted in accelerated lake eutrophication, algae blooms, and resulting fish kills.

In 1970, with the cooperation of the U.S. Forest Service, wastewater discharge into the creek was halted. The effluent was pumped two miles north to a natural depression known as Telephone Lake where it contributed to the development of wildlife habitat. In 1977, due to increasing population and resulting effluent flows, the treatment system was expanded to include additional natural depressions to the East which became known as Pintail and South Lake Marshes. In Pintail Lake the U.S. Forest Service began to construct islands to enhance waterfowl reproduction.

By 1982 wastewater flows exceeded the treatment plant's design capacity. Discharges directly into Show Low Creek and decreased quality of effluent delivered to the marsh treatment areas resulted in degraded habitat quality and sharply decreased waterfowl populations. In 1985 the City began to work on a long term solution to the problems of treatment plant capacity and providing high quality effluent to the created wetlands.

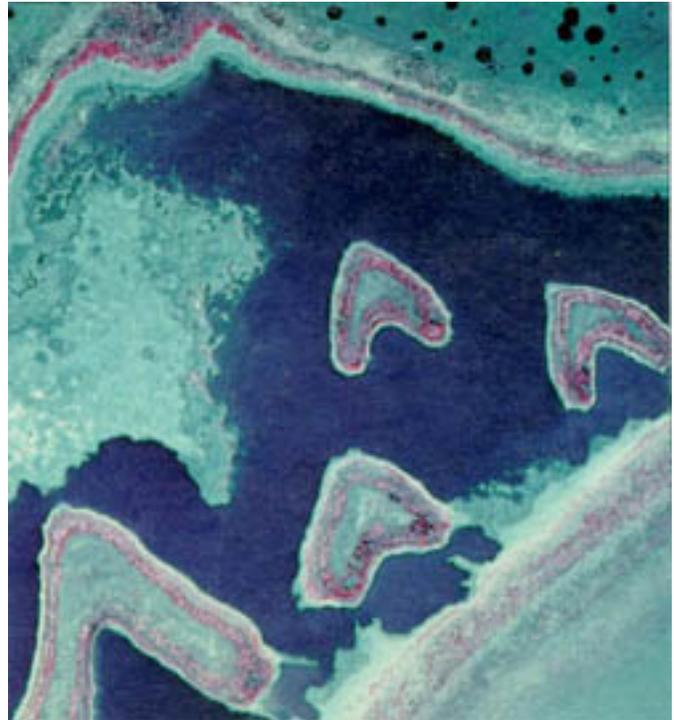
The solution selected was to deepen and improve the existing treatment lagoons by adding aeration, increase pumping capacity, add stabilization ponds for secondary treatment, increase the capacity of Telephone Lake for effluent storage, and add additional marsh capacity for final treatment and reuse.



Pintail Lake in winter.

Treatment Facility

The City of Show Low wastewater treatment facility now consists of two aerated lagoons that may be operated in series or parallel, a lift station with two 1,150 gpm pumps, four biological stabilization ponds that may also be operated in series or parallel, a chlorination contact chamber, effluent storage and clarification in Telephone Lake, nutrient removal in constructed riparian areas, and eventual reuse in constructed waterfowl marshlands.



Aerial view.

Site Description

The created wetlands at Pintail Lake and Redhead Marsh are located 4 miles north of the City of Show Low, 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.

Weather Summary

| Month | Average High Temp. | Average Low Temp. | Historic Record Low | Average Precip. |
|-------|--------------------|-------------------|---------------------|-----------------|
| Jan | 44.2°F | 17.7°F | -25°F | 1.40" |
| Feb | 48.3°F | 21.0°F | -11°F | .96" |
| Mar | 53.8°F | 25.4°F | -7°F | 1.25" |
| April | 63.9°F | 32.1°F | 11°F | .60" |
| May | 73.0°F | 38.5°F | 14°F | .31" |
| Jun | 82.8°F | 47.6°F | 27°F | .50" |
| Jul | 85.5°F | 55.5°F | 42°F | 2.47" |
| Aug | 82.9°F | 54.1°F | 37°F | 2.25" |
| Sept | 79.4°F | 47.6°F | 25°F | 1.22" |
| Oct | 68.5°F | 35.7°F | 10°F | 1.46" |
| Nov | 55.3°F | 24.8°F | -9°F | 1.06" |
| Dec | 45.6°F | 18.9°F | -16°F | 1.87" |

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 12 inches per month in May and June. Summer is characterized by the onset of a monsoon type pattern with frequent showers and high night time temperatures. Fall is ushered in as the rainfall diminishes and nights get colder. Winter is marked by colder temperatures and the wetlands freeze over. Ice may occur 1 to 2 months of winter. Snow depths of 3 to 12 inches are common.



Water control structure at Redhead Marsh.

The soils of this area are heavy clays with low water permeability. The natural vegetation is typical pinyon-juniper woodland. This is a very common vegetation type in this area. The topography is flat to moderately sloping with some natural basins which form Pintail and Telephone Lakes. The elevation above sea level is 6,350 to 6,380 ft.

Evaporation from wetland surfaces is a key factor affecting their functions. Total evaporation exceeds precipitation by 48 inches per year. The evaporative loss is greatest during the months of May and June which account for one half of the year's total. During winter months evaporation is near zero, so ponds fill up and total storage capacity becomes a concern.

Design and Layout



Since the construction of the first wetland at Pintail Lake in 1978, there has been a gradual evolution of the wetlands. In 1985 a major expansion occurred with the construction of Redhead Marsh. This surge of construction was required as effluent volumes produced began exceeding treatment and disposal capacities. The present system is designed to handle 1.42 million gallons of wastewater per day to serve a population of 13,500.



Size of Wetlands

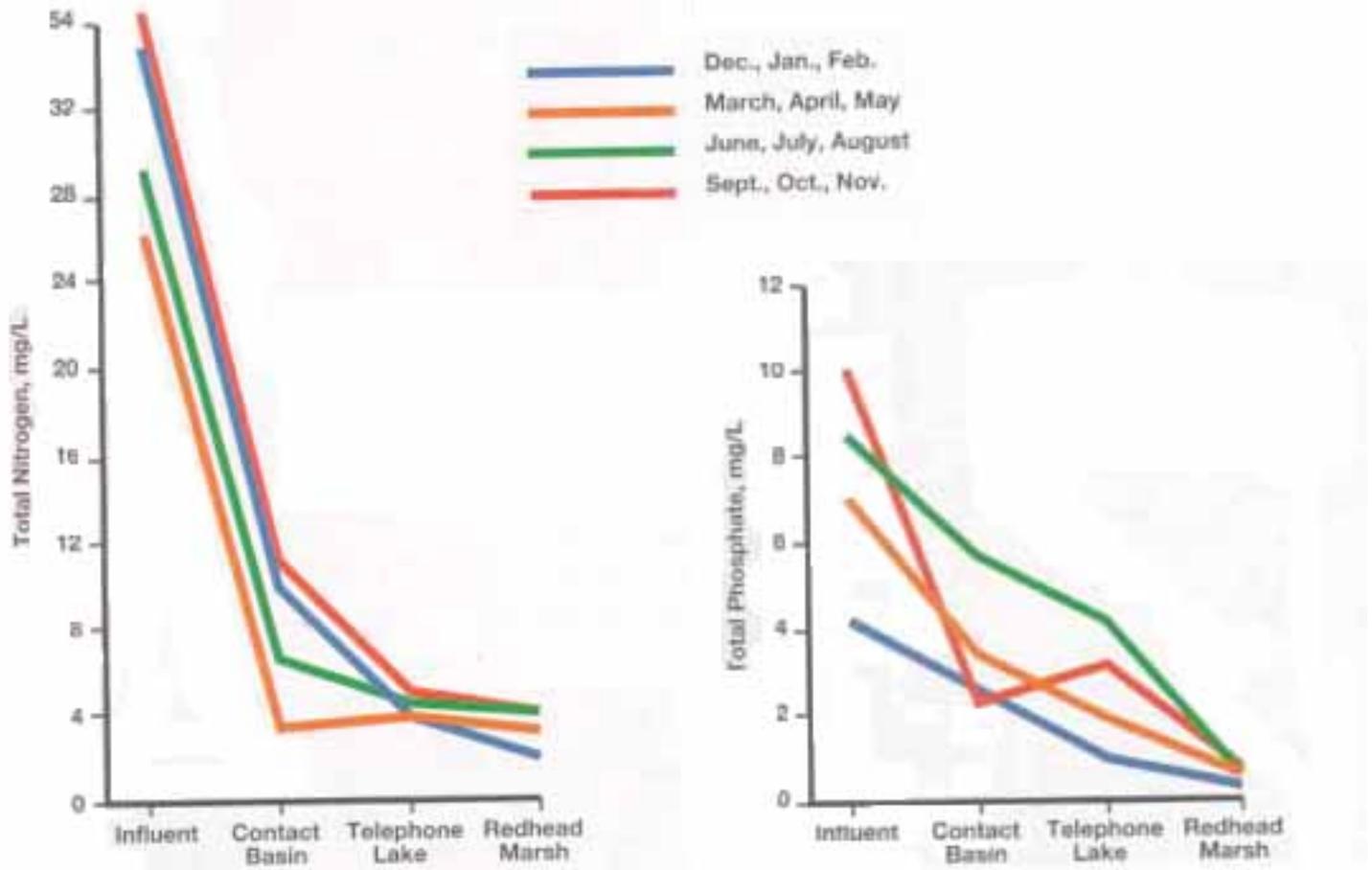
| | |
|---------------------|----|
| Telephone Lake..... | 45 |
| acres | |
| Pintail Lake..... | 57 |
| acres | |
| South Marsh..... | 19 |
| acres | |

| | |
|---------------------|-----------|
| Redhead Marsh..... | 49 |
| acres | |
| Bullseye Marsh..... | 1 |
| acre | |
| Ned Lake..... | 15 |
| acres | |
| Riparian Area..... | 15 |
| acres | |
| Total Acres = | 201 acres |

The system was designed to integrate several lakes and marshes into an effective wetlands complex. Flexibility in management options was built in to accommodate changes from year to year. The water delivery system was designed to provide additional treatment before the effluent reaches Redhead Marsh.

Operation and Monitoring

The



main techniques used in operating the wetland complex involve the management of the water. The quantity, quality, and delivery routes are varied to manage the wetland habitat. The flexibility designed into the system allows a variety of management options. For example, water control structures with adjustable water boards are used to hold water levels at desired levels. Water can be diverted away from some ponds to allow them to dry up. This is desired to allow for maintenance and to accomplish vegetation management goals.

Monitoring of the wetlands is conducted in accordance with the requirements of the Arizona Department of Environmental Quality by the City of Show Low. Additional monitoring is conducted by the Arizona Game and Fish Department and the U.S. Forest Service.

As water progresses through the system, water quality improves. For example, secondary effluent coming from the polishing ponds flows into Telephone Lake, then into an open channel which delivers it to the riparian area. After the riparian area, the water flows into another open channel and is finally delivered to pond one of the Redhead Marsh. During this delivery process the water quality greatly improves. The following charts show the removal rates for nitrogen and phosphorus as water moves through the system.

Response

Pintail Lake and Redhead Marshes have exceeded the original objectives and expectations. What started out as a project to favor waterfowl has developed into a complex of wetland ecosystems with a wide range of benefits. Similar projects in other areas have been developed as a result of the success here.

Vegetation

Experience has shown that the addition of water to these previously arid sites brings on dramatic vegetation changes. A prime objective has been the establishment of a vigorous vegetative cover. Cattail, water grass, spike rush, and various sedges have become established naturally in the created wetlands while others such as hardstem, softstem, and alkali bulrushes and sego pondweed have been successfully planted.

Animal

The response of animals to the new wetlands has been exciting. After 3 years of data collection on Pintail Lake, L. Piest (1981) stated: “The response of breeding waterfowl has been dramatic. I estimated that 1,544 ducklings or 76.4 ducklings per hectare (30.93 per acre), were produced in 1981.” The response of other birds has been similar with the establishment of cormorant and black-crowned night heron rookeries in the new wetlands.

To date ten bird species which are classified as endangered, threatened, or sensitive have been seen using the wetlands. These include the bald eagle, peregrine falcon, osprey, northern goshawk, snowy egret, belted kingfisher, American avocet, sora rail, black-crowned night heron, and the double-crested cormorant. Four of these species (the avocet, sora rail, black-crowned night heron, and cormorant) have been found nesting here. A survey done in 1991 to document total bird use on a weekly basis found 120 different species of birds using the created wetlands. Some of the birds are predators, feeding on fathead minnows, a small fish that inhabits part of this wetland system. Other animals found in the wetlands include rocky mountain elk, mule deer, pronghorn, black bear, coyote, raccoon, and various kinds of amphibians.



Shorebirds using Telephone Lake.

People are also attracted to these wetlands for a variety of reasons— to relax and watch animals is probably the intent of most people. Facilities were provided to improve wildlife viewing at Pintail Lake. School groups often use these wetlands for environmental field trips. The concepts of wastewater cleanup and recycling have more meaning after experiencing the created wetlands.

Acknowledgements

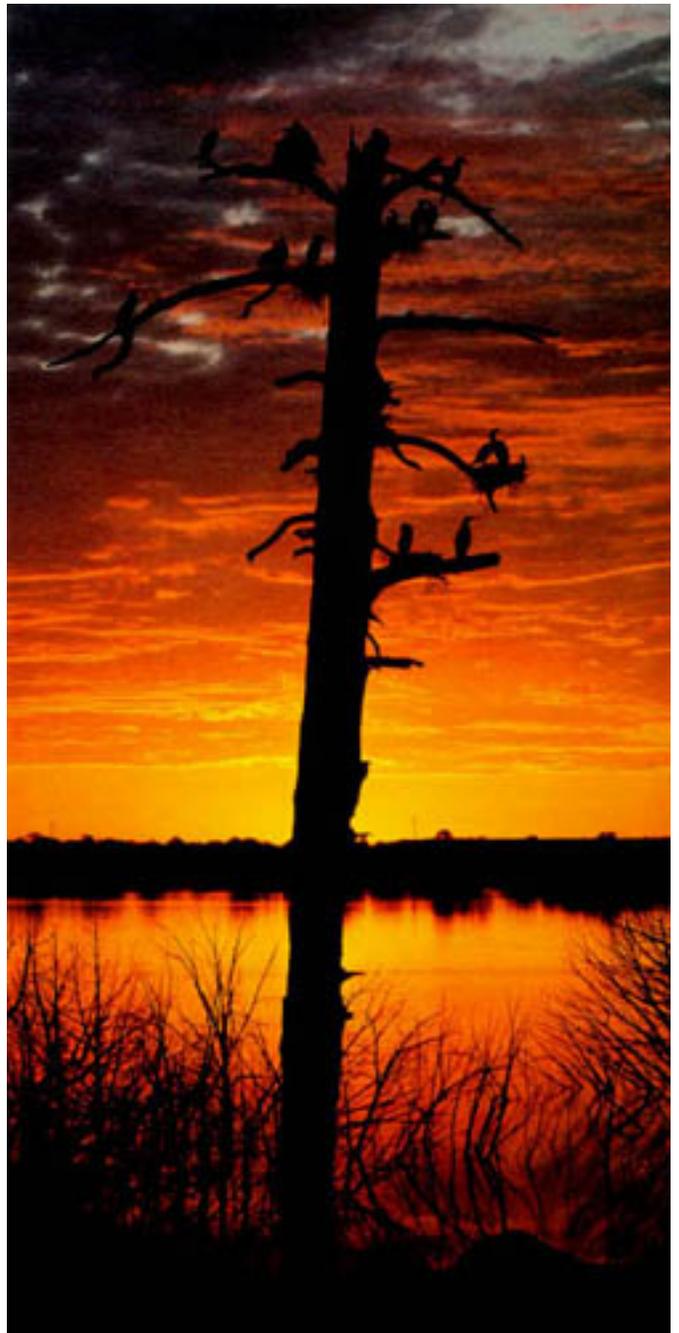
Since the first wetland was built at Pintail Lake in 1978 to the present, the wetlands have been a cooperative effort. The "core team," which started the project and continues to make it successful today, include the City of Show Low, the Arizona Game and Fish Department, and the U.S. Forest Service.

Other groups have also played a major role. The U.S. Environmental Protection Agency has provided guidance and funding for this innovative wastewater treatment project. The Arizona Department of Environmental Quality is involved in the monitoring and operational permitting process.

The wetland project is also supported by the local communities. This includes the local schools with their field trips. The White Mountain Chapter of the Audubon Society with the field trips and work projects.

References

L. Piest, 1981. "Evaluation of Waterfowl Habitat Improvements on the Apache/Sitgreaves National Forests, Arizona." USDA/Forest Service. 119pp.



Newly established cormorant rookery.