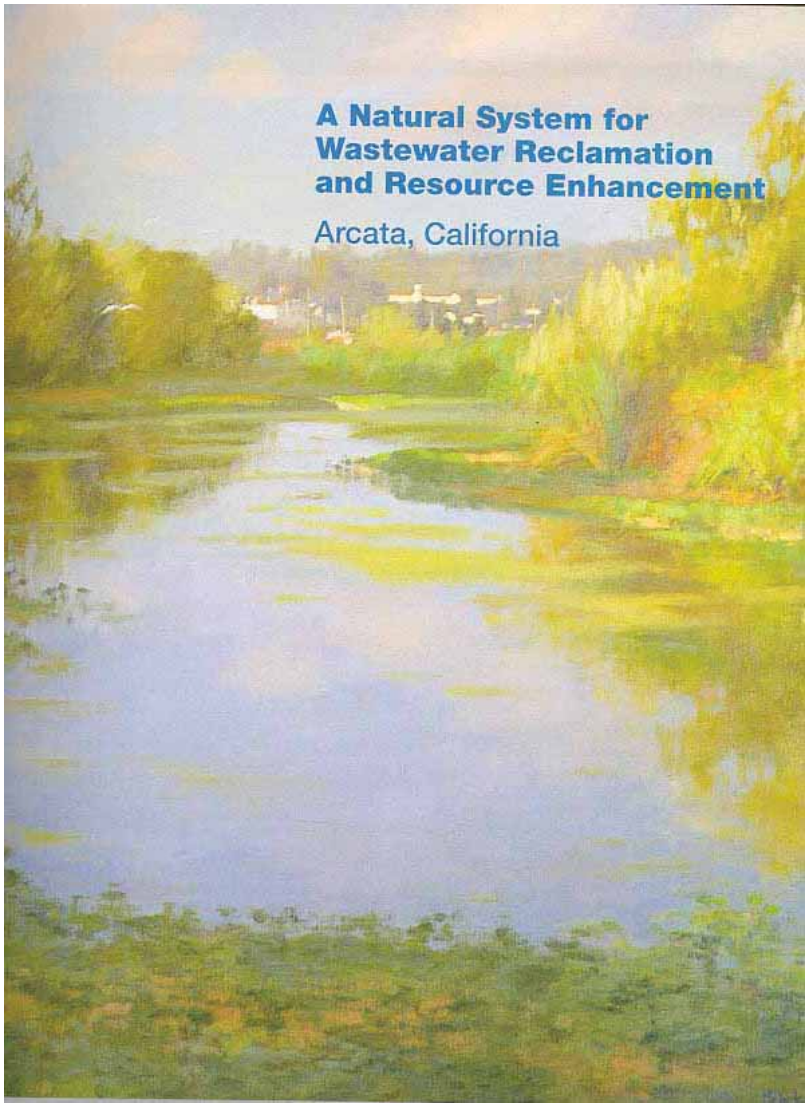
Note: This information is provided for reference purposes only. Although the information provided here was accurate and current when first created, it is now outdated.

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 Users are cautioned that information reported at that time may have become outdated.

Arcata, California - A Natural System for Wastewater Reclamation and Resource Enhancement



Introduction

...a constructed wetland system can be a cost efficient and environmentally sound wastewater treatment solution.

The constructed wetland system is the cornerstone of Arcata's urban watershed renovation program. This program includes major urban stream restoration, log pond conversion to a swamp habitat, pocket wetlands on critical reaches of urban streams, and an anadramous wastewater aquaculture program to restore critical commercial recreational and ecological important populations. The Arcata project is a demonstration of wastewater reuse, ecological restoration, and reuse of industrial, agricultural and public service land.

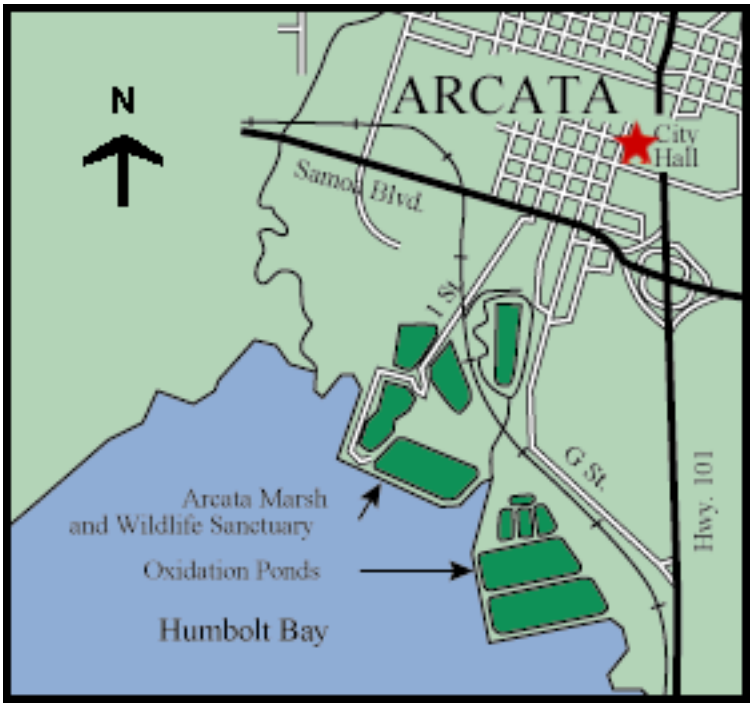
Arcata Site Plan

Situated in the heart of the redwood country and along the rocky shores of the Pacific Northcoast, the City of Arcata is located on the northeast shore of Humboldt Bay in Northern California, 280 miles north of San Francisco. Arcata, with a population of approximately 15,000, is a diverse community whose resourcefulness and integrity has demonstrated that a constructed wetland system can be a cost efficient and environmentally sound wastewater treatment solution. In addition to effectively fulfilling wastewater treatment needs, Arcata's innovative wetland system has provided an inspiring bay view window to the benefits of integrated wetland enhancement and wastewater treatment.

What is the Arcata Marsh and Wildlife Sanctuary?

Arcata is a small town located on the north-eastern side of Humboldt Bay, about 280 miles north of San Francisco. Humboldt Bay is a focal point where timber resources and marine resources cross paths as they struggle to sustain Humboldt County's economy. Resource management is a practice that receives high priority and expert advice in this scenic niche of the Pacific Northcoast. Arcata, with a population of approximately 15,000, is a diverse community whose resourcefulness and integrity has served to lead the city down a successful path marked by innovative decisions and maintained by pride. So, when the city faced making a change in their wastewater treatment methods, they demonstrated that a constructed wetland system can be a cost efficient and environmentally sound wastewater treatment solution. In

addition to effectively fulfilling wastewater treatment needs, Arcata's innovative wetland system has provided an inspiring bay view window to the benefits of integrated wetland enhancement and wastewater treatment.



How did the project evolve?

Arcata established its innovative treatment system as a result of extensive community involvement and a series of political events. In the early 1970's, Arcata's active wastewater treatment plant discharged unchlorinated primary effluent into Humboldt Bay. In 1974 the State of California enacted a policy which prohibited discharge of wastewater into bays and estuaries unless enhancement of the receiving water was proven. In response to this policy the local Humboldt Bay Wastewater Authority proposed the construction of a state sponsored regional wastewater treatment plant that would serve all the communities in the Humboldt Bay vicinity. The plant was to have large interceptors around the perimeter of the bay with a major line crossing under the bay in the region of active navigation. The proposed treatment facility was energy intensive, with significant operational requirements. Effluent from the proposed plant was to be released offshore into an area of shifting sea bottom and heavy seas during winter storms. As the scale of the regional treatment plant grew, the costs and difficulties of incorporating other communities became apparent

---

Arcata established its innovative treatment system as a result of extensive community involvement and a series of political events.

Recognizing the constraints of the local environment and criteria for wastewater treatment, the City of Arcata began exploring the design of a decentralized system which employed constructed wetlands. Wastewater aquaculture projects at the City of Arcata started as early as 1969 and had been successful in raising juvenile Pacific Salmon and Trout in mixtures of partially treated wastewater and seawater. This project demonstrated that wastewater was a "resource" that could be reused and not simply to be viewed as a disposal problem. With this philosophy a city Task Force on Wastewater Treatment determined that the natural processes of a constructed wetland system could offer the city an effective and efficient

wastewater treatment system. From 1979 to 1982 the city, and associated proponents of alternative wastewater treatment, experimented with partially treated wastewater and the natural processes of wetland ecosystems. These experiments demonstrated that constructed freshwater wetlands could be utilized to treat Arcata's wastewater and at the same time enhance the biological productivity of the wetland environment into which treated wastewater was discharged. The Task Force determined that a constructed wetland system was extremely cost effective. Moreover, a successful system offers the city a vital wetland ecosystem that could be used for the rearing of salmon and steelhead as well as offer the community a unique site for recreation and education.

With the aid of the Arcata City Council and political representatives in the state capital, the city received authorization in 1983 to develop the constructed wetland system and incorporate its use at the original Arcata Wastewater Treatment Plant. The wetland system that exists today was completed in 1986. Since that time the natural ability of marsh plants, soils and their associated microorganisms has successfully been utilized to meet the need for a cost-effective and environmentally sound wastewater treatment technology that meets federal and state mandated water quality requirements.

Who cares and what are the benefits?

At the same time that wetland wastewater technology has been used to successfully meet water quality criteria, it has also aided in restoring a degraded urban waterfront. Prior to the installation of its wetland treatment system, the City of Arcata's waterfront was the site of an abandoned lumbermill pond, channelized sloughs, marginal pasture lands, and a closed sanitary landfill. Today, Arcata's waterfront has been transformed into 100 acres of freshwater and saltwater marshes, brackish ponds, tidal sloughs and estuaries. Because of the wetland communities and wildlife habitats that the waterfront now supports, the area in its entirety has come to be known as the Arcata Marsh and Wildlife Sanctuary (AMWS.) The AMWS's three freshwater wetlands are Gearheart, Allen and Hauser Marshes. They were constructed to receive treated wastewater, thereby treating the wastewater further and enhancing the receiving water at the same time. These enhancement marshes are a host of aquatic vegetation that, in association with Klopp Lake and the adjacent estuaries and ponds, have further provided an extraordinary habitat for shorebirds, waterfowl, raptors and migratory birds.

As a home or rest stop for over 200 species of birds, the AMWS has developed a reputation as one of the best birding sites along the Pacific North Coast. The Redwood Region Audubon Society uses the site on

a regular basis for its weekly nature walks. For the past 10 years, docents trained by the Society have explained the role the wetlands play in attracting birds and mammals, as well a s their role in managing the water quality of Humboldt Bay. The beauty and uniqueness of the AMWS has served as inspiration to many artists, whose products range in form from plays and poems to photographs and paintings.

Arcata has become an international model of appropriate and successful wastewater reuse and wetland enhancement technologies. Over 150,000 people a year use the AMWS for passive recreation, bird-watching, or scientific study. Visitors from around the world have come to Arcata to investigate its success in wastewater management. Students of all ages and institutions use the AMWS for scientific study. In 1987, the City of Arcata was selected by the Ford Foundation to receive an award for this wastewater wetlands project as an innovative local government project. This award included a $100,000 prize to be used to fund the establishment of the Arcata Marsh Interpretive Center. The Center focuses on the historical, biological and technical aspects of the AMWS, and attempts to meet the informational and educational demands of the wastewater treatment system.

Today, Arcata's waterfront has been transformed into 100 acres of freshwater and saltwater marshes, brackish ponds, tidal sloughs and estuaries.

Take a look at some of the living environments of the Arcata resources. *(JPG format, 39KB)*

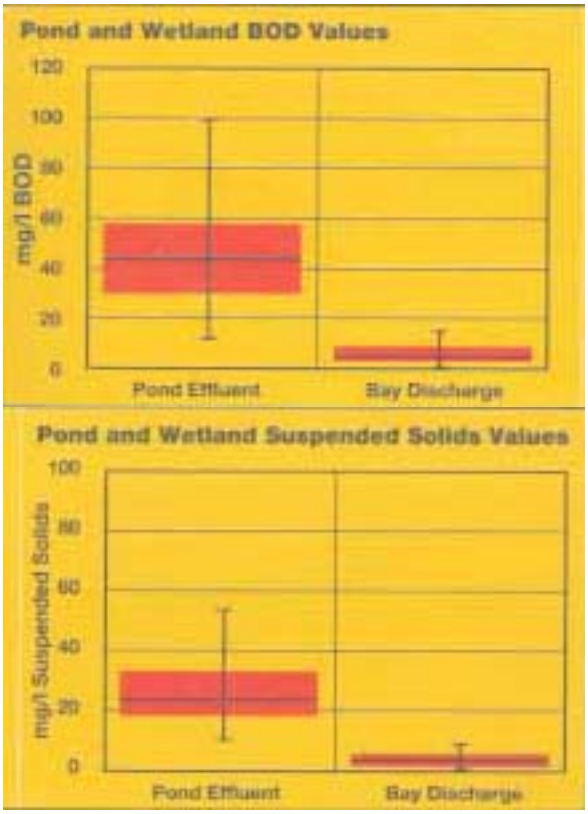
Stage in Treatment Plan

Take a look at the Stage in Treatment Plan

Arcata's present wastewater treatment plant consists of seven basic components. These are the headworks, primary clarification, solids handling, oxidation pond, treatment marshes, enhancement marshes and disinfection. Each one of these components will be detailed as follows.

Headworks: The "headworks" component of Arcata's wastewater treatment plant is the first phase in the treatment of raw sewage and consists of technologies aimed at removing inorganic materials from the raw sewage. The technologies include two screw pumps that lift the sewage fifteen feet and pass it through bar screens, a parshall flume (for flow measurement) and grit separators before it enters the clarifiers.

Primary Clarification: Two clarifiers are used to settle out any remaining suspended material that passes through the headworks. The liquid form of sewage that results from clarification flows to the oxidation ponds, completing primary treatment. The solids that settle out in the clarifiers are pumped to the digesters.



Sludge Pumping and Stabilization/Cogeneration: The sludge from the clarifiers is pumped first to the primary digester and then the secondary digester. The digestors mix the sludge by recirculating methane gas with compressors. The digestors were designed in conjunction with a methane recovery and cogeneration system. The cogeneration component is designed burn the methane gas and utilize the heat to aid in the digestion process.

Oxidation Pond: The oxidation ponds efficiently remove approximately 50 percent of the BOD and suspended solids that remain after primary treatment. Long detention times and natural processes (see diagram showing plant and animal roles) accomplish these reductions.

Treatment Marshes: The treatment marshes reduce the levels of suspended solids and BOD concentrations that remain in the oxidation pond effluent. The three, two-acre treatment marshes in operation are located north of the oxidation ponds. They were created by subdividing the previous oxidation ponds. All treatment marshes were planted with hardstem bulrush (Scirpus acutus), a freshwater marsh plant native to the Humboldt Bay area. This plant's effectiveness as a treatment species was shown by Marsh Pilot Project data. The treatment marsh's effluent is combined at a pump station where it is pumped to the disinfection facility.

Enhancement Marshes: After the first chlorination, wastewater is directed to the enhancement marshes, which are located northwest of the oxidation ponds. The three enhancement marshes cover a total of 31 acres. These marshes are managed to maintain the greatest diversity of aquatic plant species and to maintain or improve water quality. Flow is directed through the enhancement marshes with sluice gates and wooden stop-log weirs. After disinfection, the wastewater flows into George Allen Marsh, then Robert Gearheart Marsh, and finally Dan Hauser Marsh. The effluent from Hauser Marsh is pumped back to the disinfection facility.

Disinfection: Chlorine gas is used to disinfect Arcata's waste water before it is discharged to the enhancement marshes and again before it is discharged into Humboldt Bay. Because of this “double™ chlorination” two chlorine contact basins are necessary. These basins are built as one unit, which is located immediately south of the headworks. Any free chlorine remaining in the final effluent after the 60 minute contact time is removed with sulfur dioxide.

Arcata Marsh and Sanctuary: Points of Interest

1 Robert Gearheart Marsh: Completed in 1981, this marsh was built from pastureland and now uses treated wastewater as the sole water source.

2 George Allen Marsh: Also completed in 1981, this marsh was built on an abandoned log deck and is enhanced with wastewater.

3 Dan Hauser Marsh: The final marsh to be irrigated with treated wastewater before returning to the treatment plant for disinfection and release into to the bay. This marsh was a barrow pit for the closure of the adjacent landfill.

4 Mount Trashmore: This grassy hill has been reclaimed from a sealed sanitary landfill that operated during the 1960's and 70's.

7 Arcata Boat Ramp: The only concrete boat ramp maintained in Arcata Bay, this serves as an access point for sport boating, duck hunting, and sport shellfish harvesting.

11 Butcher’s Slough: Butcher’s Slough is a restored estuary receiving feed from Jolly Giant Creek, the principal watershed in Arcata. A California Coastal Conservancy Project returned the estuary to its original alignment and ecological value. This slough serves as home to the Coastal Cutthroat Trout.

12 Butcher's Slough Marsh: An old log pond restored to provide swamp-like habitat in the Arcata Marsh and Wildlife Sanctuary.

16 AMWS Interpretive Center: This is the site where the AMWS Interpretive Center is built. This center will attempt to meet the educational demands of the treatment system.

5 Frank Klopp Lake: This brackish lake was also a barrow pit for the closure of the landfill and is now a

popular loafing area for shorebirds, a feeding area for diving birds and river otters, and a place for artificial-bait-only sport fishing.

6 Treatment Marshes: Three 2.5 acre constructed wetlands which process oxidation pond effluent to secondary standards prior to release to the Arcata Marsh and Wildlife Sanctuary.

8 Wastewater Aquaculture Project: Fish hatchery and ponds where salmon, trout and other fish are raised in a mixture of wastewater and seawater.

9 Marsh Pilot Project: These ten 20’ X 200’ marsh cells have been used since 1980 to demonstrate the effectiveness of constructed wetlands to achieve water quality and habitat goals.

10 Oxidation Ponds: These 45 acres of ponds, built in the late 1950’s, treat Arcata’s wastewater to secondary standards.

13 Arcata Bay: This bay produces more than half of the oysters grown in California and is home to a variety of other aquatic animals.

14 Headworks Facility: This is the place where the influent to the treatment system is received.

15 Discharge Point: This is the point where a mixture of treatment of marsh effluent and enhancement marsh effluent is discharged into the Arcata Bay side of Humboldt Bay.

Specifications

Design Population.....19,056
Average Annual Flow.....2.3 mgd
Maximum Monthly Flow.....5.9 mgd
Peak Flow.....16.5 mgd
BOD's Load.....4100 lbs/day
TSS Load.....3400 lbs/day

Headworks

Mechanically Cleaned
Bar Screens.....2 at 5 mgd each
Gravity Grit Removal.....144 ft.2

Primary Treatment

2 Primary clarifiers .....26 ft. diam./60 ft. diam
Retention time at design flow.....3.8 hrs.
Retention time at max. monthly flow.....1.4 hrs.

Treatment Marshes

Total area.....7.5 acres
Ave. Depth.....2 ft.
Total detention time at design flow.....1.9 days

Chlorination/Dechlorination

Volume.....185,400 gallons
Retention time at design flow.....58 min.
Retention time at max. monthly flow.....30 min.

3 Enhancement Marshes

Total area.....31 acres
Ave. depth.....1.5 ft.
Retention time at ave. flow.....9 days

Acknowledgments - Elected Officials
Lynne Canning
Elizabeth Lee
Bob Ornelas
Sam Pennisi
Victor Schaub *Mayor*

City Staff
Frank Klopp *Director of Public Works*
Steve Tyler *Deputy Director of Public Works*
David Hull *Aquatic Resources Specialist*

Supporting Organizations
California Coastal Conservancy
California State Water Resources Control Board
California Coastal Commision
California Department of Fish and Game
Humboldt State University
Redwood Regional Audubon Society
U.S. Environmental Protection Agency

Cover Painting--Jim McVicker