United States
Environmental Protection
Agency

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Fort Deposit, Alabama

Constructed Wetland Treatment System Case History

SYSTEM DESCRIPTION

As designed, the Fort Deposit wetland treatment system includes the following main components:

- An 8.9-acre aerated pond
- Two 7.5-acre constructed wetland cells
- A 0.1-acre post-aeration pond

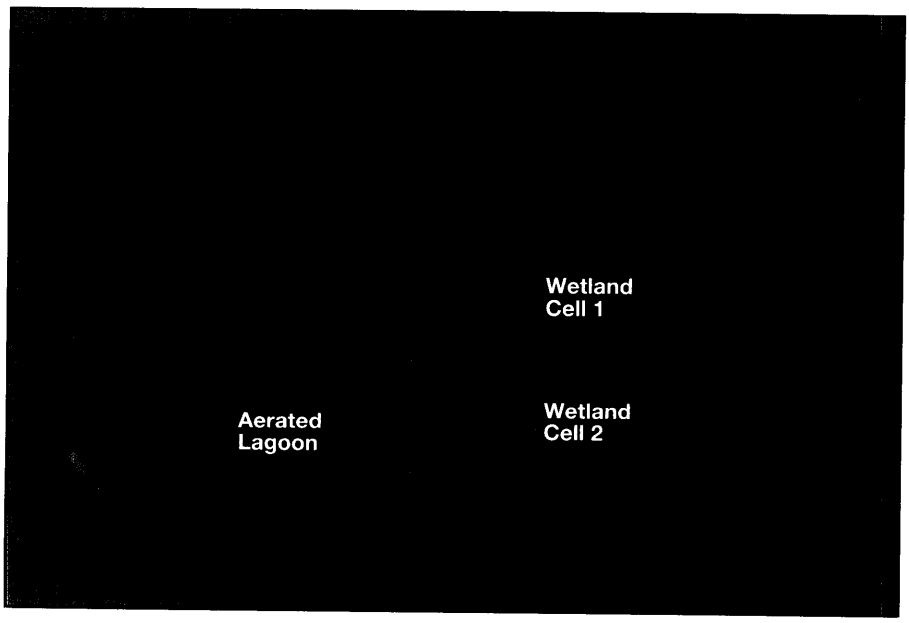
The town's existing stabilization pond was modified to provide more effective pre-treatment. The modifications included relocating the influent and effluent points and adding floating mechanical aerators. Seven acres of the pond were aerated, leaving the remaining area to serve as a settling basin. These modifications improve 5-day biochemical oxygen demand (BOD5) and ammonia nitrogen (NH3-N) removal efficiency, reduce organic and solids loading to the wetland cells, and provide additional flexibility in the overall treatment process.

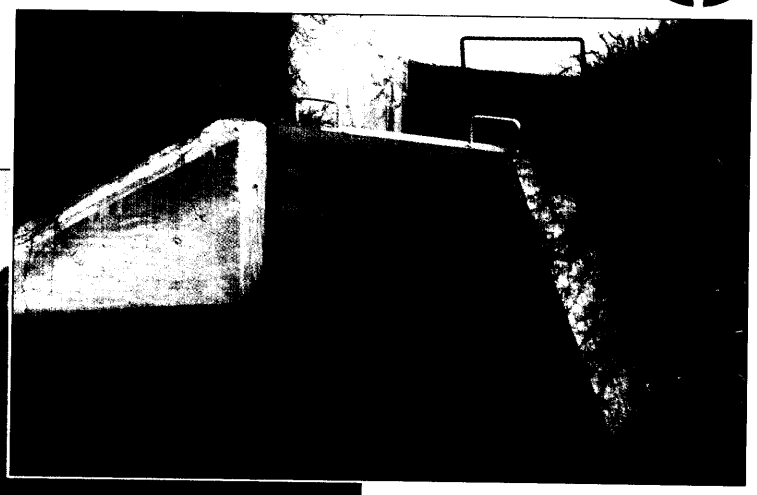
The wetland cells are configured side by side. Each cell covers 7.5 acres and has an aspect ratio (length to width) of 4.6:1. The cell floors are slightly sloped for easy draining during maintenance. Although most of the 15 acres of wetland cells are less than 2 feet deep, each cell has three "deep zones," which are 4 feet deep and about 20 feet wide. The deep zones remain free of rooted marsh vegetation, thus allowing effluent to be redistributed through the system and providing atmospheric aeration. The deeper water in these zones also furnishes year-round habitat for aquatic life, particularly mosquito fish and wetland birds.

The parallel operation of the two wetland cells gives the town the ability to direct all flow through a single cell during wetland resting and maintenance periods. Moreover, the rate of flow to each cell can be varied to allow flexibility in operations and to aid in testing or research.

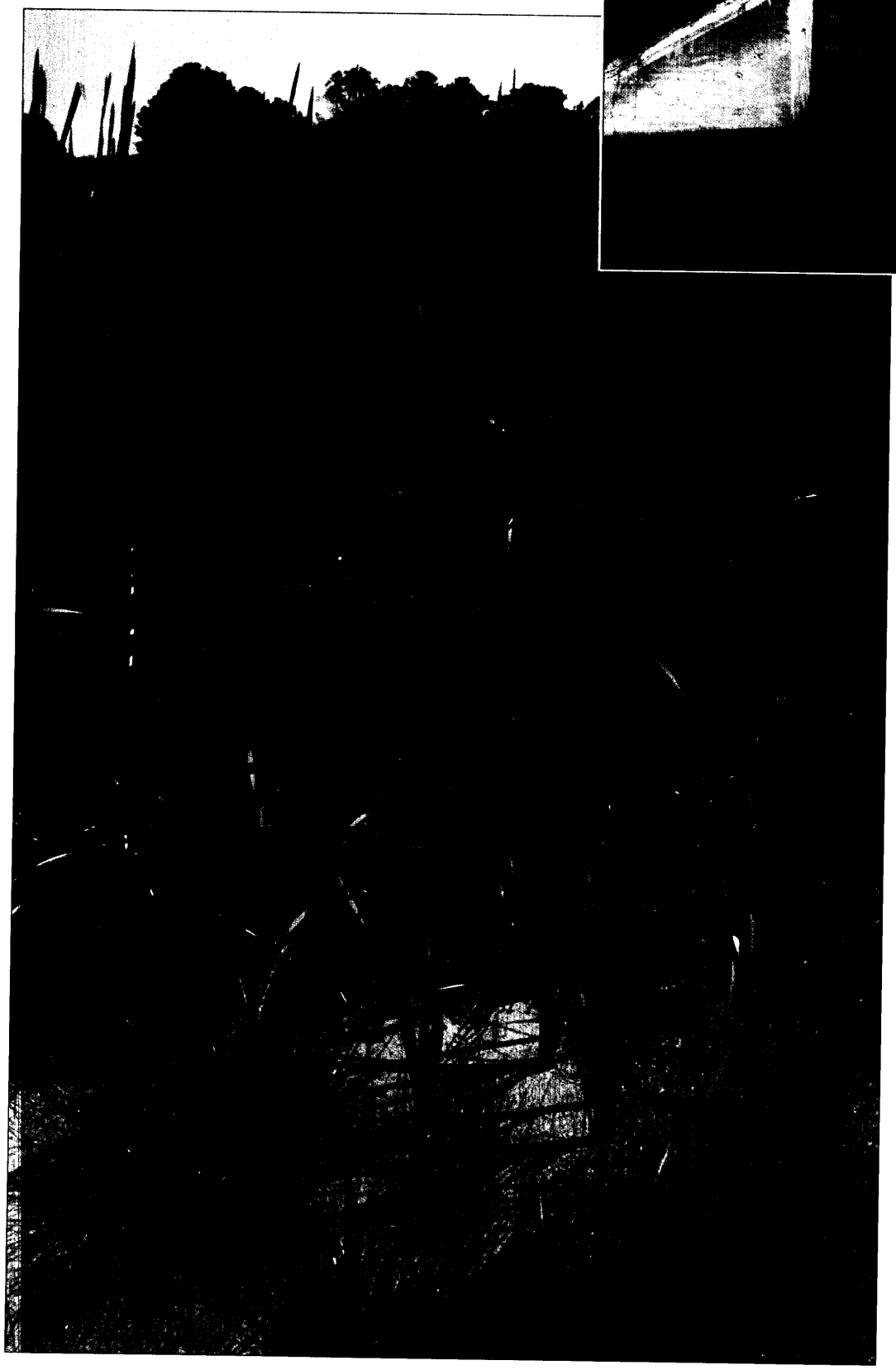
The treated effluent enters a post-aeration pond after passing through the wetland cells. This system component is used to meet the effluent dissolved oxygen limits specified in the permit. This 75,000-gallon earthen pond is equipped with a floating mechanical aerator. Final effluent flow rate from the post-aeration pond is continuously measured by a Parshall flume.

The Fort Deposit constructed wetland treatment system uses an aerated lagoon for pretreatment followed by two parallel wetland cells.





Outlet weir structures allow water level control for adjustment of hydraulic retention time.



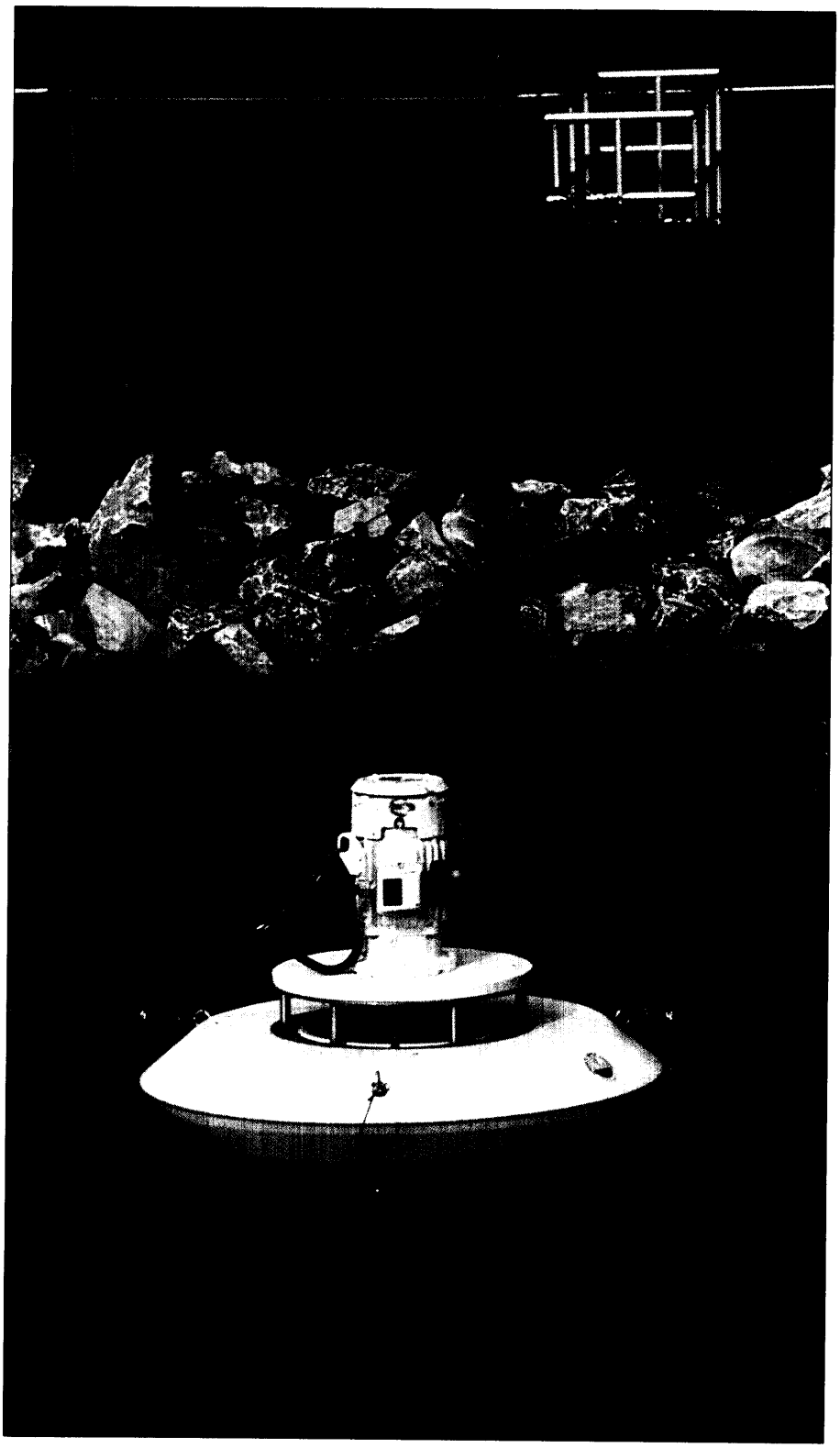
Dense stands of submerged cattail stems and leaves serve as growth media for microorganisms that feed on impurities in the influent. The natural transfer of atmospheric oxygen to these microbes is essential in removing organic matter and ammonia from the wastewater.

BACKGROUND

The town of Fort Deposit, located south of Montgomery, Alabama, has a population of slightly more than 1,500. Until 1985, the town's wastewater was treated in a 10-acre waste stabilization pond and consistently met discharge limits. In 1985, a new discharge permit was issued by the Alabama Department of Environmental Management. This permit required the town to meet more stringent standards based on water quality limitations in the receiving water. Since the town's stabilization pond was unable to meet the new standards, an administrative order requiring the town to upgrade its system was issued.

An engineering analysis of treatment alternatives was conducted by the environmental consulting firm CH2M HILL to compare a variety of conventional and innovative technologies. On the basis of an evaluation of environmental benefits, reliability, and cost, treatment by constructed wetlands was selected as the most cost-effective approach for compliance with the new permit limitations.

The use of constructed wetlands to remove impurities in wastewater and to consistently achieve treatment levels that meet permit requirements was an emerging technology in 1985. To assist with funding their new system, the town applied for and was awarded a $610,000 U.S. Environmental Protection Agency (EPA) Innovative/Alternative Technology grant for its wetland project. This additional funding, coupled with low construction and maintenance costs associated with the wetland system, reduced the financial impact of the upgrade on the community and provided it with a system that would require only slightly more maintenance than the existing stabilization pond.



Post-aeration is essential for compliance with the effluent standard for dissolved oxygen.

ANCILLARY BENEFITS

In addition to improving the quality of the effluent discharged to the receiving stream, the creation of the Fort Deposit constructed wetland treatment system has significantly increased wildlife. This new habitat provides cover and food for various types of wetland-dependent vertebrate and invertebrate life including a variety of ducks and wading birds and their prey.

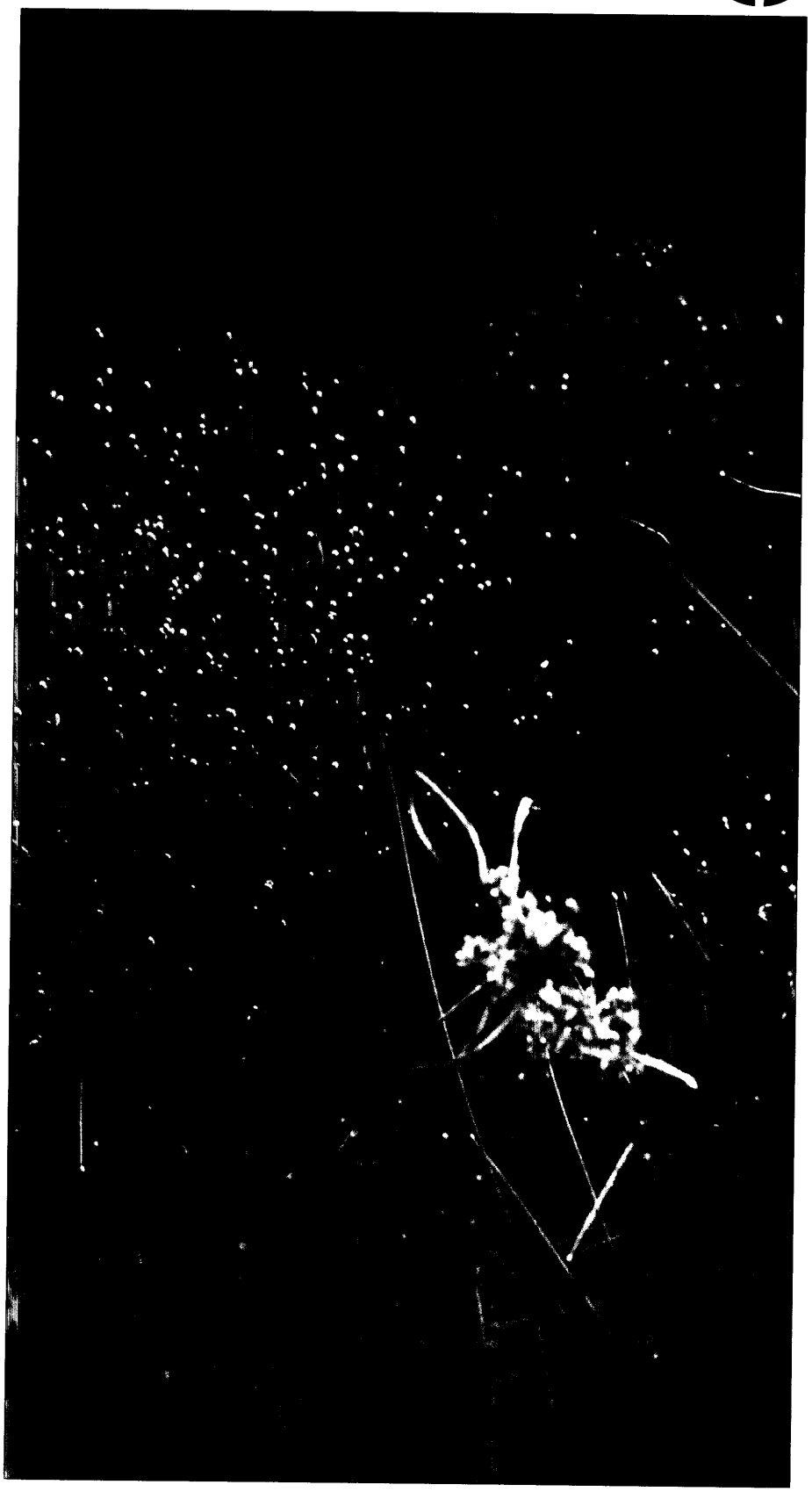
As a result of the wetland's success and the desire of others to adopt similar technology, the town is receiving visitors from other areas of the state and the nation.

Fort Deposit Wetland Design Criteria

Average Daily Flow 0.24 mgd

Influent Quality	
BOD_5	40 mg/L
TSS	100 mg/L
TN	20 mg/L
NH_3-N	10 mg/L
Effluent Criteria	
BOD_5	10(18)[a] mg/L
TSS	30 mg/L
NH_3-N	2(5)[a] mg/L
pH	6-9 units
Areas	
Lagoon	10 acres
Wetland Cells (2)	7.5 acres each

( ) [a] winter limits December-April



The Fort Deposit wetlands continue to diversify as new plant species colonize the cells.

OPERATIONS AND MANAGEMENT

In the Fort Deposit wetland system, wastewater is treated by the naturally occurring bacteria and fungi that colonize the sediments on the bottom of the cells and the stems and leaves of the wetland vegetation below the water level. These microorganisms help transform and remove organic matter and nutrients that might otherwise degrade adjacent surface waters.

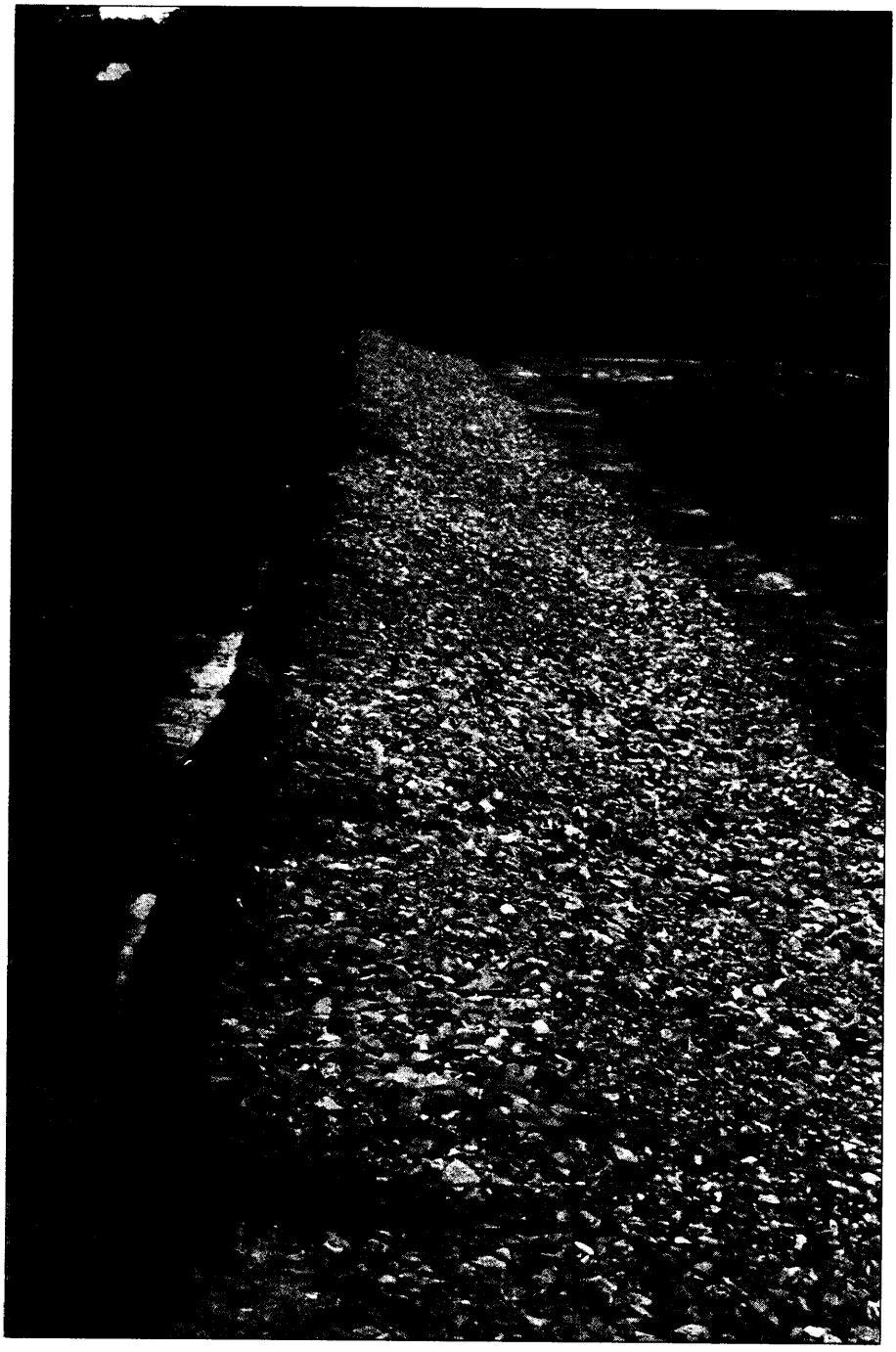
The vegetation in the two wetland cells was selected to simulate a natural wetland and included an initial planting of 68,000 cattail and bulrush plants.

Influent from the aerated pond is distributed to the cells by pipes with 1-inch holes drilled at 10-foot intervals. This method of distributing influent starts the flow through the treatment system and reduces the buildup of solids at the head of the wetland cells.

The system is designed so that the effluent takes up to 30 days to flow through the wetland cells. The actual retention time varies seasonally to account for changes in the reaction rate of microorganisms in the cells. Because the microorganisms react more quickly at higher temperatures, the retention time can be decreased during the summer and still provide the required contact time for effective removal of impurities. Conversely, during the winter's colder temperatures, the reaction rate of the microorganisms is lower and the retention time is increased by raising water levels.

Aluminum stop logs, located in three outlet structures along the width of each wetland cell, control cell water depth and promote the flow of effluent through the treatment system.

After treatment by the wetland cells, effluent is conveyed to the post-aeration pond, where it receives supplemental aeration from a floating aerator.



Influent distribution to the wetland cells is enhanced by perforated pipes on a rip-rap slope across the width of the wetland cells.

ACKNOWLEDGEMENTS

The Waterworks and Sewer Board of the Town of Fort Deposit

Henry Crenshaw, *Chairman*

Leo Goldsmith, *Board Member*

W.O. Ward, *Board Member*

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This brochure was prepared by
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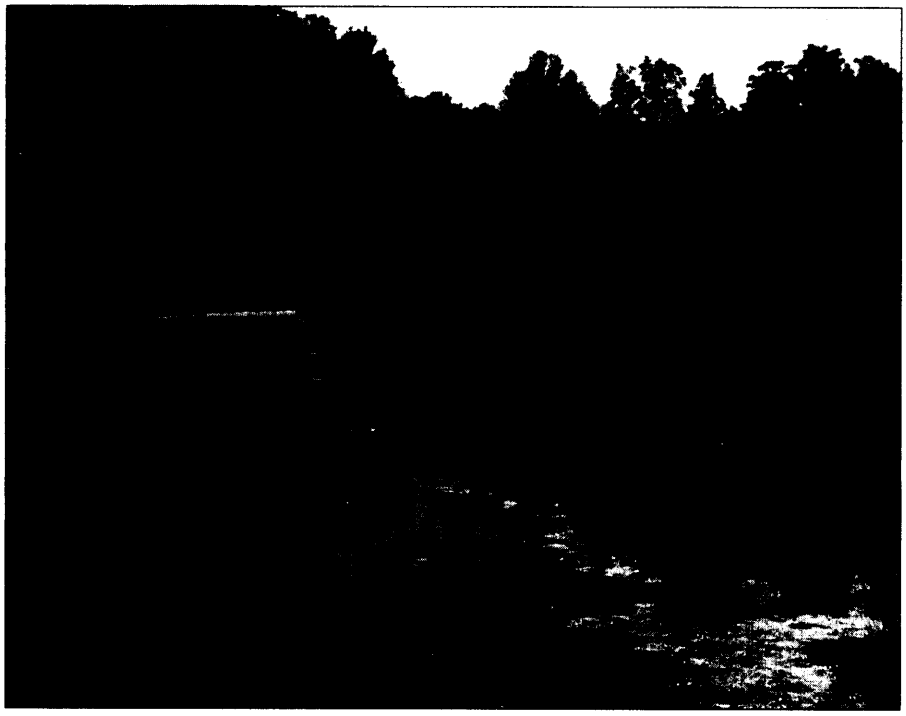
U.S. Environmental Protection Agency.

PERFORMANCE



Deep zones in the wetlands provide open water for ducks and wading birds, enhance flow distribution in the wetland cells, serve as a sump for settling solids, and provide additional hydraulic residence time in the wetland cells.

Construction of the cells began in June 1989, with planting starting during May 1990. By August 1990, the vegetation provided almost complete cover, and operation of the wetland cells began. Since then, with only one exception for NH3, the Fort Deposit constructed wetland treatment system has consistently achieved permit compliance and has caught the attention of others seeking a low cost, dependable natural treatment system. Because of its outstanding contribution to water resource conservation, the Fort Deposit system received several awards including the Alabama 1991 Governor's Conservation Achievement Award, the Alabama Engineering Excellence Award, and the Grand Award from the American Consulting Engineers Council.

Month		BOD_5		TSS		Nitrogen	
		In	Out	In	Out	TKN In	NH_3 Out
1990	August	102	5	137	10	20.0	0.57
	September	27	8	101	18	11.0	0.66
	October	30	3	168	18	19.0	0.78
	November	27	3	127	10	14.0	0.93
	December	15	4	71	9	10.0	2.60
1991	January	20	5	52	10	8.0	1.10
	February	13	4	18	4	11.0	0.74
	March	26	7	40	8	19.0	0.89
	April	22	10	97	15	10.0	0.70
	May	21	9	52	20	8.0	0.35
	June	29	10	72	25	5.0	0.94
	July	33	7	69	10	21	6.43
	August	56	7	183	7	20.0	0.90
	September	24	4	87	12	10.0	0.99
	October	30	8	125	18	6.0	0.75
	November	32	4	106	7	11.0	0.21
	December	33	12	64	16	11.5	0.87
1992	January	39	4	83	19	10.0	0.38
	February	22	4	32	4	6.7	0.15
	March	34	4	58	5	10.0	0.22
	April	31	4	119	3	12.0	0.51

Wetland effluent BOD5 and total suspended solids (TSS) are consistently in compliance with permit limits despite variable inflow quality to the wetland cells. Total kjeldahl nitrogen (TKN) is mineralized in the wetland cells to NH3 and then nitrified to achieve the low discharge limits.