AquaMats® PROCESS

SITE STATS:

Average Daily Flow: 1.47 MGD
Population Served: 12,000
Location: Southwestern Illinois
Water Temperature: Avg. Low (1°C), Avg. High (25°C)

PERMIT(S):

- BOD_5 – 20 mg/L
- TSS – 25 mg/L

RATIONALE FOR AQUAMATS® PROCESS UPGRADE:

Columbia determined that a system upgrade was necessary because (1) the population served and the related daily flow rates were increasing substantially from approximately 0.65 mgd to 1.47 MGD and Columbia WWTP was reclassified to a major facility (2) discharge permit requirements for treatment were becoming more stringent from Total Suspended Solids ("TSS") at discharge of 25 mg/L (from 45 mg/L) and Biochemical Oxygen Demand ("BOD") at discharge of 20 mg/L (from 37 mg/L) and (3) Columbia was not consistently meeting discharge requirements. Without changed practices, compliance by Columbia with the even more stringent standards from Illinois EPA, at more than twice the daily flow rate, was regarded as improbable.

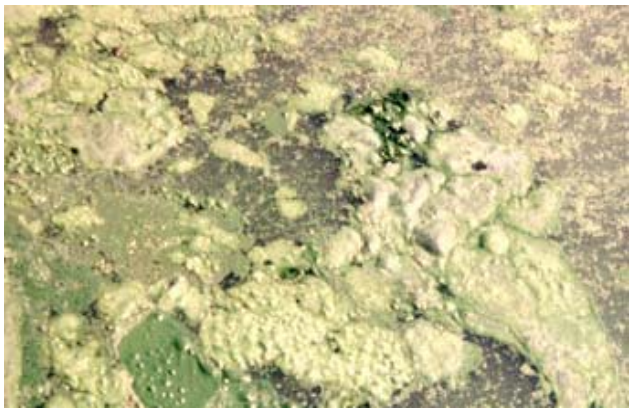
The principal problem areas were determined to be:

- Ineffective oxygen delivery by mechanical surface aerators as evidenced by supersaturation of oxygen on the surface and low or no dissolved oxygen at the bottom of the lagoon.
- Substantial accumulation of organic sludge, particularly in the primary and secondary treatment cells.
- Inadequate treatment in their 8,000 ton rock filter/tertiary cell which was principally a rock filter. (Columbia installed a rock filter field in 1986 as required by ILEPA. It was plugged and non-functional within a year of initial operations. Columbia bypassed the rock filter field with a six-foot wide channel to allow discharge of effluent and continued operations. Accordingly, very little if any nitrification (ammonia removal) and TSS removal was occurring in the final or tertiary stage of the Columbia system as evidenced by progressively increasing ammonia, BOD, phosphorus and TSS values.)
- Significant surface algae problems in warm weather conditions.

Columbia and its design engineer Horner and Shifrin were impressed with the performance history of the AquaMats® Process and its predicted capability to provide solid year round performance, (even with the cold climate conditions of Illinois winters), and to substantially reduce the high cost associated with periodic sludge disposal. **Briefly, AquaMats® Process provides the quality treatment of mechanical plants in lagoons at significant savings in capital and operating costs.** The AquaMats® Process process combines ADS's proprietary diffusion aeration products, engineered surface area ("AquaMats®") and bioaugmentation ("Bacta-Pur®") technologies to form a very stable, and low-maintenance integrated system for natural microbial treatment of municipal wastewater. Operational costs are typically very low. Because of the efficiency of AquaMats® Process, sludge handling is not necessary for up to 10 years or longer.

Case Study Snapshots Columbia, Illinois

Prior to the AquaMats® Process, Columbia experienced the detrimental effects of inadequate oxygen delivery and substandard biofiltration capacity.

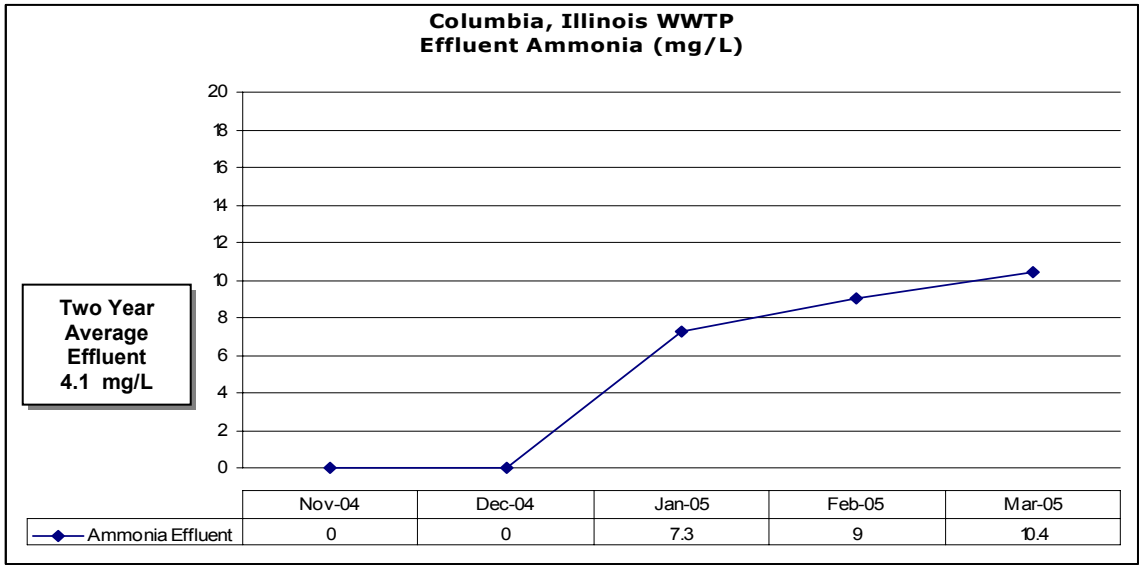


Sludge accumulations prior to the AquaMats® Process.

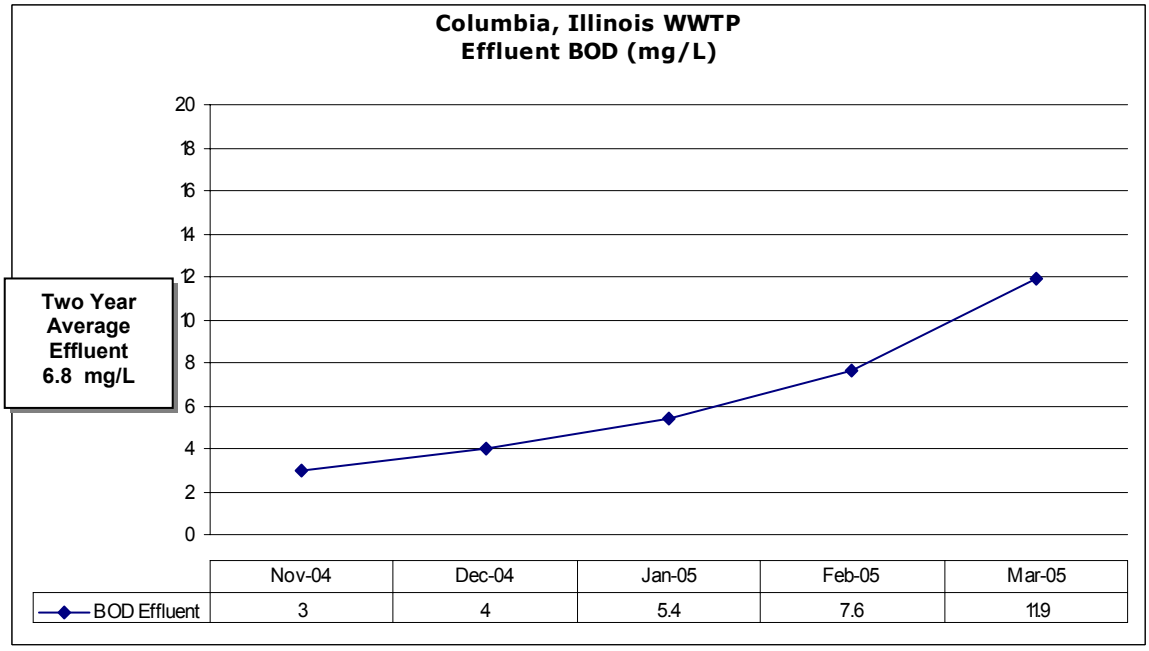
SITE DATA * SITE DATA

DESCRIPTION OF AQUAMATS® PROCESS SITE DATA:

We are very committed to providing unbiased, objective evidence that the process is efficient, cost-effective and reliable. As evidence of this, we work regularly with our customers to gather as much data as we can about their system on a regular basis. IMPORTANT: None of the data is gathered by us directly, it is all provided to us by our customers and then presented here for your review.



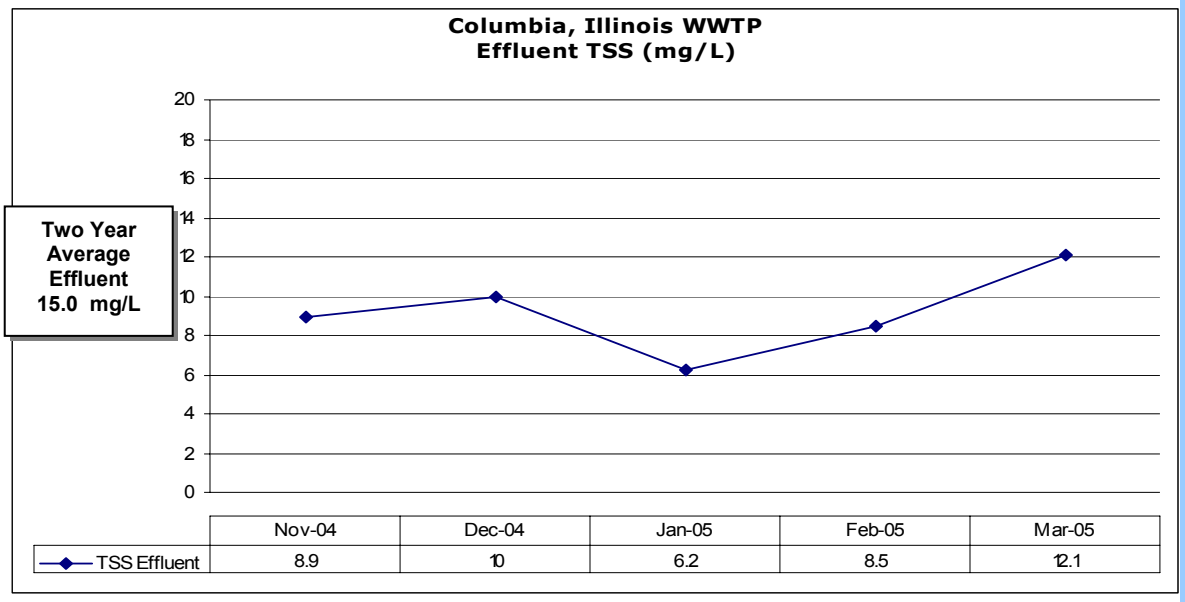
COLUMBIA, IL AMMONIA EFFLUENT DATA TABLE												
2002	**J**	**F**	**M**	**A**	**M**	**J**	**J**	**A**	**S**	**O**	**N**	**D**
2002 Ammonia Effluent		7.8	5.0	4.8	4.0	5.8	5.6	6.5	6.5	6.0	5.0	6.7
2003	**J**	**F**	**M**	**A**	**M**	**J**	**J**	**A**	**S**	**O**	**N**	**D**
2003 Ammonia Effluent	9.0	8.0	10.0	0.9	0	2	3.7	0.4	0.5	0.5	2.3	3.7
2004	**J**	**F**	**M**	**A**	**M**	**J**	**J**	**A**	**S**	**O**	**N**	**D**
2004 Ammonia Effluent	5.7	8.3	6.4	16	4	7	4	2	0		0	0
2005	**J**	**F**	**M**	**A**	**M**	**J**	**J**	**A**	**S**	**O**	**N**	**D**
2005 Ammonia Effluent	7.3	9	10.4									



COLUMBIA, IL BOD EFFLUENT DATA TABLE												
2002	**J**	**F**	**M**	**A**	**M**	**J**	**J**	**A**	**S**	**O**	**N**	**D**
2002 BOD Effluent	17.4	22.6	22.2	14.5	12.2	4.3	2.7	2.8	3.7	2.5	2.7	7.5
2003	**J**	**F**	**M**	**A**	**M**	**J**	**J**	**A**	**S**	**O**	**N**	**D**
2003 BOD Effluent	21.9	33.8	25.7	20.4	9.0	5.9	2.3	0.7	1.7	7.0	10.5	1.9
2004	**J**	**F**	**M**	**A**	**M**	**J**	**J**	**A**	**S**	**O**	**N**	**D**
2004 BOD Effluent	13.1	11.7	9.6	8.3	9.5	5.5	4.5	1.4	0.9	3.0	4.0	7.3
2005	**J**	**F**	**M**	**A**	**M**	**J**	**J**	**A**	**S**	**O**	**N**	**D**
2005 BOD Effluent	5.4	7.6	11.9									

SITE DATA * SITE DATA

SITE DATA



SITE DATA

COLUMBIA, IL TSS EFFLUENT DATA TABLE

2002	J	F	M	A	M	J	J	A	S	O	N	D
2002 TSS Effluent	16.7	31.9	35.7	23.9	24.6	15.4	8.3	7.5	12.7	10.5	4.5	12.6
2003	**J**	**F**	**M**	**A**	**M**	**J**	**J**	**A**	**S**	**O**	**N**	**D**
2003 TSS Effluent	24.3	46.1	56.4	53.4	24.8	11.5	7.3	5.4	6.8	19.8	13.4	10.3
2004	**J**	**F**	**M**	**A**	**M**	**J**	**J**	**A**	**S**	**O**	**N**	**D**
2004 TSS Effluent	22.8	20.1	24.4	10.7	27.9	14.5	10.2	7.4	9.5	8.9	10.0	7.3
2005	**J**	**F**	**M**	**A**	**M**	**J**	**J**	**A**	**S**	**O**	**N**	**D**
2005 TSS Effluent	6.2	8.5	12.1									

DESCRIPTION OF AQUAMATS® PROCESS UPGRADE:

System Wide: Installation of ADS fine-bubble aeration in the primary, secondary and tertiary cells to provide required oxygen transfer rates throughout the water column of the lagoon to replace mechanical surface aerators. Three blowers (rated at 50 HP each—two operational, one standby) were installed to provide the required air for oxygen transfer and circulation.

Primary and Secondary Treatment Cells: Supplemental bioaugmentation with sludge digesting bacteria using certified non-pathogenic and non-GMO strains of beneficial microbes from BactaPur® for organic digestion of accumulated sludge and influent organics.

Tertiary Treatment Cell: Installation of rows of AquaMats® for Biofiltration to provide surface area for biological reduction of TSS, BOD_5, Phosphorus and to also enhance nitrification along with supplemental bioaugmentation with nitrifying bacteria using certified non-pathogenic and non-GMO strains of beneficial microbes from BactaPur®. ILEPA approved the AquaMats® for Biofiltration as a replacement for the previous rock filter tertiary treatment system that had not functioned effectively at Columbia.

AQUAMATS® PROCESS COSTS---CAPITAL, OPERATING AND MAINTENANCE:

Capital costs incurred by the City of Columbia for the AquaMats® Process upgrade were under $2,000,000. This cost is projected to be recaptured through the higher volumes processed by the plant and an increase in sanitary sewer hookup fees for new customers. Operating and Maintenance costs (principally labor and electrical use charges) for AquaMats® Process have not increased as compared to the surface aerator system that AquaMats® Process replaced, despite the increased system capacity and improved treatment. To date, Columbia has lowered its operating costs because the AquaMats® Process system is sufficiently effective in reducing Fecal coliform levels so that routine chlorination and dechlorination is not necessary.

Case Study Snapshots Columbia, Illinois

AquaMats® in polishing cell with later view of surface biofilm and invertebrate colonization on an AquaMat after 6 weeks in wastewater lagoon! When combined with ADS fine bubble diffusion and BactaPur's formulations, AquaMats® support the animal (as opposed to the plant or algal) side of the biological food chain and convert vast quantities of organic waste into aquatic animal life!

Elimination of the routine chlorination also has important environmental stewardship benefits and reduces the risk to plant personnel that is inherent in handling liquid or gaseous chlorine.

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INTERNET LINKS:

Meridian Aquatic Technology for High Performance AquaMats® Technology - http://www.aquamats.com/Biofiltration/biofiltration.html

Air Diffusion Systems, A John Hinde Co.: Lead supplier of aeration engineering and technology products and services - http://www.airdiffusion.com/

IET Aquaresearch for Bacta-Pur® and Bactivator™ Bioaugmentation Products - http://www.bactapur.com/

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Case Study Snapshots
Columbia, Illinois

Since installation in early 2002, Columbia WWTP is comfortably meeting discharge requirements while digesting years of accumulated sludge deposits.

"It is amazingly different. I am one who has to see things to believe it. I'm seeing this water now, as it is now, and in my 24 years of working with the city, I have never seen this wastewater look this clear and clean. Its just unbelievable…. We can look in the [final lagoon with AquaMats®] 10 feet off the banks and look into the water 18-20 inches and see the bottom of the pond. It is definitely making a big difference for us!"

Morris Linnemann
Columbia WWTP Superintendent