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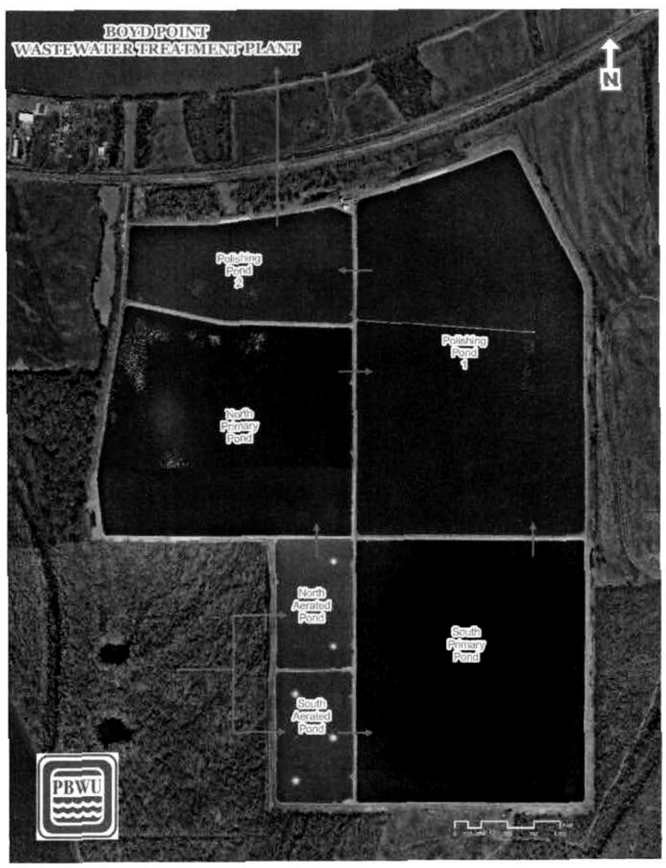
Report

PBWU

Pine Bluff Wastewater Utility

Boyd Point Wastewater Treatment Plant Evaluation

February 19, 2003



Pine Bluff Wastewater Utility

Boyd Point Wastewater Treatment Plant Evaluation

February 27, 2003

Prepared for:

Pine Bluff Wastewater Utility

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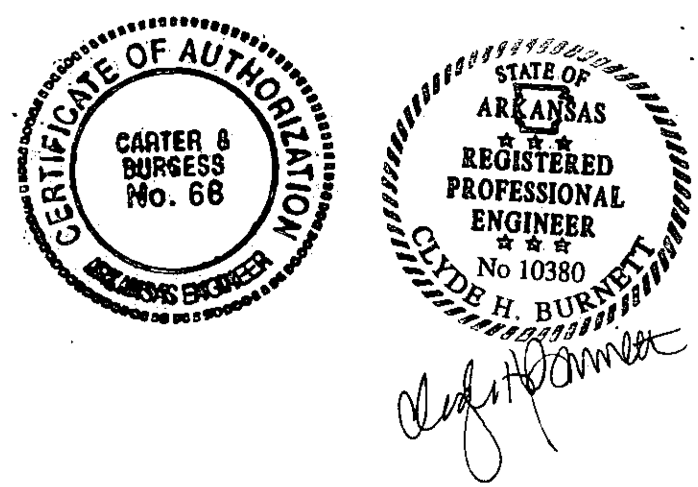

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Section 1
Introduction

The Boyd Point Wastewater Treatment Plant which serves Pine Bluff, Arkansas is near its treatment capacity limit. To evaluate its capacity and determine requirements for upgrading the plant, Bluff Wastewater Utility (PBWU) retained the engineering firm of Carter & Burgess, Inc., Little Rock, to study the facility and develop a plan for increasing its treatment capacity.

Project Scope

This report presents the results obtained from the Boyd Point Wastewater Treatment Plant Evaluation project. Included in the project scope were the following major tasks:

- Evaluate existing wastewater flows and pollutant loadings
- Estimate future flows and loadings using population projections and other sources
- Evaluate deficiencies in the existing plant and determine its realistic treatment capacity
- Identify and evaluate alternatives for upgrading the plant
- Determine the optimum upgrade alternative based on costs and other factors
- Provide a recommended plan for implementing the selected alternative

Carter & Burgess was assisted on this project by the PBWU staff, whose timely assistance, insights, and constructive feedback are hereby acknowledged. The extensive and well organized data record for treatment plant analytical data was also most helpful in evaluating the past operating history of the plant.

Description of Existing Plant

The Boyd Point Wastewater Treatment Plant (WWTP) consists of a system of six ponds or lagoons totaling about 490 acres in size. The original 165 acres of lagoons were constructed in 1968, with the additional ponds including two aerated cells added in 1988. A layout of the pond system is shown on Figure 1. The basic treatment system is comprised of the two aerated ponds, each 14.5 feet in depth and 20 acres in surface area, followed by four facultative ponds about 5 feet in depth, known as the primary and polishing ponds. Flow to the plant first enters the two aerated ponds in parallel followed by the north and south primary ponds, Polishing Pond #1, and finally Polishing Pond #2 where the flow is discharged. The physical characteristics of the ponds are summarized in Table 1. At the current average daily wastewater flow of 11.3 million gallons per day (MGD), the detention time in the pond system is about 86 days.

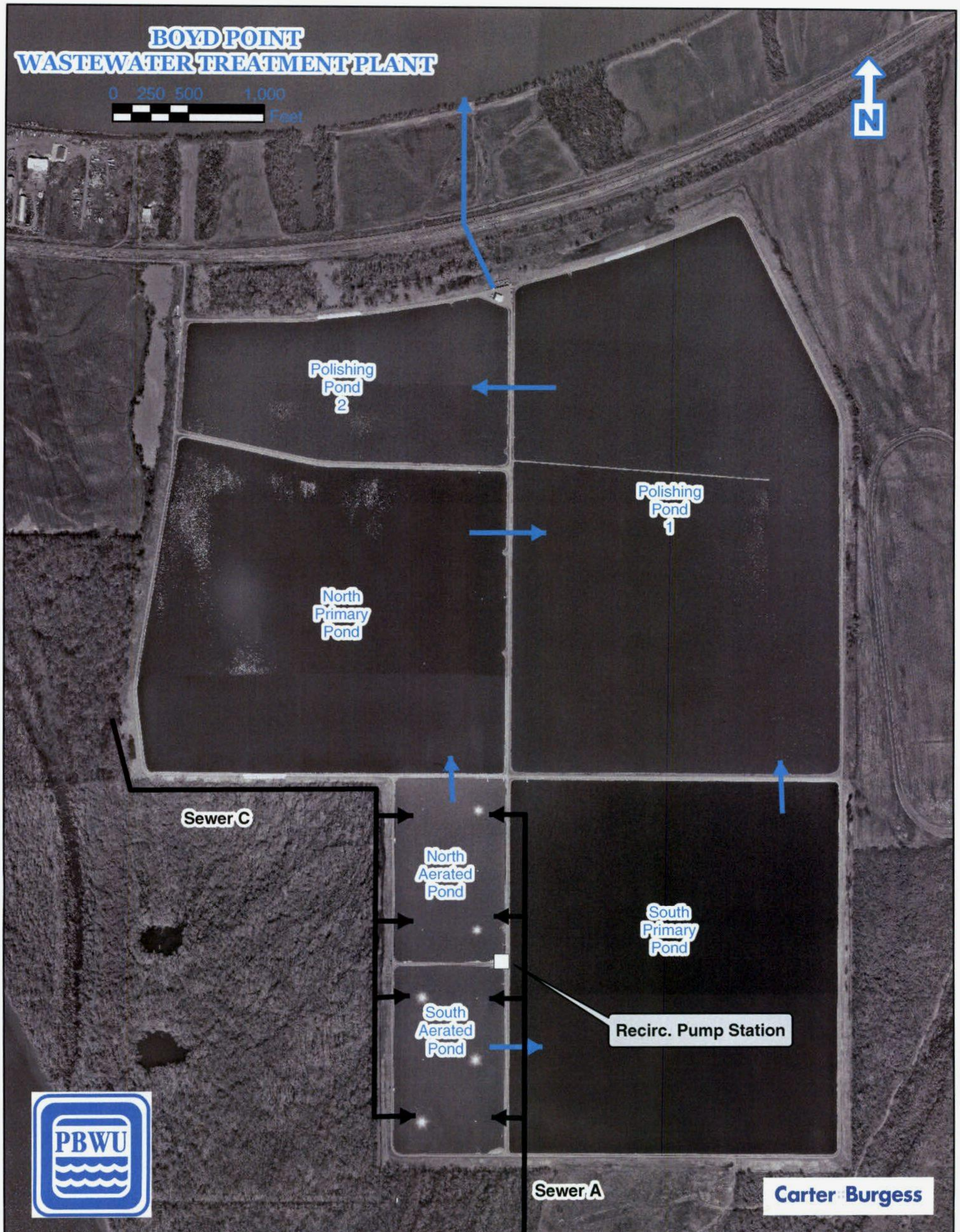

BOYD POINT
WASTEWATER TREATMENT PLANT
0 250 500 1,000
Feet
N
Polishing Pond 2
Polishing Pond 1
North Primary Pond
Sewer C
North Aerated Pond
South Primary Pond
South Aerated Pond
Recirc. Pump Station
PBWU
Sewer A
Carter Burgess

Figure 1

Table 1
Characteristics of Existing Pond System

Cell	*Surface Area (Ac)*	*Average Depth (ft)*	*Volume (MG)*	*Detention Time (days)*	*Average BOD Load (lb/ac/day)*
North Train					
Aerated Pond	20.3	14.5	95.9	17.0	888
Primary Pond	110.4	6.5	233.8	41.4	90
South Train					
Aerated Pond	20.5	14.5	96.9	17.1	879
Primary Pond	122.3	4.5	179.3	31.7	102
Polishing					
Pond #1	164.2	5.5	294.3	26.0	25
Pond #2	45.9	4.5	67.3	6.0	66
Total	483.6		967.5	85.6	75
Average flow, MGD	11.3				
Average BOD load, lb/day	36,037				

The original plant was designed to treat an average daily wastewater flow of 14 MGD, with design solids and organic loads of 250 mg/L total suspended solids (TSS) and biochemical oxygen demand (BOD). Flow currently averages about 11 MGD although influent wastewater strength is high, with BOD in the 600 mg/L range which limits the capacity for additional loading.

The plant is well operated and consistently meets the discharge permit. Discharge limits are 25/90/15 mg/L cBOD/TSS/ammonia during the warmer months and 30/90 mg/L BOD/TSS in the winter. cBOD refers to carbonaceous BOD, which does not include the nitrogenous oxygen demand measured in the test for total BOD. PBWU requested and received permission to monitor cBOD for the May through November permit period. Ammonia removal is only needed during the warmer months and is not required from November through April.

Each of the two 20 acre aerated lagoons contains six 75 HP aerators. Generally, only three are operated in each cell. The plant has chlorination facilities although chlorine is typically not required to control fecal coliform in the pond effluent. Chlorine is used at times to reduce ammonia. Odors are an occasional problem during the summer months.

Additional plant capacity is desired in order to accommodate future growth and provide the capability for more industrial expansion in the city. The required increase in capacity is discussed in the following section.

Section 2
Wastewater Flow and Loading

The Boyd Point WWTP staff has compiled extensive data on water quality and characteristics of each pond in the system amassed through almost daily sampling and laboratory analysis. Data for the period 1998-2001 were examined in detail to accurately assess the loading and variation in BOD, suspended solids, and other parameters compared to the original design values. Results of this examination are presented below. Tables showing the detailed monthly data for the period 1998-2001 are provided in Appendix A.

Current Conditions

A summary of the existing wastewater flows and loadings is provided on Table 2. Included in the table is the wastewater data for both influent sewers to the plant. Sewer A, referred to as the city sewer, serves most of the residential and commercial areas of the city. Sewer C, referred to as the industrial sewer, is actually a force main serving mostly industrial areas within the city. As can be seen from Table 2, while the wastewater flow is less than the design flow, the organic (BOD) loading on the plant is significantly greater than the original design value. This indicates that the plant is currently overloaded. More significantly, since the plant effluent discharge permit requirements are based on a 30-day average, the maximum average over a month's time is more meaningful than the annual average. The maximum month value from 1998 through 2001 was 60,614 lb/day of BOD, which means the treatment plant is required to remove this daily loading of BOD for an entire month. Compared to the design capacity of 29,190 lb/day, it can be seen that the plant is often being required to remove more than twice the amount of organic material that it was originally designed for. That it is doing so successfully is due to the skill and care of the plant operating staff; however, clearly the plant is operating on the edge and improvements are needed now to increase the treatment capacity. Doing so will provide room for additional growth as well as the normal margin of safety these facilities are expected to have.

Since flow meters are not installed on the two influent sewers, the values in Table 2 are based on the assumption by PBWU staff, based on past experience, that Sewer A contributes approximately 40% of the flow and Sewer C contributes 60%. Since the organic load in Sewer C is much greater than Sewer A, assuming 60% of the flow containing this amount of BOD greatly contributes to the large average and maximum month loadings observed. Ideally, flow meters should be installed in these sewers in order to more accurately characterize the total organic load on the plant.

The data also indicate that the plant is receiving significant quantities of oil and grease. Oil and grease constitutes a significant fraction of the BOD load on the plant as well as causing grease and scum accumulations on the surface of the aerated ponds. As a result plant staff is required to occasionally remove accumulated grease with a pumper truck and pay for off-site disposal. Table 2 also includes a summary of maximum and

Table 2
Boyd Point Wastewater Treatment Plant
Existing Wastewater Flow and Loadings

Parameter	*Original Design*	*1998-2001 Average*	*1998-2001 Maximum Month*
Wastewater Flow, MGD - Sewer A		4.6	6.9
Wastewater Flow, MGD - Sewer C		6.9	10.3
Total Wastewater Flow, MGD	14.0	11.4	17.2
Influent BOD, mg/L - Sewer A	250	138	338
Influent BOD, mg/L - Sewer C	250	545	807
Influent BOD, lb/day - Sewer A		5,321	16,449
Influent BOD, lb/day - Sewer C		30,716	51,153
Total Influent BOD, lb/day	29,190	36,037	60,614
Influent TSS, mg/L - Sewer A	250	69	202
Influent TSS, mg/L - Sewer C	250	194	586
Influent TSS, lb/day - Sewer A		2,655	9,838
Influent TSS, lb/day - Sewer C		10,868	26,291
Total Influent TSS, lb/day	29,190	13,523	28,625
N. Aerated Pond Ammonia, mg/L	25	36	52
S. Aerated Pond Ammonia, mg/L	25	41	90
Estimated Influent Ammonia, lb/day	2,919	3,747	7,102
Influent Oil & Grease, mg/L - Sewer A		55	--
Influent Oil & Grease, mg/L - Sewer C		263	--
Influent Oil & Grease, lb/day - Sewer A		2,092	3,156
Influent Oil & Grease, lb/day - Sewer C		15,135	22,835
Total Influent Oil & Grease, lb/day		17,226	25,991

Monthly Average Temperature 1998-2001	*Minimum °C*	*Maximum °C*
Influent	1.8	33.0
Aerated Ponds	5.3	32.3
Primary Ponds	2.2	31.9
Polishing Ponds	1.6	31.5

Discharge Permit Limits	*30-Day Average*
CBOD5, May-November	25
BOD5, December-April	30
Ammonia, May-November	15

Notes

1. Flow split between Sewer A and C estimated at 40%/60%.
2. Sewer A is primarily residential/commercial and Sewer C is primarily industrial.

minimum temperatures that occur in the various pond cells, since this data is needed to characterize and calculate BOD removal rates and dissolved oxygen (DO) transfer rates.

Industrial Contribution

The fraction of the existing wastewater flow and loading that is contributed by industries in Pine Bluff is depicted on Table 3. Wastewater flow was calculated using water consumption records for each industry in the *PBWU Industrial Pretreatment Program*, and assuming 10% consumptive use; i.e., the wastewater flow is 90% of the total water use. Using these values, it appears industries contribute 25% of the total flow but about half of the total organic loading on the plant. Since most of the cost of treatment is associated with the organic load, about half of the total cost of treatment is directly due to the local industries.

Table 3
Industrial Wastewater Contribution

Industrial Component	*Average*	*% of Plant Average*
Industrial Flow, MGD	2.9	25.4%
Industrial BOD Load, lb/day	17,890	49.6%
Industrial TSS Load, lb/day	10,270	75.9%
Industrial Oil & Grease Load, lb/day	3,439	20.0%

Pond Water Quality

Table 4 provides a summary of the water quality in the various ponds. As can be seen, the combined average influent BOD of 379 mg/L is reduced to 119 mg/L in the aerated ponds, further reduced to 43 mg/L in the primary ponds, and exceeds the required discharge permit limit of 30 mg/L in the polishing ponds. While the polishing ponds show an average water quality the meets the discharge criteria, there is basically no margin of safety since the BOD has averaged 29 mg/L over the past 4 years.

Table 4
Pond Water Quality Summary

Water Quality Summary 1998-2001	*BOD mg/L*	*TSS mg/L*	*NH3 mg/L*	*DO mg/L*
Aerated Ponds	119	114	43	1.0
Primary Ponds	43	68	28	2.2
Polishing Ponds	29	50	10	4.5

Proposed Design Criteria

In determining required design values for upgrading the Boyd Point WWTP, it was desired by PBWU to achieve two primary conditions. These are:

- Provide capacity for future population growth in Pine Bluff
- Provide capacity for future industrial growth

Although the population of Pine Bluff has actually declined slightly in recent years, the City of Pine Bluff Planning Department projects that this trend will be reversed and that population will begin to increase. Based on this forecast, it was desired to provide enough wastewater treatment capacity for the population to grow at a modest rate over the next 20 years. Additionally, the Pine Bluff Industrial Alliance is optimistic about the prospect of a new industry moving to the city. One of the primary drivers for enlarging the plant is to provide assurance to a potential industry that wastewater treatment capacity would not be an issue. In this regard, it was decided that enough WWTP capacity should ideally be available to accommodate another large food processing industry the size of the existing Tyson – Industrial Park operation.

Using water consumption records for Tyson together with the approximate organic load, it was determined that a future industrial allowance of about 10,000 lb BOD/day should be provided for industrial growth together with an allowance for future population growth of 4,000 lb BOD/day, recognizing that the improvements required to support this growth can be phased in over time as the growth materializes. However, due to the overloaded condition of the existing plant, some improvements are required now regardless of future growth.

The proposed design criteria for enlarging the plant is shown on Table 5. It is recommended that a future BOD load of 50,000 lb/day be planned for compared to the existing load of 36,000 lb/day, a 39% increase. However, since maximum month conditions govern the size of the installed treatment facilities, it is recommended that a maximum month treatment capacity of 75,000 lb BOD/day be provided, compared to the existing maximum month amount of 60,600 lb BOD/day. Therefore, the basis of design for enlarging the plant should be 75,000 lb BOD/day. Hydraulically, provisions should be made to accommodate an increase in flow from 14 to 16 MGD average, or 17 to 24 MGD for the maximum month. As a means of comparison, wastewater flow from the City of Little Rock contains approximately 80,000 lb BOD/day. Thus, PBWU will need to be able to treat a wastewater load roughly equivalent to the City of Little Rock.

Table 5
Proposed Wastewater Flow and Loadings

Parameter	Original Design	1998-2001 Average	1998-2001 Maximum Month	Proposed Design Average Month	Proposed Design Maximum Month
Total Wastewater Flow, MGD	14.0	11.4	17.2	16	24
Total Influent BOD, lb/day	29,190	36,037	60,614	50,000	**75,000** ✓
Total Influent TSS, lb/day	29,190	13,523	28,625	20,000	35,000
Estimated Influent Ammonia, lb/day	2,919	3,747	7,102	5,200	8,500
Total Influent Oil & Grease, lb/day	--	17,226	25,991	24,000	33,000

In addition to BOD, a greater capacity for removal of ammonia is also required. The existing discharge permit requires only partial removal of ammonia during the summer months. An effluent limit of 15 mg/L NH3 must be met from April through October. Water quality issues in the Arkansas River, which is the receiving stream for the Boyd Point WWTP, continue to be studied by the Arkansas Department of Environmental Quality (ADEQ). It is possible that a lower ammonia limit, such as 4 mg/L, will be required at some point in the future. Therefore, the plant upgrade should be planned with the capability to achieve or easily add ammonia removal should this become a requirement.

Some WWTPs in Arkansas are required to remove phosphorus, which is a nutrient that can cause algae blooms in downstream lakes. However, there is no indication that phosphorus removal will become a requirement on the Arkansas River, and it is unlikely that any water quality problems occur downstream due to phosphorus. For this reason it does not appear necessary to plan for phosphorus removal at the Boyd Point facility. Any upgrade made to the plant, however, should be planned so that phosphorus removal could be added in the future if necessary.

Section 3
Evaluation of Existing Plant

In addition to the detailed examination of historical plant operating data, Carter & Burgess also evaluated the condition of the existing processes and facilities that comprise the Boyd Point WWTP. The results of this condition assessment are provided in this section.

Capacity

An analysis of the operating data presented in Section 2 clearly shows that on average the plant is receiving and treating 23% more BOD than it was designed for. Given that the staff have been very successful in meeting the required discharge permit almost all of the time, it might be assumed that the plant has not reached its full capacity. Examination of the effluent discharge quality for the period 1998-2001 indicates the following excursions or violations of the plant's discharge permit, where average effluent exceeded the discharge limit for an entire month:

Table 6
Permit Compliance History

	No. Excursions, 1998-2001		
Year	*BOD*	*TSS*	*Ammonia*
1998	1	0	0
1999	6	0	0
2000	0	0	0
2001	1	0	0

The fact that some excursions have occurred in the past and given that the average water quality in the final Polishing Ponds (29 mg/L BOD) is very near the discharge limit (30 mg/L BOD), it is apparent that the existing plant cannot be reliably expected to treat additional load. In fact, considering the normal margin of safety and degree of reliability the plant should have, the normal capacity of the plant is estimated at 80% of the existing average organic load of 36,000 lb/day, which is very close to the original design capacity of 29,190 lb/day. And, as further described below, the plant has insufficient oxygen transfer to metabolize and remove more than this amount of BOD.

Aeration

As mentioned, the two aerated lagoons are each equipped with six 75-HP floating high-speed aerators. Generally, only three are operated in each aerated lagoon since dissolved oxygen levels do not change markedly even with all 12 machines running. The reason this occurs is that the oxygen demand from the large BOD load greatly exceeds the amount of DO available from the aerators. For BOD removal, about 1.5 lb O2/lb BOD is required. For the average influent load shown in Table 2, about 54,000 lb O2/day are required in the aerated ponds. However, the 12 75-HP aerators are capable of transferring only about 38,000 lb O2/day if all aerators are running. This results in low or negligible dissolved oxygen levels in the ponds, which reduces treatment efficiency and can create odors caused by anaerobic conditions.

To adequately treat the current wastewater load as well as provide an increase in treatment capacity in the future, significantly more aeration capacity is required. Alternatives for providing the increase in oxygen transfer are described in Section 4.

Sludge

In normal wastewater lagoon treatment systems, some sludge can be expected to accumulate in the pond cells over time. The ponds at the Boyd Point WWTP have not been cleaned since they were originally constructed. If accumulation of sludge is significant the volume available for wastewater treatment is reduced and odors may be released as well.

To determine the amount of sludge in the Boyd Point ponds, two separate sludge investigations were conducted. Both were carried out by private contractors who are in the business of cleaning lagoons and disposing of sludge. These were Terra Renewal Services in Russellville, Arkansas, and Synagro, a sludge disposal contractor from Houston, Texas who currently manages sludge from storage lagoons owned by the City of Little Rock. Both surveys were conducted from a boat on the ponds using a sounding pole or depth finder. Neither survey found appreciable accumulation in the aerated ponds, which is not surprising since the ponds are mixed which keeps most of the solids in suspension. Accumulation varied but averaged about 1.5-ft in depth in the aerated ponds.

In the Primary Ponds, sludge was largely absent from most of the pond area, with <6-in. accumulation. Some sludge deposits were found on the northerly side of the Primary Ponds, with maximum depths to 2.5-ft. However, on aggregate, there is not enough overall sludge accumulation to impede the treatment performance or to warrant draining the ponds at this time and hiring a sludge disposal contractor. Instead, accumulations should continue to be monitored periodically in the years ahead and sludge removed at the appropriate time in the future.

Samples of sludge in the ponds were also collected and tested to determine if Class B pathogen standards of 2,000,000 MPN/g fecal coliform were met as specified in 40 CFR Part 503 EPA regulations. Fecal coliform levels in all samples tested were well below this level which means the sludge can be applied to area farmland for ultimate disposal.

Copies of laboratory data on the sludge and correspondence received regarding sludge disposal is provided in Appendix B.

Discharge Flexibility

A limitation on the operation of the Boyd Point WWTP is the inability to discharge effluent during all flow conditions on the Arkansas River. Additionally, when water quality is exceptionally good in the Polishing Ponds it would be preferable to discharge a greater quantity of flow than allowed by permit, so that in turn effluent can be retained should treatment standards be less than desired. PBWU sought approval to discharge more flow and loading than is currently allowed by applying for a permit amendment to incorporate a hydrograph controlled release (HCR) system. Under the HCR approach, when flow in the Arkansas River is greater than 10,000 cfs, the plant can discharge up to 1.7% of the river flow to a maximum of 50 MGD. This would provide needed flexibility in operating the plant, and would be achieved by constructing an effluent pump station capable of discharging the maximum 50 MGD allowed.

At the present time approval of the HCR amendment to the Boyd Point WWTP discharge permit has not been granted by ADEQ. However, the HCR pump station would still be beneficial by allowing plant discharge to continue during high river flows. This benefit is significant since high flows can last a number of days and adequate freeboard may not always be available to accumulate and hold flow within the plant. For this reason, it is recommended that design and construction of the HCR effluent pump station proceed.

Other Operational Issues

In addition to the above items, certain other issues effect the capacity and operation of the plant, which are discussed below.

Influent Flow Measurement

At present no measurement of the influent flow to the plant is available. The plant does have an effluent flow meter which is required by ADEQ. Measurement of influent flow is also important in that it allows accurate characterization of actual loadings on the plant. For this reason it is recommended that flow meters be installed on both Sewer A and Sewer C, or, alternately, in a new influent structure which receives the combined flow from both lines.

Flow Routing Baffles

The previous plant expansion included construction of floating baffles in both Primary Ponds and Polishing Pond #2 as an aid in routing wastewater through the pond cells to prevent short circuiting. This maximizes the detention time in the pond and should lead to better overall treatment. The original floating baffles have since been destroyed by wind and wave action, and short circuiting through the ponds is undoubtedly occurring. To maximize the detention time in the ponds and take full advantage of the investment in lagoon volume, it is recommended that these flow routing baffles be replaced. More robust designs are now available which will withstand the expected wind and wave conditions.

A concern has been expressed by PBWU staff that effluent quality actually improved after the baffles were destroyed, which is attributed to the shorter detention time that retarded algae growth. In other words, the detention time in the ponds was thought to be too long. However, even with short circuiting it is unlikely that the baffles caused an increase in algae concentrations, since algae would still be expected to grow throughout the pond area regardless of the presence of baffles. It is not truly possible to determine precisely why water quality improved without the baffles. For example, wind could have moved the algae away from effluent pipes and caused it to settle in a location that did not leave the system. But, with proper design of effluent structures it is possible to control the amount of algae leaving the pond. Taking advantage of all of the pond area available will allow more BOD removal to occur in the Primary Ponds, which in turn will reduce the aeration requirements of the aerated ponds. For this reason, it is recommended that the baffles be replaced together with installation of appropriate algae management tools. These tools are described in more detail in Section 4.

Analytical Measurements

The laboratory staff at the Boyd Point WWTP has compiled an extensive analytical data record for each pond in the facility. These data were used to evaluate and characterize the historical flows and loadings on the plant as discussed in Section 2. All information relevant to an engineering analysis of the plant was available. In fact, it may be practical to reduce the amount of sampling and analysis being conducted for some parameters, such as the nitrogen series, to a less frequent time period. Weekly testing of the nitrogen compounds would save on labor and laboratory costs, and should be considered unless these data are needed for other purposes.

Section 4
Plant Upgrade Alternatives

Using the design criteria developed in Section 2, and based on the evaluation of the existing plant, feasible alternatives for expanding and upgrading the Boyd Point facility were developed and are evaluated in this section. Evaluation included identification of feasible plant upgrade options, screening of technologies, and formulation of detailed alternatives for upgrading the plant. Each alternative was then evaluated on the basis of cost and other factors as described below.

Final Design Criteria

The criteria used for sizing facilities and equipment needed to enlarge the plant are summarized in Table 7, which represents an approximately 40% increase in loadings compared to current conditions.

Table 7
Boyd Point WWTP Upgrade
Design Criteria

Influent Parameter	*Max. Month*
Design flow, MGD	24
BOD, lb/day	75,000
BOD, mg/L	375
TSS, lb/day	35,000
TSS, mg/L	175
Ammonia, lb/day	8,500
Ammonia, mg/L	42
Oil & Grease, lb/day	33,000
Oil & Grease, mg/L	165
Minimum Temperature, deg C	1.8
Maximum Temperature, deg C	33.0

Aeration requirements in the aerated ponds are based on a certain degree of BOD removal in the Primary and Polishing Ponds downstream; i.e., it is not necessary to provide the mechanical aeration necessary to remove all of the influent BOD in the aerated ponds. To do so would not make wise use of the considerable investment that has been expended in constructing the entire pond system.

Aerated Pond Upgrade

As mentioned, more aeration and oxygen transfer is required to increase the BOD removal capacity of the aerated ponds. Techniques are available to enhance the performance of the aerated ponds through reconfiguration of the lagoon system. One approach would be to reconfigure the lagoons into one of the treatment systems listed below.

- Dual powered multi-cellular aerated lagoon system
- Complete mix/partial mix lagoon system
- Activated lagoon system

Options for using these systems are further described below.

Dual Powered Multi-cellular Aerated Lagoon

The dual powered multi-cellular (DPMC) lagoon system, developed in South Carolina, is a high-rate system that uses short detention time cells to remove BOD and retard the growth of algae. The typical configuration requires an aerated cell with 2 days detention time followed by 2 or 3 polishing cells with 1 day detention time. All aeration required is provided in the initial cell. While the systems do work quite well, the DPMC lagoon system would not be appropriate for Pine Bluff due to the presence of existing large lagoons which would largely be abandoned if the shorter detention time, high-rate system was installed. Additionally, substantially more aeration would be required compared to other available alternatives, and more operator attention would be needed to monitor and control the high-rate treatment system.

Complete Mix/Partial Mix Lagoon

The complete mix/partial mix is similar in concept to the DPMC system, except that larger cells and greater detention time are used. Complete mix refers to providing enough energy to mix the pond contents as well as meeting the oxygen transfer requirements. Partial mix refers to providing enough energy to meet the oxygen transfer requirements but not enough to maintain all solids in suspension. Generally, with complete mix/partial mix systems aeration is provided in all pond cells with the exception of the final polishing cells. For application to the Boyd Point facility, the second stage facultative cells (Primary Ponds) are too large for installation of effective partial mix systems. However, reconfiguring the two aerated ponds into a complete mix/partial mix system followed by the facultative ponds would provide a more efficient level of treatment compared to the existing arrangement.

Activated Lagoon

The activated lagoon is a more advanced treatment system designed to achieve total nitrification, or ammonia removal, year round. This is accomplished by settling out sludge from the aerated ponds and recycling it back to the influent. Over time the solids retention time will increase, creating conditions for growth of nitrifying microorganisms. The activated lagoon can be used with any aerated lagoon system, but would not be appropriate for Pine Bluff unless complete nitrification were required. Since this is a future possibility for Boyd Point, the activated lagoon option warrants further consideration.

Boyd Point WWTP Approach

Given that the Boyd Point WWTP has 490 acres of ponds, the treatment efficiency of the existing pond system should be maximized in order to reduce the amount of additional aeration that must be provided mechanically. Maximizing existing treatment will require making improvements to the Primary Ponds. Doing so will reduce the overall cost of upgrading the plant as well as result in lower operating costs compared to not using these facultative lagoons.

Improvements required to the Primary Ponds consist mainly of installing new baffles to increase the detention time and reduce short circuiting of flow. With these improvements the ponds can be loaded at 40 lb BOD/ac/day, resulting in removal of about 9,300 lb BOD/day. With the requirement to remove a total of 75,000 lb BOD/day at the maximum month condition, the remaining 65,700 lb BOD/day must be removed in the aerated ponds. While still significant, this approach results in the lowest total horsepower requirements for the pond system.

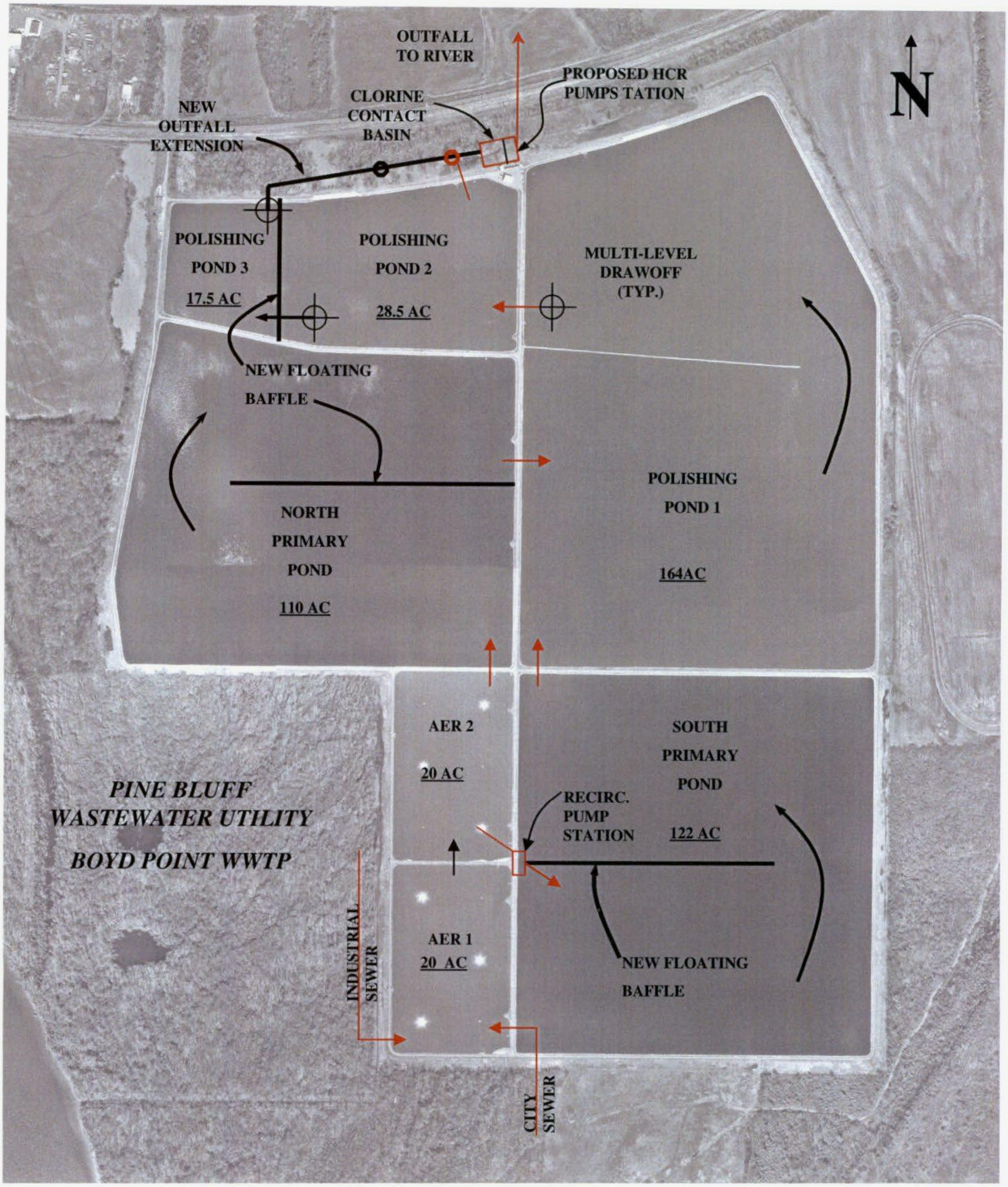
Algae Management System

In addition to reducing the short circuiting that is undoubtedly occurring in the Primary Ponds, other improvements are needed to both the Primary and Polishing Ponds to provide a better defense against algae. The improvements recommended in the Primary and Polishing Ponds are:

- Install new floating baffles to reduce short circuiting
- Reduce detention time in final polishing cell to 2-4 days.
- Provide capability to remove effluent from various depths
- Install hydrograph-controlled release (HCR) effluent pump station

A layout of the reconfigured Primary and Polishing Ponds incorporating the above features is shown on Figure 2. The new floating baffles in the Primary Ponds should significantly increase the detention time through these cells. Additionally, a floating baffle is shown in the last pond to create a new Polishing Pond #3 with the shorter detention time. Keeping the detention time under 4 days will retard the reproduction rate of algae and slow their continued growth in the final polishing pond. While other configurations are possible, the new baffle is shown on the westerly end of Polishing Pond #2 to provide a more regular shape to the final cell. As shown, the existing WWTP outfall would need to be extended to the new cell.

Providing a multi-level drawoff from the ponds will allow water with the best quality and least algae to be transferred from one pond to another. This in turn will reduce the amount of algae being transferred downstream. Since the existing Primary and Polishing Ponds are only 5-6 ft in depth, providing a multi-level drawoff may not be practical.



PBWU

BOYD POINT WWTP

UPGRADES TO PRIMARY

AND POLISHING PONDS

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FIG. 2

Instead, the discharge pipe from one cell to the next should be adjusted to approximately two feet below the water surface.

In the final polishing cell, it is important that multi-level drawoff capability be provided. To achieve this it is recommended that this cell be dredged an additional 2.5-ft to a total depth of 8-ft. An 8-ft total depth will provide flexibility by allowing selection of 3 or more different levels within the pond for discharge, depending on which layer has the best water quality. Additionally, by adding the proposed effluent pump station, it will be possible to discharge greater quantities of water during conditions when pond water quality is exceptionally good, assuming the permit amendment for HCR is approved by ADEQ. The effluent pump station will in any case allow the plant to continue discharging during high river stages.

With these improvements to the Primary and Polishing Ponds, the only remaining item is upgrading the Aerated Ponds to provide more BOD removal capability, which is where most of the cost of upgrading and operating the plant will occur. The alternatives for upgrading the aerated ponds are discussed in the following section.

Description of Alternatives

There are a variety of means for increasing the treatment capacity of a conventional wastewater lagoon treatment system. Given the deficiency in current aeration capacity, all alternatives evaluated require varying degrees of increased aeration. As discussed, the Primary and Polishing Ponds require changes to reduce short circuiting, increase their treatment efficiency, and control algae. These downstream improvements are common to all alternatives.

Other upgrade techniques are also possible but were ruled out as being impractical. These include enlarging the existing plant by constructing more pond cells. The Utility does not own land needed for adding more ponds and purchasing additional land would be difficult considering the development that is encroaching on the existing facility. Also, the Boyd Point WWTP is already one of the largest pond treatment systems in the U.S., and further expansion of the pond system is not considered practical. Another upgrade technique is the use of duckweed treatment to control algae. By creating proper growth conditions for duckweed, it can be made to cover the surface of the pond to block sunlight. However, duckweed would not help in providing the significant increase in dissolved oxygen required to meet the design criteria, and was therefore ruled out. Additionally, the algae management scheme proposed is less costly than a comparable duckweed system..

The basic upgrade alternatives selected for evaluation are:

Alternative 1: Upgrade aerated lagoons.
Alternative 2: Install anaerobic lagoons.
Alternative 3: Provide pretreatment for oil and grease removal.
Alternative 4: Provide further upgrade to achieve complete ammonia removal.

Alternative 1 is further divided into two sub-alternatives:

Alternative 1A: Upgrade aerated lagoons using surface aerators.
Alternative 1B: Upgrade aerated lagoons using diffused air.

All of the alternatives involve reconfiguring the aerated ponds into a complete mix/partial mix system. The South Aerated Pond would be divided into two cells, with more aeration concentrated in the first cell where the BOD load is highest. The second cell in the South Aerated Pond would also be completely mixed. The North Aerated Pond would have the lowest fraction of the required aeration and would be a partially mixed pond.

The various upgrade alternatives are described in detail below.

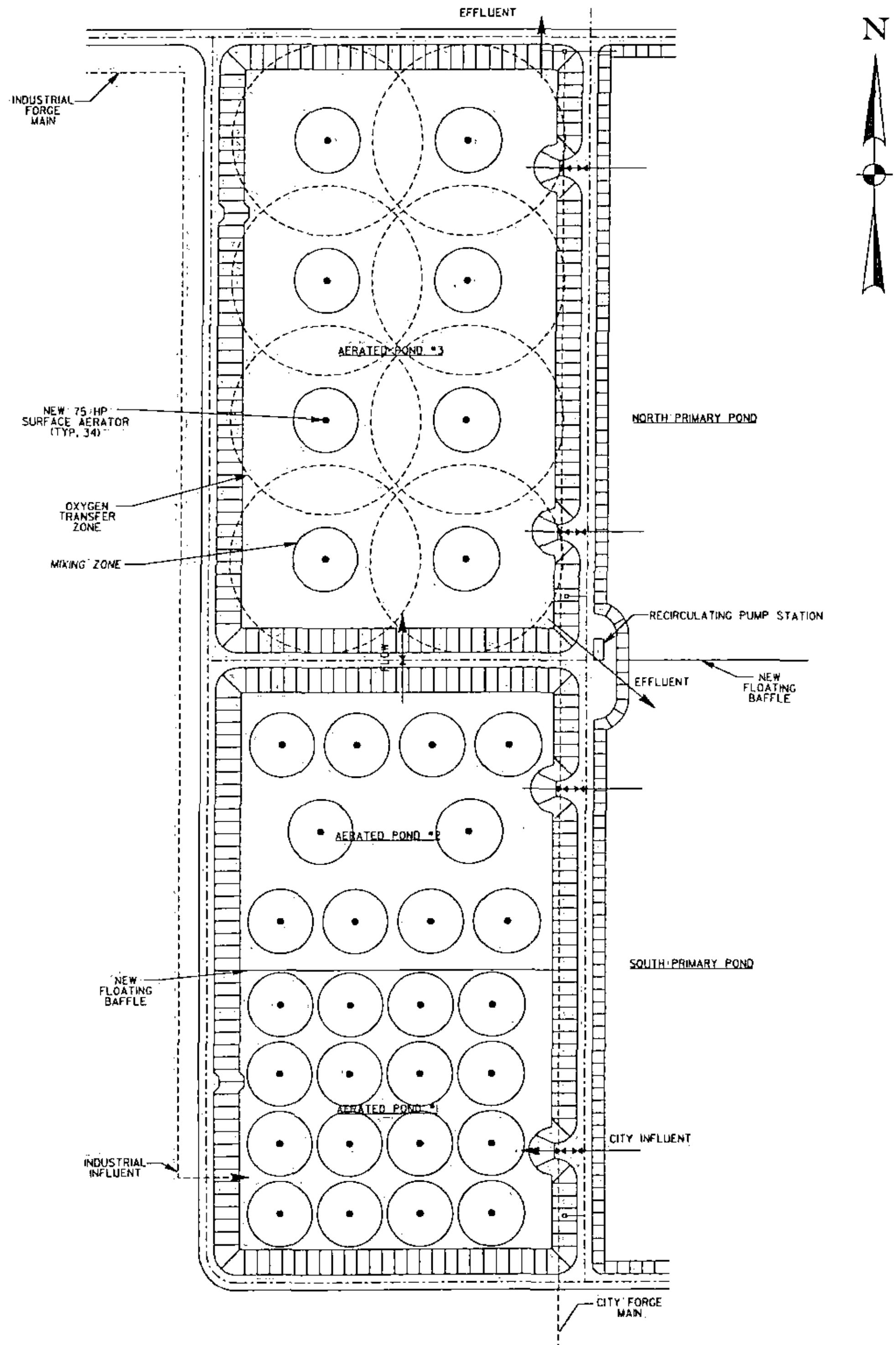
Alternative 1A: Upgraded Aerated Lagoon System Using Surface Aerators

Alternative 1A consists of modifying the existing aerated ponds to improve treatment efficiency by adding more surface aerators, and reconfiguring the ponds to provide a more efficient tapered aeration system. A layout of Alternative 1A is shown on Figure 3. Features of Alternative 1 include:

1. Divide South Aerated Pond into 2 cells, one with 2.25 days detention time (DT) at projected average flow of 16 MGD, and the second with 3.75 days DT.
2. Refurbish 12 existing 75 HP Aqua Aerobics surface aerators.
3. Purchase 22 new 75 HP surface aerators.
4. Install 16 aerators in Aerated Cell 1, 10 aerators in Aerated Cell 2, and 8 aerators in North Aerated Pond.
5. Install new floating baffles in North and South Primary Ponds.
6. Install new floating baffle in Polishing Pond 2 to create Polishing Pond 3 with 2-4 days DT.
7. Install new multi-port outlets in all three Polishing Ponds.
8. Install 4-50 HP surface aerators in Polishing Pond 3 to drive off CO2 and retard algae growth.
9. Extend existing 36-in outfall to new Polishing Pond 3.

Advantages of the surface aeration system include:

- Easier to remove sludge from basin (do not have to disassemble and remove air headers and diffusers).
- Aerators require little maintenance.



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ALTERNATIVE 1A

UPGRADED AERATED LAGOON SYSTEM USING SURFACE AERATORS

Figure 3

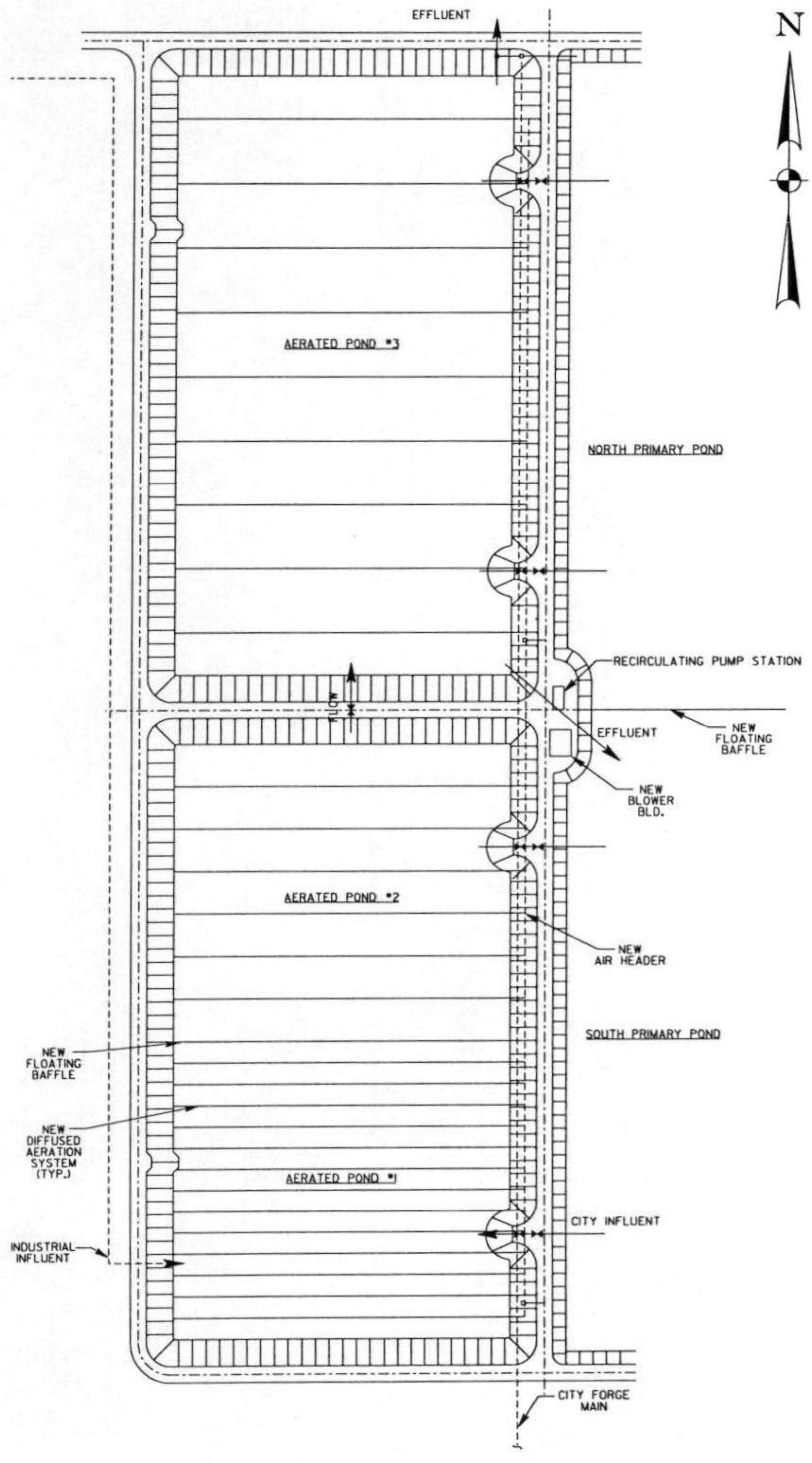
Alternative 1B: Upgraded Aerated Lagoon System Using Diffused Air

Alternative 1A is the same as Alternative 1B except that a new fine bubble diffused aeration system would be installed in lieu of additional surface aerators. A layout of the aerated ponds showing the diffused air system is shown on Figure 4. The different features of this alternative include:

1. Refurbish 3 existing 75-HP Aqua Aerobics surface aerators.
2. Purchase and install new fine bubble membrane-tube diffused air system.
3. Construct new building to house aeration blowers.
4. Purchase and install 5-400 HP blowers.
5. Install air piping to diffused air system.
6. Install new floating baffles in North and South Primary Ponds.
7. Install new floating baffle in Polishing Pond 2 to create Polishing Pond 3 with 2-4 days DT.
8. Install new multi-port outlets in all three Polishing Ponds.
9. Install 3 refurbished 75 HP surface aerators in Polishing Pond 3.
10. Extend existing 36-in outfall to new Polishing Pond 3.

Advantages of the fine bubble aeration system include:

- About 40% less energy required for the same oxygen transfer.
- Major mechanical equipment (blowers) can be maintained without entering pond and can be covered or enclosed.
- Can vary oxygen input without affecting mixing of the basin contents.
- No additional electrical service will be required.



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ALTERNATIVE 1B

UPGRADED AERATED LAGOON SYSTEM USING DIFFUSED AIR

Figure 4

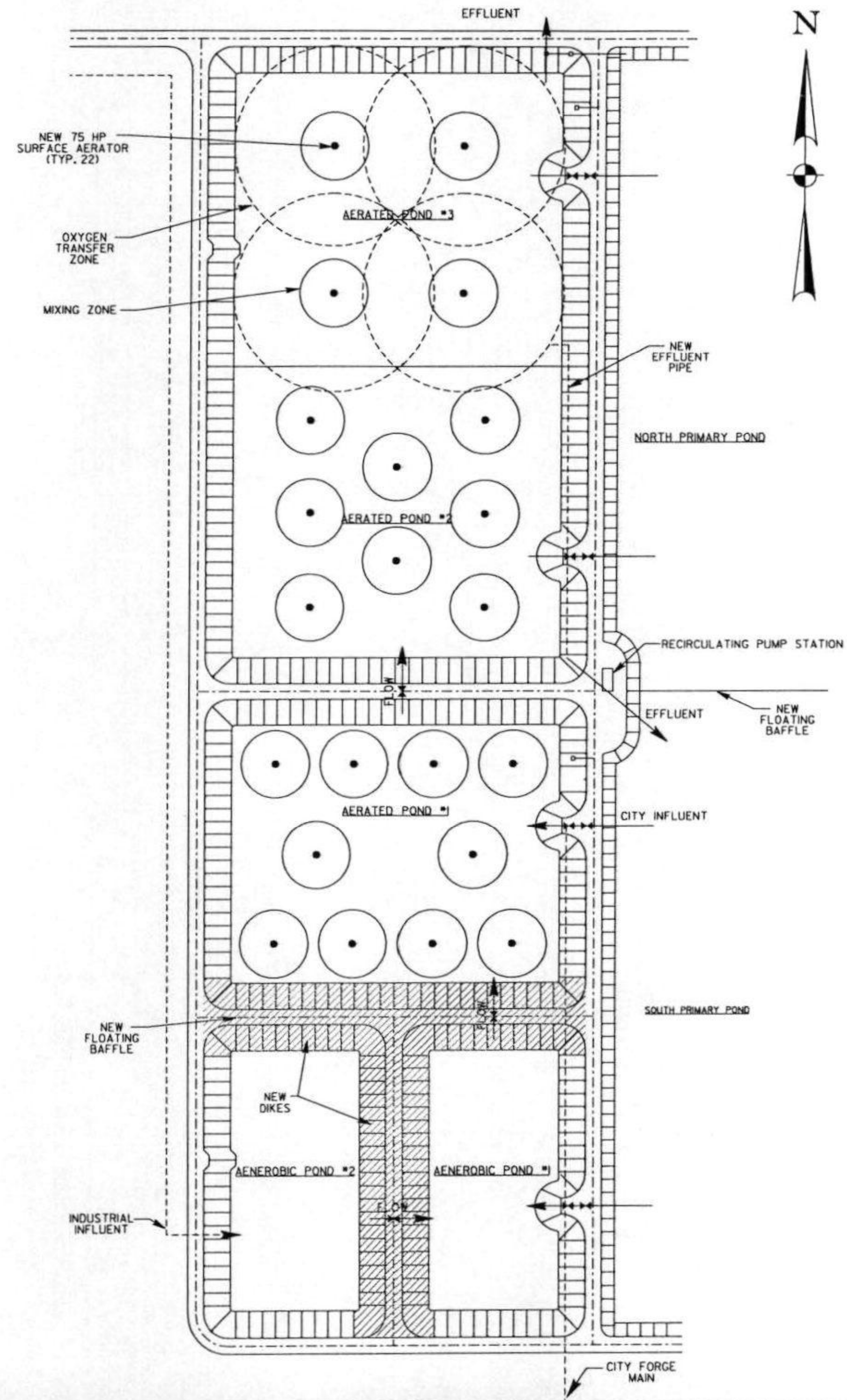
Alternative 2: Anaerobic Lagoon with Upgraded Aerated System

Alternative 2 consists of modifying the ponds as in Alternative 1A, except that two anaerobic cells in series would be installed for the industrial sewer only. The anaerobic cells will have approximately 8 days DT and should reduce influent BOD by at least 40%. A layout of Alternative 2 is shown on Figure 5. Principal features of Alternative 2 include:

1. Install two anaerobic cells on the south side of the South Aerated Pond. Each anaerobic cell would be approximately 5 acres in size.
2. No aerated surface layer on the anaerobic pond would be provided, at least initially. Influent oil and grease would be allowed to accumulate and form a thick scum layer to help seal the pond and retard odors. (Aspirating aerators could be added later if needed for odor control.)
3. Install a floating baffle to divide the North Aerated Pond into two cells.
4. Purchase 10 new 75-HP surface aerators and refurbish 12 existing 75 surface aerators.
5. Install 10 aerators in Aerated Cell 1, 6 aerators in Aerated Cell 2, and 6 aerators in Aerated Cell 3.
6. Complete improvements as in Alternative 1 for Primary Ponds and Polishing Ponds.

Advantages of the anaerobic pond system include:

- About 33% less energy required overall compared to the fully aerobic option.



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ALTERNATIVE 2

ANAEROBIC LAGOON WITH UPGRADED AERATED SYSTEM

Figure 5

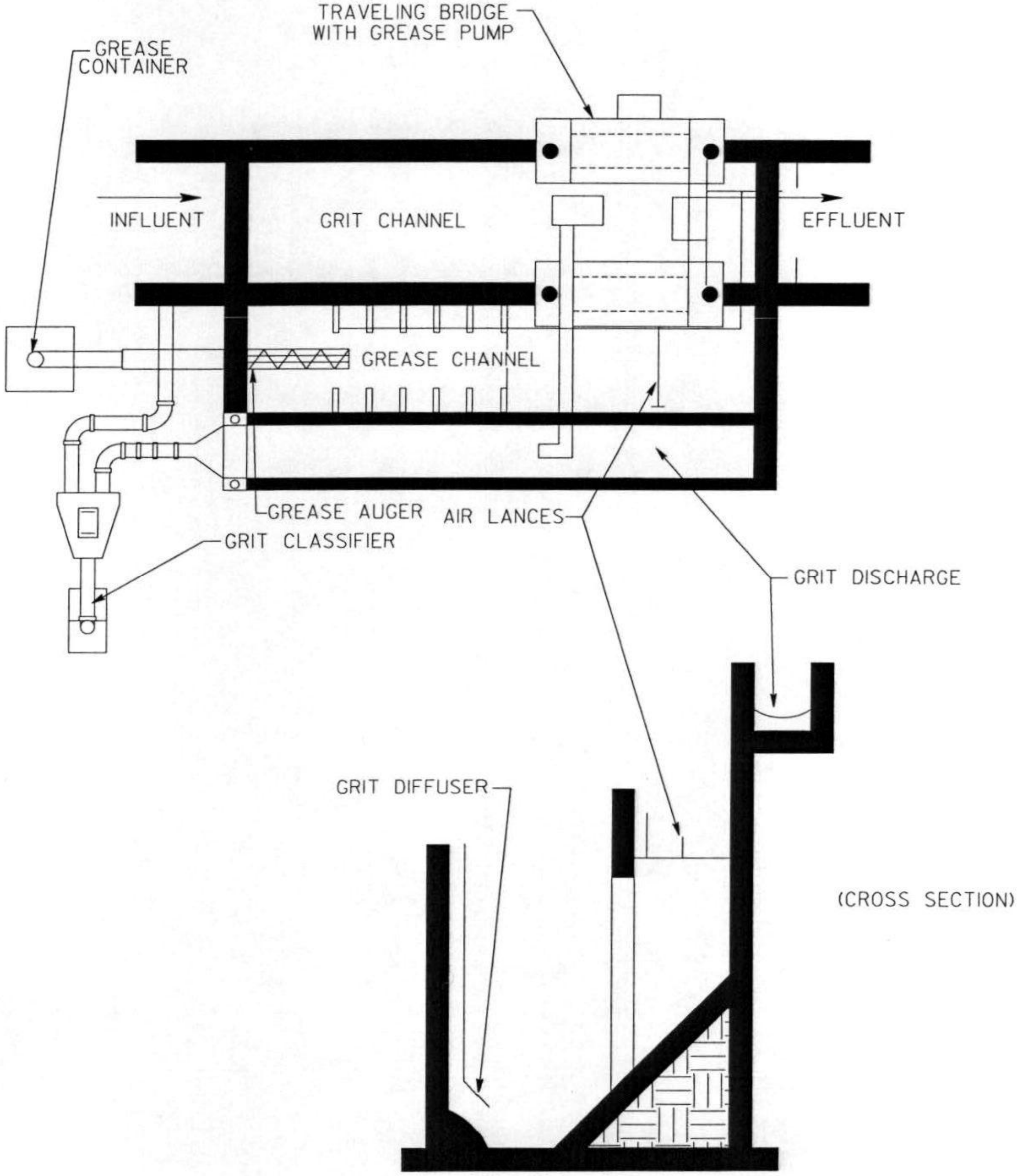
Alternative 3: Upgraded Aerated Lagoon System with Pretreatment for Grease Removal

Alternative 3 is the same as Alternative 1A except that a grease removal facility would be added as a pretreatment step on the industrial sewer. Removing grease should result in an approximately 15% reduction in the BOD load entering the plant and a correspondingly lower aeration requirement. Principal features include:

1. Construct mechanical grease pretreatment system, which will also remove grit.
2. Grease in solid form would be collected in a container and disposed of in the landfill.
3. Modify aerated ponds as in Alternative 1A except that only 17 new surface aerators would be required instead of 22.
4. Complete improvements as in Alternative 1 for Primary Ponds and Polishing Ponds.

A layout of the grease removal system is shown on Figure 6. It consists of an aerated channel with a quiescent channel running parallel. Wastewater flows through the aerated channel where a spiral roll is established by aeration lances. Air keeps the organics in suspension while allowing heavier grit particles to settle out. Oil and grease tends to migrate out of the aerated zone through baffles into the quiescent zone, where it rises to the surface. A series of air spray bars pushes the grease to one end where it is removed in solid form by an auger.

The grease removal unit would only be installed on the industrial sewer, which has the largest oil and grease load. The proposed location of the oil and grease pretreatment system is shown on Figure 7.



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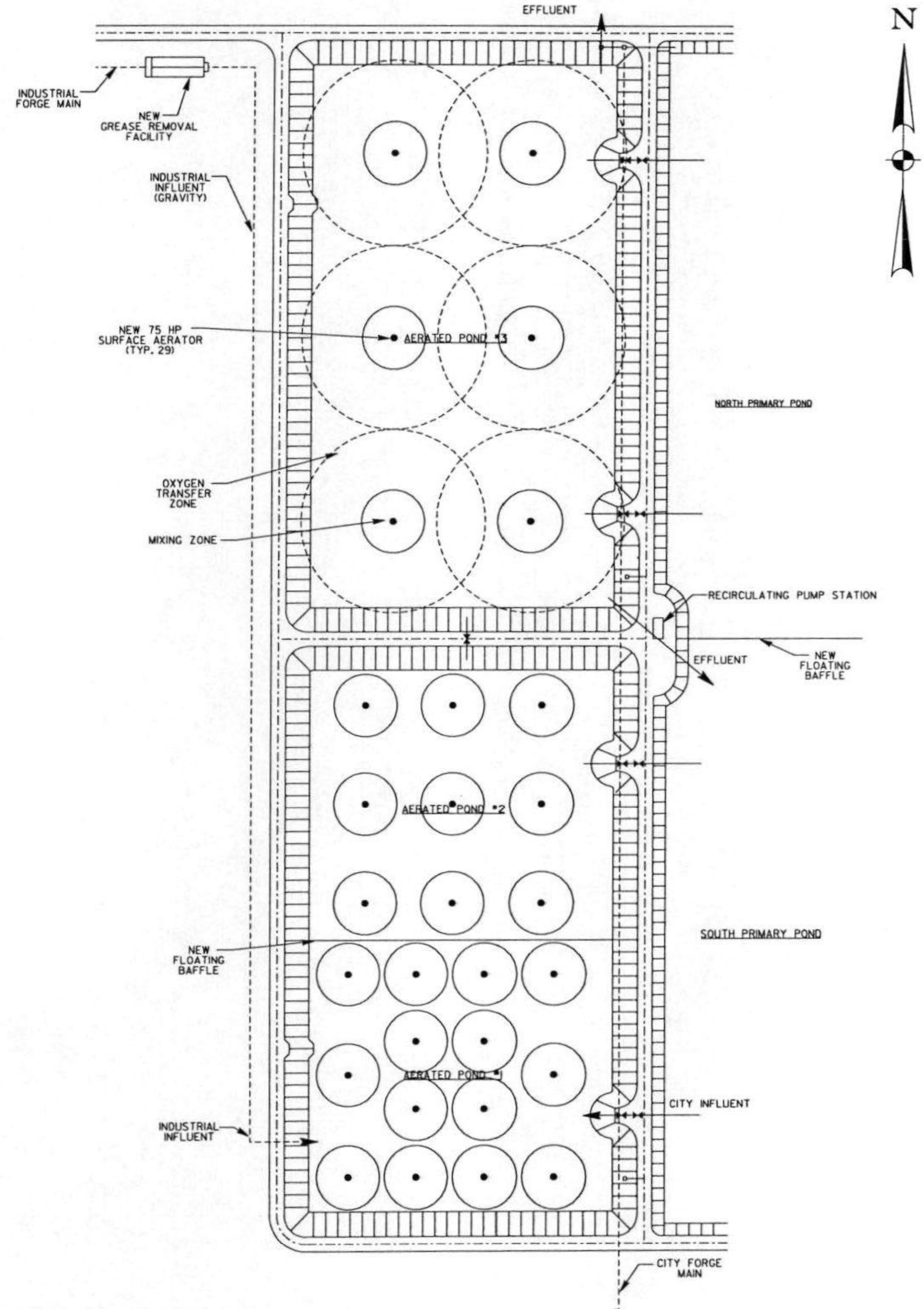
SCHEMATIC & CROSS-SECTION

GREASE REMOVAL FACILITY

Figure 6



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ALTERNATIVE 3

UPGRADED AERATED LAGOON SYSTEM WITH PRETREATMENT FOR GREASE REMOVAL

Figure 7

Alternative 4: Activated Lagoon System for Complete Nitrification

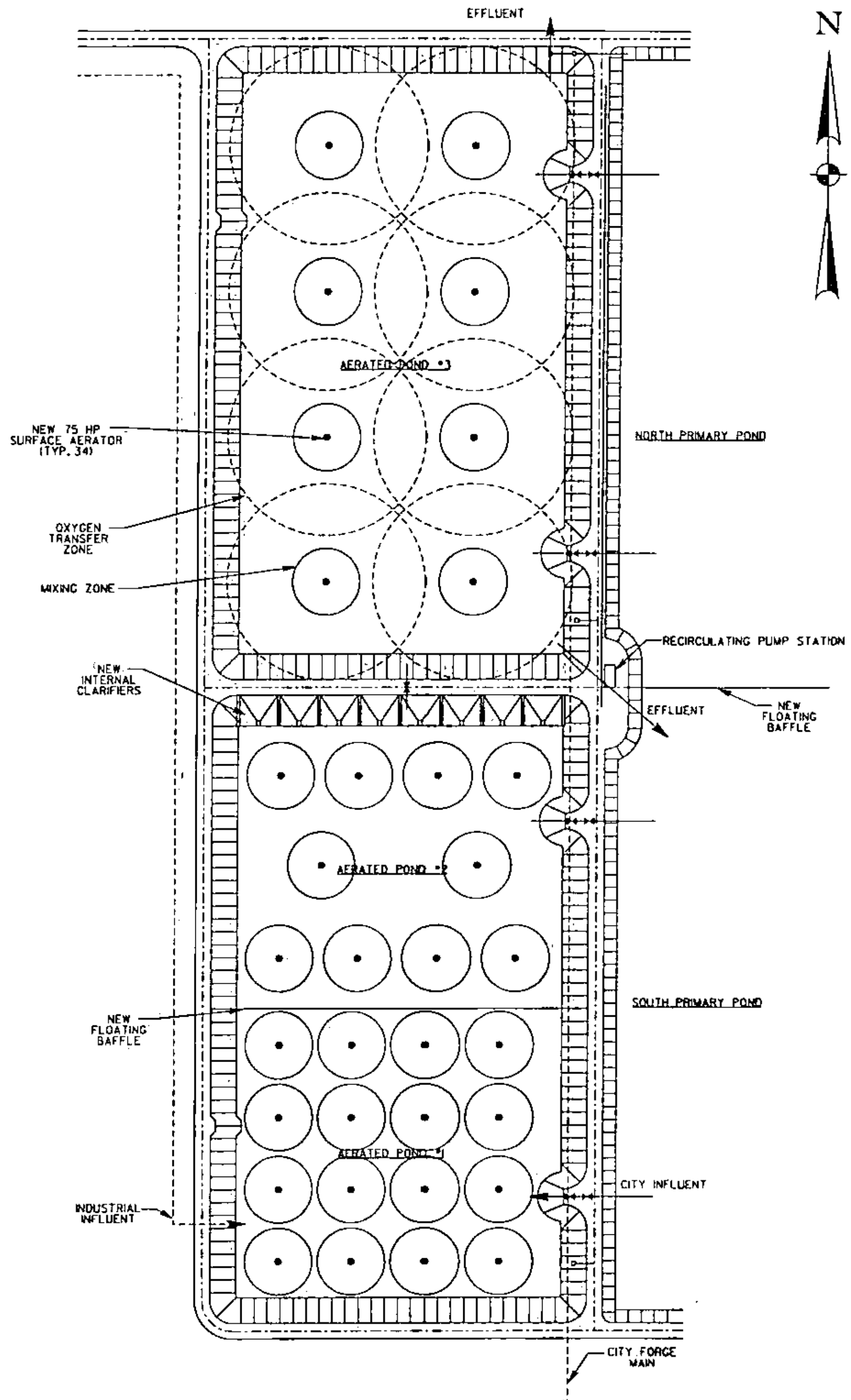
Alternative 4 differs from the other alternatives in that it will achieve complete nitrification and reduce ammonia levels to less than 3 mg/L year-round. This is accomplished by installing a sludge recycling system to allow buildup of mixed liquor suspended solids in the aerated ponds and the necessary increase in sludge age to support growth of nitrifying microorganisms. A layout of the activated lagoon system is shown on Figure 8.

Alternative 4 includes a series of earthen-walled clarifiers constructed within the South Aerated Pond as shown on Figure 9. Simple air lift pumps would be used to collect sludge and return it to one of the influent force mains, where it would be recirculated through the system. In lieu of the simple internal clarifiers, a pump station and conventional external clarifiers could also be constructed but at greater expense.

Alternative 4 consists of the following:

1. Make all improvements to the aerated ponds, primary ponds, and polishing ponds as in Alternative 1A.
2. Install 8 internal clarifiers, each approximately 5,000 sf in surface area.
3. Install concrete floor for sludge collection in each clarifier.
4. Install raised platform with walkway to center of each clarifier.
5. Install air lift pump in each clarifier.
6. Construct equipment pad.
7. Furnish and install 2-40 HP aeration blowers (1 standby).
8. Install air piping and header to serve each air lift pump.
9. Install discharge pipe header to collect sludge from each pump and discharge it into an influent force main for recycling to beginning of plant.

Alternative 4 would not be required unless a low ammonia limit is added to the discharge permit for the plant. However, if more restrictive ammonia limits are added this alternative would be the most effective means of achieving compliance.



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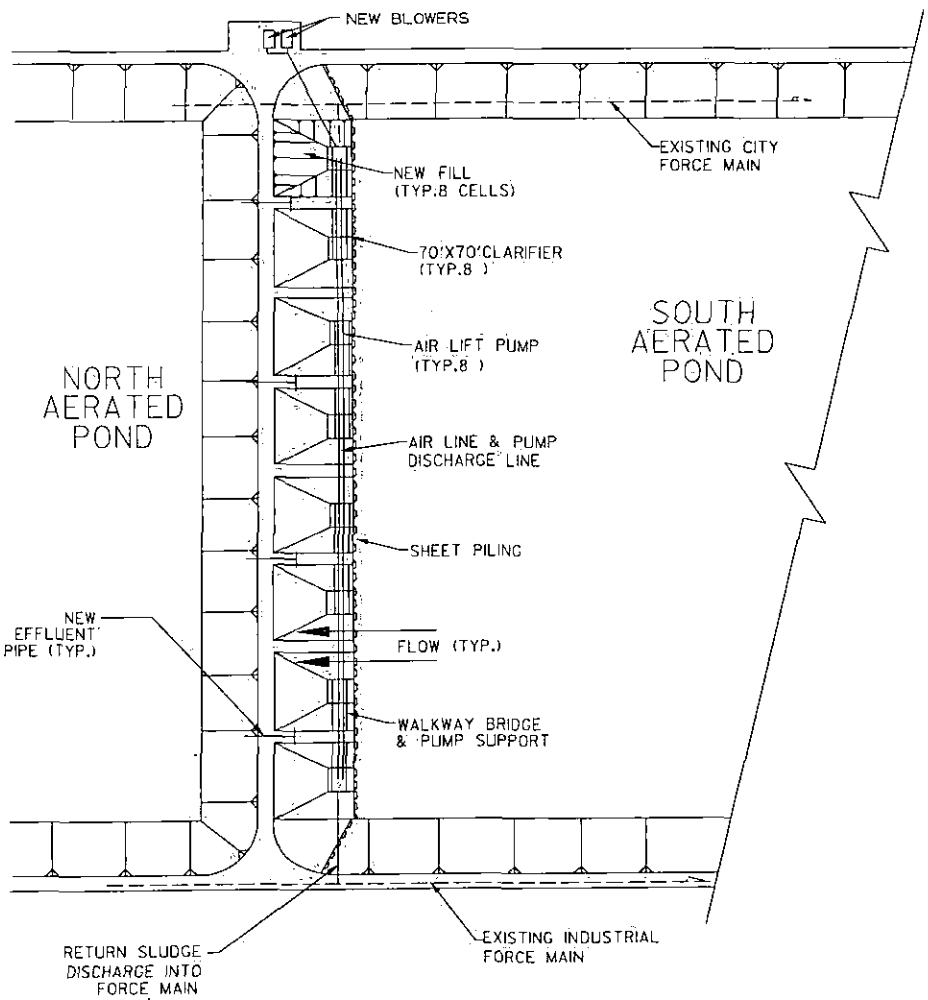
ALTERNATIVE 4

ACTIVATED LAGOON SYSTEM FOR COMPLETE NITRIFICATION

Figure 8



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ENLARGED PLAN

INTERNAL CLARIFIER & SLUDGE RECYCLE SYSTEM

Figure 9

Comparison of Alternatives

Detailed cost estimates were prepared for each of the alternatives above, including improvements needed to the Primary and Polishing Ponds. The detailed estimates are provided in Appendix C. A summary of the capital construction cost, annual operation, maintenance and replacement (OM&R) cost, and total present worth cost for each alternative is provided on Table 8.

Table 8
Cost Summary of Upgrade Alternatives

	Alternative	*Capital Cost*	*Annual OM&R Cost*	*Total Present Worth*
1A	Upgraded Aerated Lagoon System Using Surface Aerators	$2,457,000	$1,553,000	$27,753,000
1B	Upgraded Aerated Lagoon System Using Diffused Air	$4,602,000	$1,228,000	$24,605,000
2	Anaerobic Lagoon with Upgraded Aerated System	$2,505,000	$1,147,000	$21,188,000
3	Upgraded Aerated Lagoon System with Pretreatment for Grease Removal	$3,212,000	$1,490,000	$27,482,000
4	Activated Lagoon System for Complete Nitrification	$3,684,000	$1,700,000	$31,375,000

The Present Worth cost was calculated using an annual interest rate of 4.5% financed over a 20-year period, and represents the total cost of ownership including the construction cost, annual operating cost, debt service, and replacement cost. The replacement cost is based on straight-line depreciation of the project for 30 years. Table 8 indicates that Alternative 2, Anaerobic Lagoon, has the lowest capital and operating cost. This is not surprising since 40% of the BOD is removed anaerobically, which requires less purchase and operation of aeration equipment.

Alternative 1B has the highest capital cost but a relatively low O&M cost due to the greater efficiency of diffused aeration. The other alternatives are higher in cost and therefore less attractive. While anaerobic lagoons work well they have a tendency to create odors on occasion. Since one of the purposes of the plant project is to reduce odors, there will be greater risks associated with Alternative 2. For this reason, Alternative 1B, Upgrade Lagoons with Diffused Aeration, is recommended for implementation.

Section 5
Recommendation

The alternative selected for implementation to upgrade the Boyd Point WWTP is Alternative 1B. This alternative consists of converting from mechanical aeration to more efficient fine-bubble diffused aeration. However, not all of the required increase in treatment capacity is needed immediately; the component reserved for future growth in population and industry could be deferred until such time as it was actually needed. Additionally, the plant's 12 existing surface aerators continue to provide good service and could be left in operation until they reach the end of their useful life. For this reason, phased implementation of the selected alternative is recommended, as further described below.

Proposed Project Phasing

In the first phase of the proposed upgrade, improvements recommended to the Primary and Polishing Ponds would be implemented together with part of the ultimate diffused aeration system. Diffused air would be installed in the South Aerated Pond and all 12 surface aerators would be installed in the North Aerated Pond as shown on Figure 10. A floating baffle would also be installed across the South Aerated Pond to subdivide it into two cells in order to provide a more efficient tapered aeration system. The ponds would then operate in series as shown in the figure.

In Phase 2, additional diffused aeration would be installed to meet the required future design load. This would occur, for example, when a new industrial customer moved to Pine Bluff and required an increase in wastewater treatment capacity. Phase 3 would consist of replacement of the 12 existing surface aerators at the end of their useful life. These machines would be replaced with more diffused air resulting in the ultimate required aeration system.

A fourth phase is also included in the future project. In Phase 4, the internal clarifiers and sludge recirculation system would be constructed when complete ammonia removal be added to the plant discharge permit. This would convert the plant into an activated lagoon system and make possible complete nitrification year-round.

Phased Implementation Cost

The capital and operation, maintenance, and replacement cost of the various phases are shown on Table 9.

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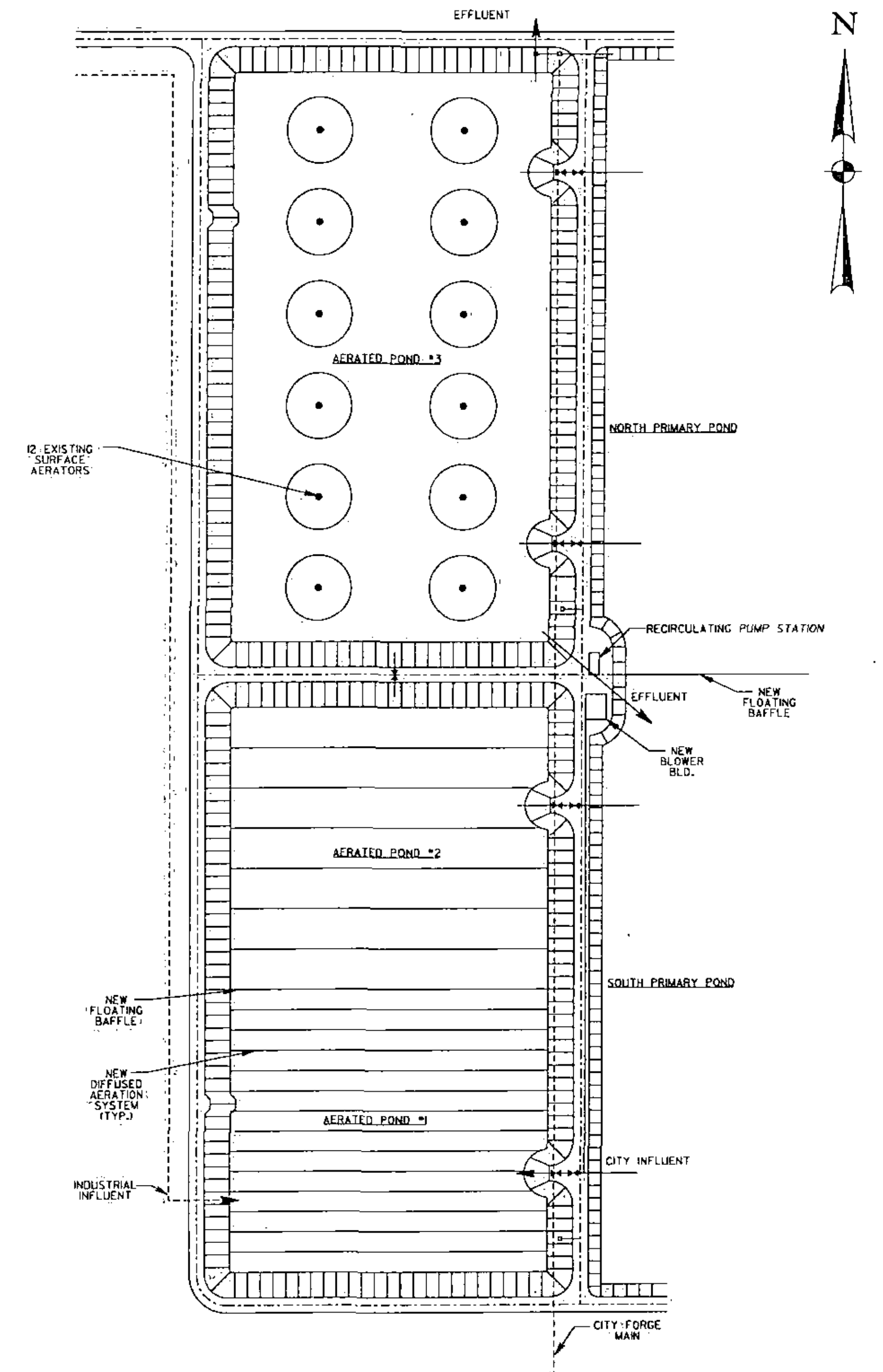

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RECOMMENDED PLAN

UPGRADED AERATED LAGOON SYSTEM USING DIFFUSED AIR AND EXISTING SURFACE AERATORS

Figure 10

Table 9
Phased Implementation Cost

Phase		Capital Cost	Annual OM&R Cost	Comment
1	Use existing aerators + diffused air	$3,168,000	$1,172,000	
2	Add more diffused air for future load	$824,000	$164,000	O&M increase
3	Replace aerators at end of life	$1,243,000	-$74,000	O&M decrease[1]
4	Additions for complete ammonia removal	$1,228,000	$153,000	O&M increase

[1]Net decrease. Includes annual power savings of $203,000 plus additional debt service and replacement reserve.

Details of the phased implementation cost, including debt service and required cash flow, are provided in Appendix C.

Implementation Schedule

Phase 1 of the project is needed now. The existing plant is receiving a wastewater load significantly greater than it was designed to treat. Constructing the Phase 1 improvements will provide the plant improvements needed to remove the incoming BOD aerobically, reduce odors from the plant, and improve the overall treatment efficiency.

At this time no definitive schedule is evident for the implementing the remaining phases. Subsequent phases of the Recommended Plan would need to be implemented when the appropriate trigger point is reached.

Appendix A

Analytical Data Summaries

Table A-1
Pine Bluff Wastewater Utility
Boyd Point WWTP
Influent Wastewater Load, 1998-2001

Year: 1998

Month	Total Flow (Effluent MGD)	Inluent A (MGD) 40%	Influent C (MGD) 60%	BOD-A (mg/L)	BOD-A (lb/day)	BOD-C (mg/L)	BOD-C (lb/day)	Total BOD Load (lb/day)	TSS-A (mg/L)	TSS-A (lb/day)	TSS-C (mg/L)	TSS-C (lb/day)	Total TSS Load (lb/day)	N. Aer. Pond Ammonia (mg/L)	S. Aer. Pond Ammonia (mg/L)	NH3 Load (lb/day)
January	14.4	5.8	8.7	90	4,309	318	22,978	27,287	46	2,211	136	9,789	12,000	42	36	4,672
February	15.1	6.0	9.1	136	6,843	402	30,384	37,227	73	3,696	149	11,277	14,973	45	46	5,722
March	12.7	5.1	7.6	114	4,807	372	23,578	28,385	89	3,757	105	6,651	10,408	43	48	4,824
April	11.8	4.7	7.1	145	5,710	371	21,879	27,589	79	3,089	105	6,165	9,254	45	60	5,135
May	15.0	6.0	9.0	213	10,662	340	25,543	36,205	102	5,092	110	8,236	13,328	52	62	7,102
June	8.1	3.2	4.8	168	4,530	197	7,965	12,496	82	2,210	54	2,180	4,390	47	52	3,341
July	8.5	3.4	5.1	195	5,542	414	17,612	23,153	39	1,102	83	3,546	4,649	40	59	3,530
August	6.3	2.5	3.8	189	3,976	554	17,448	21,424	86	1,810	169	5,314	7,123	46	78	3,239
September	10.1	4.0	6.0	193	6,491	533	26,808	33,299	107	3,595	153	7,683	11,279	29	90	5,019
October	10.7	4.3	6.4	173	6,182	549	29,349	35,530	143	5,114	167	8,955	14,069	32	67	4,428
November	11.9	4.7	7.1	225	8,884	483	28,653	37,537	102	4,039	151	8,949	12,988	43	66	5,382
December	11.1	4.4	6.7	156	5,786	352	19,528	25,314	70	2,576	112	6,189	8,766	43	51	4,340
Daily Average	11.3	4.5	6.8	167	6,144	407	22,644	**28,787**	85	3,191	124	7,078	10,269	42	60	**4,728**

Assumptions
1. Influent flow is 60% from Sewer C and 40% from Sewer A.
2. July 98 effluent flow reported as 0; value estimated from polishing pond flow record.
3. Average of ammonia concentration in aerated ponds is approximately equal to ammonia concentration in influent flow.

Year: 1999

Month	Total Flow (Effluent MGD)	Inluent A (MGD) 40%	Influent C (MGD) 60%	BOD-A (mg/L)	BOD-A (lb/day)	BOD-C (mg/L)	BOD-C (lb/day)	Total BOD Load (lb/day)	TSS-A (mg/L)	TSS-A (lb/day)	TSS-C (mg/L)	TSS-C (lb/day)	Total TSS Load (lb/day)	N. Aer. Pond Ammonia (mg/L)	S. Aer. Pond Ammonia (mg/L)	NH3 Load (lb/day)
January	14.7	5.9	8.8	172	8,450	500	36,832	45,282	74	3,645	302	22,245	25,890	39	41	4,906
February	14.9	5.9	8.9	172	8,542	663	49,259	57,801	98	4,848	239	17,760	22,608	45	52	6,003
March	16.1	6.4	9.7	165	8,889	490	39,557	48,446	74	3,998	154	12,433	16,431	44	53	6,540
April	14.6	5.8	8.8	338	16,449	605	44,166	60,614	202	9,838	253	18,499	28,336	35	39	4,552
May	9.0	3.6	5.4	153	4,582	768	34,492	39,074	78	2,334	586	26,291	28,625	43	41	3,143
June	9.2	3.7	5.5	113	3,481	476	21,982	25,463	28	850	140	6,475	7,326	38	39	2,968
July	14.7	5.9	8.8	105	5,155	539	39,532	44,687	25	1,222	165	12,124	13,346	37	41	4,779
August	7.4	3.0	4.5	64	1,580	626	23,317	24,896	28	695	177	6,587	7,282	44	45	2,766
September	12.4	4.9	7.4	94	3,863	604	37,351	41,215	24	1,002	140	8,644	9,646	32	32	3,323
October	9.1	3.6	5.4	100	3,017	628	28,417	31,434	29	883	249	11,276	12,159	29	29	2,165
November	14.6	5.8	8.8	179	8,737	426	31,133	39,869	79	3,867	139	10,200	14,068	41	40	4,948
December	15.0	6.0	9.0	109	5,452	435	32,632	38,084	31	1,537	139	10,462	11,998	45	44	5,584
Daily Average	12.6	5.1	7.6	147	6,516	563	34,889	**41,405**	64	2,893	224	13,583	16,476	39	41	**4,306**

Table A-1
Pine Bluff Wastewater Utility
Boyd Point WWTP
Influent Wastewater Load, 1998-2001

Year: 2000

Month	Total Flow (Effluent MGD)	Inluent A (MGD) 40%	Influent C (MGD) 60%	BOD-A (mg/L)	BOD-A (lb/day)	BOD-C (mg/L)	BOD-C (lb/day)	Total BOD Load (lb/day)	TSS-A (mg/L)	TSS-A (lb/day)	TSS-C (mg/L)	TSS-C (lb/day)	Total TSS Load (lb/day)	N. Aer. Pond Ammonia (mg/L)	S. Aer. Pond Ammonia (mg/L)	NH3 Load (lb/day)
January	9.8	3.9	5.9	143	4,658	616	30,077	34,735	43	1,394	201	9,817	11,211	52	50	4,178
February	9.7	3.9	5.8	128	4,133	581	28,196	32,329	52	1,673	182	8,817	10,489	47	43	3,635
March	10.4	4.2	6.2	95	3,314	466	24,282	27,596	35	1,201	120	6,245	7,446	52	48	4,343
April	9.4	3.7	5.6	133	4,136	492	23,019	27,155	133	4,135	124	5,795	9,930	43	43	3,335
May	14.0	5.6	8.4	93	4,326	553	38,626	42,952	32	1,479	318	22,221	23,700	20	19	2,249
June	10.0	4.0	6.0	90	3,019	636	31,907	34,927	43	1,453	182	9,116	10,569	26	25	2,150
July	10.6	4.2	6.3	109	3,853	688	36,404	40,257	53	1,859	256	13,534	15,393	31	35	2,888
August	5.2	2.1	3.1	125	2,152	662	17,095	19,247	33	560	187	4,837	5,397	40	41	1,734
September	7.9	3.1	4.7	92	2,410	633	24,847	27,257	26	676	202	7,940	8,616	37	38	2,473
October	9.4	3.8	5.7	107	3,363	744	35,084	38,447	30	935	214	10,101	11,036	32	34	2,619
November	12.2	4.9	7.3	88	3,583	652	39,913	43,497	32	1,301	283	17,338	18,639	32	34	3,362
December	11.5	4.6	6.9	178	6,825	575	33,060	39,886	21	806	153	8,793	9,599	42	40	3,956
Daily Average	10.0	4.0	6.0	115	3,814	608	30,209	**34,024**	44	1,456	202	10,379	11,835	38	38	**3,077**

Year: 2001

Month	Total Flow (Effluent MGD)	Inluent A (MGD) 40%	Influent C (MGD) 60%	BOD-A (mg/L)	BOD-A (lb/day)	BOD-C (mg/L)	BOD-C (lb/day)	Total BOD Load (lb/day)	TSS-A (mg/L)	TSS-A (lb/day)	TSS-C (mg/L)	TSS-C (lb/day)	Total TSS Load (lb/day)	N. Aer. Pond Ammonia (mg/L)	S. Aer. Pond Ammonia (mg/L)	NH3 Load (lb/day)
January	12.7	5.1	7.6	105	4,438	509	32,244	36,683	58	2,428	190	12,037	14,465	29	32	3,226
February	17.2	6.9	10.3	148	8,491	596	51,153	59,644	48	2,731	233	19,973	22,703	27	29	3,996
March	16.7	6.7	10.0	96	5,338	477	39,776	45,115	30	1,666	160	13,337	15,004	22	25	3,249
April	11.6	4.6	6.9	106	4,089	510	29,525	33,614	33	1,283	157	9,109	10,392			
May	9.0	3.6	5.4	122	3,657	492	22,149	25,806	52	1,555	147	6,627	8,182			
June	9.3	3.7	5.6	219	6,811	660	30,823	37,634	146	4,559	192	8,950	13,510			
July	8.6	3.4	5.1	119	3,391	607	25,985	29,376	57	1,628	529	22,673	24,301			
August	10.9	4.4	6.5	111	4,053	546	29,770	33,823	45	1,633	177	9,647	11,280			
September	6.7	2.7	4.0	126	2,813	699	23,387	26,200	53	1,172	501	16,761	17,932	19	18	1,039
October	12.0	4.8	7.2	118	4,704	807	48,344	53,048	57	2,291	235	14,071	16,363			
November	11.4	4.6	6.9	135	5,152	767	43,907	49,060	342	13,037	60	3,423	16,460			
December	16.0	6.4	9.6	90	4,801	554	44,380	49,181	55	2,960	157	12,562	15,522			
Daily Average	11.8	4.7	7.1	125	4,812	602	35,120	**39,932**	81	3,079	228	12,431	15,510	24	26	**2,878**
1998-2001 Average	11.4	4.6	6.9	138	5,321	545	30,716	**36,037**	69	2,655	194	10,868	13,523	36	41	3,747
Maximum Month	17.2	6.9	10.3	338	16,449	807	51,153	**60,614**	202	9,838	586	26,291	28,625	52	90	7,102
Standard Deviation	2.95	1.18	1.77	49	2,595	127	9,228	10,487	55	2,282	107	5,478	5,938	9	15	1,341
Mean + 2 Std. Dev.	17.3	6.9	10.4	237	10,512	800	49,172	57,012	179	7,218	408	21,823	25,398	53	71	6,430

Table A-2
Pine Bluff Wastewater Utility
Boyd Point WWTP
Influent Oil and Grease, 1998-2001

Month	Year 1998		Year 1999		Year 2000		Year 2001	
	Influent A O&G (mg/L)	Influent C O&G (mg/L)	Influent A O&G (mg/L)	Influent C O&G (mg/L)	Influent A O&G (mg/L)	Influent C O&G (mg/L)	Influent A O&G (mg/L)	Influent C O&G (mg/L)
January	26	419	502	550	61	336	18	101
	33	99	28	163	59		11	93
February	29	78	41	253	48	1,462	31	14
	47	5	56	190	49	67	40	586
							27	390
							12	58
							14	133
March	42	107	603	960	98		46	313
	116	32		16	60			
April	26	368	18	101	27	63	27	255
	142	114	74	244	121	23	25	70
May	89	25	63	1,105	14	326	51	65
	8	5	182	155	42	39	96	64
			51					
June	95	17	64	1,182	11	2,634	93	40
	26	42	72	75			30	1,738
			75					
July	33	55	69	528	37	414	12	655
	71	17	59	180	22	57	45	100
August	30	210	46	71	14	38	42	333
	42	684	50	477	17	130	32	113
September	37	46	41	41	25	521	71	132
	32	155	29	628	14	38	51	122
October	36				31	92	47	282
	31	33			12	25	170	30
					15	38		
					8	17		
					31	13		
					28			
November	70	94	39	141	32	20	17	421
	48	221	30	51	8	473	41	897
					36	274		
					29	43		
					31	178		
					41	177		
					57	168		
					55	410		
December	41	37	40	164	20	14	43	357
	18	234	44	72		112		
Daily Average	**49**	**135**	**99**	**334**	**36**	**283**	**44**	**294**

1998-2001	Average	Maximum Month
Sewer A	55	603
Sewer C	263	2,634

Table A-3
Pine Bluff Wastewater Utility
Boyd Point WWTP
Pond Temperature Variation, 1998-2001

Year	Month	Influent A		Influent C		N. Aerated Pond		S. Aerated Pond		N. Primary Pond		S. Primary Pond		Polishing Pond #1		Polishing Pond #2		Effluent	
		Min. °C	Max. °C	Min. °C	Max. °C	Min. °C	Max. °C	Min. °C	Max. °C	Min. °C	Max. °C	Min. °C	Max. °C	Min. °C	Max. °C	Min. °C	Max. °C	Min. °C	Max. °C
1998	January	6.0	15.3	6.3	15.1	9.9	14.4	10.6	14.8	6.0	12.3	5.7	14.0	5.6	11.5	5.3	12.2	5.2	12.1
	February	6.0	14.3	2.5	13.7	11.5	15.0	11.7	15.6	8.5	13.5	8.7	14.2	8.4	13.5	8.6	13.9	7.6	13.8
	March	3.1	20.6	4.9	22.6	9.8	20.1	10.9	21.2	5.6	20.6	6.5	20.7	6.2	20.0	6.1	20.4	6.6	20.3
	April	14.5	20.2	15.5	22.1	17.0	20.6	17.0	20.7	14.4	21.0	15.2	21.0	16.6	20.8	16.2	21.3	17.8	20.4
	May	17.3	28.1	20.2	28.2	19.7	26.3	20.1	26.1	19.2	27.2	19.1	27.3	19.3	27.4	19.2	27.4	19.5	27.6
	June	23.2	31.5	25.0	31.6	25.0	28.7	23.2	31.5	25.0	30.1	25.0	30.4	25.0	30.4	25.0	30.9	25.0	31.0
	July	26.1	34.7	27.4	32.3	25.0	30.3	22.2	30.6	24.6	33.9	25.0	31.3	25.0	31.5	25.0	31.6	--	--
	August	26.1	29.9	25.3	30.8	27.0	30.0	21.7	29.9	21.8	30.4	21.6	29.8	26.8	30.2	27.1	30.4	25.6	29.9
	September	22.8	28.6	22.4	29.9	23.9	29.3	22.8	29.5	22.6	28.5	22.7	28.2	22.9	28.4	22.7	28.9	21.2	29.1
	October	13.7	25.0	16.0	26.1	17.8	37.2	18.3	26.6	14.7	56.4	14.6	26.8	16.3	27.0	13.6	27.4	15.5	27.5
	November	7.3	21.2	8.7	21.5	15.9	21.5	15.9	21.6	11.8	19.9	12.1	20.9	13.0	20.9	12.6	20.6	12.4	20.7
	December	2.0	17.3	2.5	19.0	7.9	19.6	8.2	19.7	4.1	19.0	4.3	18.9	3.8	18.5	4.1	18.9	4.0	14.7
	Average	14.0	23.9	14.7	24.4	17.5	24.4	16.9	24.0	14.9	26.1	15.0	23.6	15.7	23.3	15.5	23.7	14.6	22.5
	Min/Max	2.0	34.7	2.5	32.3	7.9	30.3	8.2	31.5	4.1	33.9	4.3	31.3	3.8	31.5	4.1	31.6	4.0	31.0
1999	January	2.1	16.9	2.0	18.8	7.2	15.7	7.3	16.4	2.2	13.9	3.2	14.9	--	--	1.5	13.7	1.5	15.1
	February	2.6	18.0	7.7	19.0	12.2	18.4	12.9	18.3	8.9	17.6	8.5	18.5	--	--	8.3	18.1	8.0	18.0
	March	8.3	16.3	9.1	19.0	10.4	15.8	11.0	16.3	7.6	15.1	7.6	15.9	--	--	7.7	15.9	7.7	16.0
	April	14.5	19.7	15.2	21.9	16.6	21.5	16.4	22.1	13.9	22.7	14.1	22.3	--	--	13.5	22.3	13.5	22.3
	May	19.3	25.1	19.6	25.3	20.1	24.8	19.8	24.5	20.1	26.4	19.7	26.2	--	--	19.8	26.5	19.1	25.8
	June	22.1	29.2	21.6	29.6	23.1	27.9	22.3	27.9	23.2	29.8	22.7	29.0	--	--	24.1	29.7	24.0	29.9
	July	24.3	30.6	24.5	30.3	25.0	30.4	24.5	30.3	26.3	32.0	25.0	31.9	--	--	26.5	31.8	25.0	31.7
	August	27.9	30.6	24.1	31.2	22.2	30.0	25.1	29.3	26.5	31.4	25.0	30.7	--	--	26.2	31.3	27.6	30.3
	September	14.5	27.8	15.5	28.0	21.3	28.1	19.8	27.5	20.3	28.8	19.7	28.0	--	--	20.9	28.7	20.6	28.4
	October	12.4	22.9	11.6	24.9	16.9	22.7	16.9	22.1	14.8	22.6	14.4	22.3	--	--	14.6	22.0	13.6	22.2
	November	8.0	19.0	8.2	18.5	13.5	19.6	12.6	19.5	10.9	18.6	10.9	18.6	--	--	11.1	18.4	10.8	17.2
	December	3.2	14.4	6.2	17.2	7.8	16.6	5.5	17.2	5.4	14.6	5.3	15.5	--	--	5.6	14.1	5.4	13.6
	Average	13.3	22.5	13.8	23.6	16.4	22.6	16.4	22.6	15.0	22.8	15.0	22.8	--	--	15.0	22.7	14.7	22.5
	Min/Max	2.1	30.6	2.0	31.2	7.2	30.4	5.5	30.3	2.2	31.4	3.2	31.9	--	--	1.5	31.8	1.5	31.7

Table A-3
Pine Bluff Wastewater Utility
Boyd Point WWTP
Pond Temperature Variation, 1998-2001

Year	Month	Influent A		Influent C		N. Aerated Pond		S. Aerated Pond		N. Primary Pond		S. Primary Pond		Polishing Pond #1		Polishing Pond #2		Effluent	
		Min. °C	Max. °C	Min. °C	Max. °C	Min. °C	Max. °C	Min. °C	Max. °C	Min. °C	Max. °C	Min. °C	Max. °C	Min. °C	Max. °C	Min. °C	Max. °C	Min. °C	Max. °C
2000	January	0.9	16.9	0.9	19.6	8.3	15.5	7.3	16.6	4.3	14.1	0.6	14.7	4.5	13.6	3.9	14.2	3.6	17.7
	February	2.9	16.0	8.4	19.7	8.4	17.5	9.1	18.3	3.9	18.8	4.6	17.0	3.9	16.2	3.6	16.3	3.9	16.4
	March	8.5	20.5	11.5	22.4	14.0	19.6	13.8	20.4	12.2	19.9	11.9	20.0	11.6	19.4	11.8	19.6	11.5	20.1
	April	11.7	19.8	12.0	22.0	15.5	21.3	1.0	21.1	14.2	21.9	14.1	22.1	14.4	21.7	14.2	21.9	12.8	22.1
	May	17.6	25.6	17.9	25.7	20.7	26.0	20.0	25.7	21.0	27.7	21.0	28.4	20.9	27.9	20.1	27.8	20.6	27.1
	June	20.6	28.0	19.4	28.7	23.0	26.9	21.9	26.6	22.7	28.4	22.0	28.5	23.1	28.5	23.7	28.8	22.0	29.0
	July	24.1	30.1	24.1	38.7	25.2	30.0	24.1	30.0	25.6	31.0	24.6	31.3	26.0	31.2	26.2	31.0	24.8	30.4
	August	25.0	29.8	24.1	31.1	26.3	39.5	1.0	29.9	27.0	30.6	26.1	30.3	27.6	30.8	27.5	30.7	26.5	30.0
	September	17.9	26.2	18.7	26.4	21.1	29.0	20.3	27.2	19.6	30.1	19.0	29.5	20.0	30.3	18.6	30.4	19.9	28.7
	October	12.2	23.6	13.6	24.5	16.3	23.5	15.8	23.5	13.4	23.5	13.0	24.0	14.5	23.8	14.1	23.8	14.3	23.5
	November	4.6	23.6	6.9	24.7	10.0	22.4	10.3	22.2	7.4	22.0	8.0	22.0	7.9	22.1	7.5	22.2	7.4	22.4
	December	6.3	13.7	3.5	14.8	1.8	13.3	1.7	13.7	0.9	10.4	1.2	11.5	0.1	10.1	0.1	9.9	0.7	9.9
	Average	12.7	22.8	13.4	24.9	15.9	23.7	12.2	22.9	14.4	23.2	13.8	23.3	14.5	23.0	14.3	23.1	14.0	23.1
	Min/Max	0.9	30.1	0.9	38.7	1.8	39.5	1.7	30.0	0.9	31.0	0.6	31.3	0.1	31.2	0.1	31.0	0.7	30.4
2001	January	2.2	11.6	2.7	15.5	4.9	12.8	5.2	12.9	0.0	10.6	1.7	11.5	0.8	10.4	0.8	12.0	0.6	10.3
	February	2.4	15.6	5.9	19.8	7.1	15.9	7.2	15.9	7.7	15.2	7.4	15.9	8.0	14.2	8.1	15.4	8.1	15.5
	March	7.5	18.9	7.5	18.9	9.3	14.7	8.7	14.9	9.4	14.2	9.8	14.3	9.6	14.0	10.0	14.2	9.8	15.8
	April	12.6	24.7	10.8	25.3	10.8	22.5	10.7	22.7	11.4	24.3	11.0	24.4	11.4	24.4	11.2	24.7	12.6	24.8
	May	18.9	27.1	19.7	26.3	21.0	26.4	21.3	27.9	21.2	26.0	21.4	26.8	20.7	26.1	20.9	26.5	20.3	27.2
	June	28.8	23.2	24.0	28.9	22.1	27.8	22.4	29.8	23.2	29.2	22.7	29.4	23.2	30.1	22.9	29.5	22.7	29.3
	July	26.6	32.9	27.7	33.9	23.2	29.7	25.1	29.7	25.2	32.4	24.6	31.5	25.1	31.6	25.4	32.1	25.3	32.1
	August	25.0	30.8	25.0	29.9	26.7	29.1	24.9	29.0	25.4	29.6	24.4	29.9	26.1	30.1	26.2	29.9	24.0	30.8
	September	16.6	26.5	9.6	26.7	20.1	27.4	19.4	27.6	19.7	28.2	19.0	28.1	20.4	28.4	20.3	28.6	18.7	28.5
	October	11.3	25.0	15.2	25.0	17.1	25.3	17.2	25.0	15.3	25.0	14.9	25.0	15.8	25.0	14.7	25.0	12.5	25.0
	November	7.1	21.8	9.1	21.5	11.1	25.0	10.1	25.0	8.0	25.0	8.1	25.0	8.0	25.0	7.9	25.0	8.2	--
	December	8.0	15.9	12.0	16.5	7.8	17.8	8.7	18.1	6.6	17.2	6.8	17.4	6.2	104.0	5.9	16.8	6.1	17.0
	Average	13.9	22.8	14.1	24.0	15.1	22.9	15.1	23.2	14.4	23.1	14.3	23.3	14.6	30.3	14.5	23.3	14.1	23.3
	Min/Max	2.2	32.9	2.7	33.9	4.9	29.7	5.2	29.8	0.0	32.4	1.7	31.5	0.8	31.6	0.8	32.1	0.6	32.1
1998-2001	Average	13.5	23.0	14.0	24.2	16.2	23.4	15.1	23.2	14.7	23.8	14.6	23.2	15.0	25.5	14.8	23.2	14.3	22.9
	Min/Max	0.9	34.7	0.9	38.7	1.8	39.5	1.7	31.5	0.0	33.9	0.6	31.9	0.1	31.6	0.1	32.1	0.6	32.1

Table A-7
Pine Bluff Wastewater Utility
Boyd Point WWTP
Treatment Summary

Year: 1998

Month	Avg Flow (Effluent MGD)	NAP BOD (mg/L)	SAP BOD (mg/L)	NPP BOD (mg/L)	SPP BOD (mg/L)	PP1 BOD (mg/L)	PP2 BOD (mg/L)	EFF BOD (mg/L)	NAP TSS (mg/L)	SAP TSS (mg/L)	NPP TSS (mg/L)	SPP TSS (mg/L)	PP1 TSS (mg/L)	PP2 TSS (mg/L)	EFF TSS (mg/L)	NAP NH3 (mg/L)	SAP NH3 (mg/L)	NPP NH3 (mg/L)	SPP NH3 (mg/L)	PP1 NH3 (mg/L)	PP2 NH3 (mg/L)	EFF NH3 (mg/L)	NAP DO (mg/L)	SAP DO (mg/L)	NPP DO (mg/L)	SPP DO (mg/L)	PP1 DO (mg/L)	PP2 DO (mg/L)	EFF DO (mg/L)
January	9.8	119	87	33	34	23	21	20	112	81	49	40	19	15	13	42	36	50	31	23.7	20.9	19.9	1.6	1.8	2.6	4.7	5.4	7.2	8.2
February	9.7	135	103	35	37	22	23	23	96	79	44	30	21	22	19	45	46	40	39	34.2	31.2	29.1	1.0	1.0	2.7	2.1	6.5	9.0	9.6
March	10.4	80	111	36	43	46	36	29	55	50	59	54	47	50	37	43	48	34	39	30.5	27.7	26.9	1.0	1.0	7.5	4.3	9.0	10.2	10.8
April	9.4	132	153	69	45	36	25	19	83	96	94	56	36	26	15	45	60	12	33	2.1	3.6	9.6	0.7	0.7	3.6	2.7	3.6	4.3	5.5
May*	14.0	98	125	37	53	11	10	8	120	128	55	65	19	20	17	52	62	5	40	9.1	7.5	7.1	0.5	0.6	1.4	1.5	3.7	6.1	8.6
June*	10.0	72	76	31	40	30	27	19	85	65	63	62	55	62	66	47	52	3	37	1.8	1.9	0.7	1.8	0.0	3.6	2.3	3.0	4.9	6.7
July*	10.6	75	177	56	55	34	30	--	72	81	127	71	71	94	0	40	59	5	30	2.4	1.2	--	2.1	2.3	2.7	2.3	2.2	3.0	--
August*	5.2	64	255	49	45	29	35	19	75	63	78	55	86	63	60	46	78	20	33	1.3	1.7	0.3	2.1	2.4	2.2	2.1	3.1	3.1	5.5
September*	7.9	81	315	56	66	31	30	21	62	62	71	73	73	72	63	29	90	9	32	2.9	1.6	0.9	1.8	2.2	2.5	1.9	2.2	3.8	6.5
October*	9.4	55	263	39	49	27	36	16	83	57	77	98	39	55	42	32	67	4	32	8.2	4.4	3.1	2.8	3.1	4.5	3.6	4.2	6.0	7.6
November*	12.2	86	233	29	59	35	33	17	111	71	81	102	47	52	41	43	66	1	37	0.2	0.7	0.6	3.8	3.8	6.4	4.0	4.3	6.8	6.5
December	11.5	100	100	44	54	44	35	38	110	105	79	101	43	48	43	43	51	18	43	1.4	2.2	2.5	1.4	1.4	4.3	2.1	3.5	5.7	8.5
Daily Average	10.0	91	167	43	48	31	28	21	89	78	73	67	46	48	35	42	60	17	36	9.8	8.7	9.2	1.7	1.7	3.7	2.8	4.2	5.8	7.6

Year: 1999

Month	Avg Flow (Effluent MGD)	NAP BOD (mg/L)	SAP BOD (mg/L)	NPP BOD (mg/L)	SPP BOD (mg/L)	PP1 BOD (mg/L)	PP2 BOD (mg/L)	EFF BOD (mg/L)	NAP TSS (mg/L)	SAP TSS (mg/L)	NPP TSS (mg/L)	SPP TSS (mg/L)	PP1 TSS (mg/L)	PP2 TSS (mg/L)	EFF TSS (mg/L)	NAP NH3 (mg/L)	SAP NH3 (mg/L)	NPP NH3 (mg/L)	SPP NH3 (mg/L)	PP1 NH3 (mg/L)	PP2 NH3 (mg/L)	EFF NH3 (mg/L)	NAP DO (mg/L)	SAP DO (mg/L)	NPP DO (mg/L)	SPP DO (mg/L)	PP1 DO (mg/L)	PP2 DO (mg/L)	EFF DO (mg/L)
January	9.8	123	140	36	63	28	37	44	51	74	38	52	26	35	29	39	42	22	22	11.4	9.6	10.1	0.9	0.8	3.9	1.1	2.4	6.4	7.3
February	9.7	121	105	39	64	21	33	20	48	52	41	47	16	27	15	45	50	27	42	25.5	21.8	23.8	0.6	0.7	2.7	1.2	2.6	4.5	5.3
March	10.4	94	102	29	52	18	18	19	62	65	24	69	12	17	14	44	53	33	39	33.2	34.6	34.3	0.9	0.8	2.5	2.8	2.5	5.2	5.8
April	9.4	101	108	50	48	34	40	32	102	114	50	49	35	34	32	35	39	24	24	14.6	15.9	12.8	0.7	0.7	3.6	1.2	3.0	5.1	6.3
May*	14.0	95	87	25	59	25	14	20	144	163	43	95	45	25	30	43	41	3	33	2.0	2.3	1.7	0.8	0.8	2.1	1.0	1.9	3.0	5.7
June*	10.0	95	89	35	58	35	26	29	132	151	90	145	78	80	80	38	39	2	29	1.7	1.2	0.4	1.0	1.1	3.8	1.5	1.9	5.5	7.3
July*	10.6	75	118	45	58	28	27	27	114	128	67	90	91	90	67	37	41	15	26	1.5	1.3	2.0	0.9	1.0	1.3	1.8	2.3	3.2	5.2
August*	5.2	69	81	40	53	24	21	39	130	146	105	67	100	101	88	44	45	27	33	1.9	2.2	1.1	0.6	0.7	1.0	1.0	2.8	4.8	5.8
September*	7.9	92	107	33	62	30	33	25	139	158	53	71	55	57	51	32	32	23	27	5.2	7.1	6.5	0.5	0.7	2.0	1.2	1.4	5.2	6.1
October*	9.4	111	103	52	63	44	66	41	170	182	61	83	64	65	61	29	29	24	25	2.2	5.8	3.8	0.3	0.3	0.7	0.8	2.5	3.9	5.1
November*	12.2	109	109	42	55	35	35	24	138	185	53	93	68	78	63	41	40	31	30	1.2	1.9	3.4	0.3	0.5	1.2	1.6	2.3	7.2	7.6
December	11.5	102	109	37	50	34	39	18	144	155	44	56	50	49	33	45	44	40	35	7.3	13.2	8.7	0.7	0.6	1.8	1.3	3.0	5.3	7.8
Daily Average	10.0	99	105	39	57	30	32	28	114	131	56	76	53	55	47	39	41	23	30	9	10	9.1	0.7	0.7	2.2	1.4	2.4	4.9	6.3

Year: 2000

Month	Avg Flow (Effluent MGD)	NAP BOD (mg/L)	SAP BOD (mg/L)	NPP BOD (mg/L)	SPP BOD (mg/L)	PP1 BOD (mg/L)	PP2 BOD (mg/L)	EFF BOD (mg/L)	NAP TSS (mg/L)	SAP TSS (mg/L)	NPP TSS (mg/L)	SPP TSS (mg/L)	PP1 TSS (mg/L)	PP2 TSS (mg/L)	EFF TSS (mg/L)	NAP NH3 (mg/L)	SAP NH3 (mg/L)	NPP NH3 (mg/L)	SPP NH3 (mg/L)	PP1 NH3 (mg/L)	PP2 NH3 (mg/L)	EFF NH3 (mg/L)	NAP DO (mg/L)	SAP DO (mg/L)	NPP DO (mg/L)	SPP DO (mg/L)	PP1 DO (mg/L)	PP2 DO (mg/L)	EFF DO (mg/L)
January	9.8	153	154	29	65	25	26	21	130	151	64	65	34	35	26	52	50	39	40	14.3	21.3	13.6	1.3	1.4	2.2	2.9	7.4	10.0	11.1
February	9.7	162	160	69	72	30	28	22	91	97	77	89	25	38	20	47	43	33	37	28.1	26.5	17.4	1.8	1.8	3.2	2.8	3.8	6.3	8.3
March	10.4	155	138	45	69	29	35	27	89	90	59	79	46	44	27	52	48	37	49	42.8	38.5	23.6	0.3	0.3	0.7	1.2	3.4	7.3	8.1
April	9.4	192	171	40	55	30	61	28	205	218	41	55	38	41	32	43	43	37	45	25.1	21.1	14.2	0.6	0.4	1.5	1.6	3.0	4.4	5.6
May*	14.0	88	82	54	54	39	31	15	182	176	76	82	60	48	46	20	19	18	22	1.7	2.9	0.6	0.6	0.5	0.7	1.9	2.0	2.7	4.0
June*	10.0	104	106	38	51	33	27	12	160	157	67	69	51	56	55	26	25	21	22	1.3	1.2	0.4	0.4	0.3	0.8	1.0	2.8	5.7	5.9
July*	10.6	116	104	34	45	29	27	16	118	136	59	82	59	77	60	31	35	21	26	2.5	2.0	1.9	0.3	0.3	0.8	0.7	1.3	2.8	4.9
August*	5.2	77	88	38	49	27	32	19	128	113	71	95	53	83	71	40	41	24	30	2.9	2.6	3.5	0.2	0.2	0.6	0.8	1.0	2.8	5.0
September*	7.9	94	85	24	35	26	31	13	120	121	45	61	47	96	27	37	38	28	32	8.7	4.8	10.0	0.2	0.2	1.6	0.7	1.7	3.5	2.4
October*	9.4	107	123	54	45	46	47	15	32	147	42	76	43	63	42	32	34	26	33	6.9	4.0	3.9	0.4	0.2	1.3	1.1	3.4	3.4	6.1
November*	12.2	120	124	24	51	22	18	8	144	148	33	71	26	31	20	32	34	28	36	6.5	3.8	3.3	0.7	0.8	2.2	3.1	3.8	6.6	7.4
December	11.5	135	155	40	43	22	19	20	137	130	45	68	23	20	19	42	40	32	42	21.4	14.0	11.3	0.7	0.6	4.8	2.3	11.7	13.7	13.0
Daily Average	10.0	125	124	41	30	32	18	18	128	140	57	74	42	53	37	38	38	29	34	13.5	11.9	8.6	0.6	0.6	1.7	1.7	3.8	5.8	6.8
1998-2000 Avg	10.0	105	132	40.7	45	31	26	22	110	117	62	73	47	52	40	40	46	23	33	10.8	10.1	8.9	1.0	1.0	2.5	1.9	3.5	5.5	6.9
Permit Limits								30/25*														15 May-Nov							

Key:

NAP	North Aerated Pond	NPP	North Primary Pond	PP1	Polishing Pond #1
SAP	South Aerated Pond	SPP	South Primary Pond	PP2	Polishing Pond #2

Table A-4
Pine Bluff Wastewater Utility
Boyd Point WWTP
Pond Temperature Extremes, 1998-2001

Year	*Industry*	*Minimum Temperature °C*	*Maximum Temperature °C*
1998	Influent - Sewer A	2.0	34.7
	Influent - Sewer C	2.5	32.3
	North Aerated Pond	7.9	37.2
	South Aerated Pond	8.2	31.5
	North Primary Pond	4.1	33.9
	South Primary Pond	4.3	31.3
	Polishing Pond #1	3.8	31.5
	Polishing Pond #2	4.1	31.6
1999	Influent - Sewer A	2.1	30.6
	Influent - Sewer C	2.0	31.2
	North Aerated Pond	7.2	30.4
	South Aerated Pond	5.5	30.3
	North Primary Pond	2.2	32.0
	South Primary Pond	3.2	31.9
	Polishing Pond #1	--	--
	Polishing Pond #2	1.5	31.8
2000	Influent - Sewer A	0.9	30.1
	Influent - Sewer C	0.9	38.7
	North Aerated Pond	1.8	39.5
	South Aerated Pond	1.0	30.0
	North Primary Pond	0.9	31.0
	South Primary Pond	0.6	31.3
	Polishing Pond #1	0.1	31.2
	Polishing Pond #2	0.1	31.0
2001	Influent - Sewer A	2.2	32.9
	Influent - Sewer C	2.7	33.9
	North Aerated Pond	4.9	29.7
	South Aerated Pond	5.2	29.8
	North Primary Pond	0.0	32.4
	South Primary Pond	1.7	31.5
	Polishing Pond #1	0.8	31.6
	Polishing Pond #2	0.8	32.1
Average	Influent - Sewer A	1.6	31.5
	Influent - Sewer C	1.9	34.5
	North Aerated Pond	2.7	33.6
	South Aerated Pond	5.3	31.9
	North Primary Pond	3.7	31.3
	South Primary Pond	2.2	32.2
	Polishing Pond #1	2.1	31.5
	Polishing Pond #2	1.6	31.5

Note: Sewer A is primarily residential/commercial and Sewer C is primarily industrial.

Table A-5
Pine Bluff Wastewater Utility
Boyd Point WWTP
Industrial Wastewater Load, 1998-2001

Year	Industry	Water Use (MGD)	Estimated Wastewater @ 90% (MGD)	BOD (mg/L)	BOD Load (lb/day)	TSS (mg/L)	TSS Load (lb/day)	O&G (mg/L)	O&G Load (lb/day)
1998	Aramark	0.064	0.058	905	435	682	328	659	317
	Century Tube	0.017	0.015	27	3	19	2	12	2
	Jefferson Regional Medical Center	0.117	0.105	119	105	83	73	36	32
	Southern Bag	0.030	0.027	287	65	225	51	25	6
	Southern Pacific Railroad	0.018	0.016	161	22	81	11	38	5
	Stant	0.085	0.077	15	10	4	3	11	7
	TreFil Arbed	0.232	0.209	49	85	45	78	12	21
	Tyson	0.536	0.482	1,236	4,973	873	3,512	373	1,501
	Tyson - Industrial Park (flow est.)	1.790	1.611	549	7,376	178	2,392	24	322
	Wheeling Machine	0.020	0.018	80	12	31	5	29	4
	Planters Cotton Oil Mill	0.001	0.001	936	7	278	2	441	3
	Sure-Pull	0.002	0.002	932	14	234	4	426	6
	Viking Bag	0.003	0.003	308	7	93	2	35	1
	Daily Average	2.915	2.624	431	13,113	217	6,462	163	2,226
1999	Aramark	0.051	0.046	831	318	951	364	790	302
	Century Tube	0.049	0.044	38	14	24	9	53	19
	Jefferson Regional Medical Center	0.122	0.110	213	195	136	125	63	58
	Southern Bag	0.061	0.055	472	216	304	139	43	20
	Southern Pacific Railroad	0.027	0.024	186	38	142	29	107	22
	Stant	0.084	0.076	38	24	52	33	15	9
	TreFil Arbed	0.184	0.166	55	76	74	102	36	50
	Tyson	0.621	0.559	1,161	5,412	1,025	4,778	382	1,781
	Tyson - Industrial Park	2.080	1.872	693	10,819	347	5,418	74	1,155
	Wheeling Machine	0.016	0.014	13	2	32	4	98	12
	Planters Cotton Oil Mill	0.081	0.073	169	103	61	37	77	47
	Sure-Pull	0.001	0.001	359	3	216	2	359	3
	Daily Average	3.377	3.039	352	17,219	280	11,038	175	3,477
2000	Aramark	0.088	0.079	966	638	1,001	661	673	445
	Century Tube	0.048	0.043	32	12	26	9	27	10
	Jefferson Regional Medical Center	0.102	0.092	351	269	217	166	74	57
	Southern Bag	0.064	0.058	383	184	189	91	46	22
	Southern Pacific Railroad	0.007	0.006	206	11	93	5	41	2
	Stant	0.055	0.050	91	38	15	6	33	14
	TreFil Arbed	0.242	0.218	37	67	88	160	22	40
	Tyson	0.721	0.649	1,148	6,213	736	3,983	323	1,748
	Tyson - Industrial Park	1.970	1.773	769	11,371	510	7,541	86	1,272
	Wheeling Machine	0.021	0.019	16	3	9	1	26	4
	Planters Cotton Oil Mill	0.083	0.075	333	207	143	89	220	137
	Rolling Pin	0.046	0.041	2,861	988	1,636	565	173	60
	Daily Average	3.447	3.102	599	20,000	389	13,278	145	3,809
2001	Aramark	0.044	0.040	1,788	591	1,592	526	897	296
	Century Tube	0.020	0.018	46	7	14	2	41	6
	Jefferson Regional Medical Center	0.100	0.090	260	195	167	125	55	41
	Southern Bag	0.063	0.057	180	85	174	82	36	17
	Southern Pacific Railroad	0.011	0.010	250	21	50	4	80	7
	Stant	0.043	0.039	59	19	68	22	35	11
	TreFil Arbed	0.195	0.176	91	133	38	56	21	31
	Tyson	0.732	0.659	1,587	8,720	811	4,456	470	2,582
	Tyson - Industrial Park	1.960	1.764	583	8,577	313	4,605	57	839
	Wheeling Machine	0.023	0.021	22	4	5	1	28	5
	Planters Cotton Oil Mill	0.073	0.066	915	501	230	126	425	233
	Rolling Pin	0.055	0.050	5728	2,365	688	284	266	110
	Central Moloney Transformer	0.028	0.025	54	11	67	14	314	66
	Daily Average	3.3467	3.012	889	21,228	324	10,303	210	4,244
1998-2001 Average		3.3	**2.9**	**568**	**17,890**	**303**	**10,270**	**173**	**3,439**

Note
1. Wastewater flows, and hence loadings, are estimated from water consumption records.

Table A-6
Pine Bluff Wastewater Utility
Boyd Point WWTP
Tyson - Industrial Park Water Use 1999-2001

Month	1998		1999		2000		2001		2002	
	100 CF	MGD	100 CF	MGD	100 CF	MGD	100 CF	MGD	100 CF	MGD
January	61,925	1.49	75,645	1.83	84,941	2.05	71,933	1.74	75,025	1.81
February	74,370	1.99	65,665	1.75	85,984	2.22	74,820	2.00	79,595	2.13
March	75,495	1.82	83,750	2.02	83,100	2.01	76,635	1.85	55,815	1.35
April	72,640	1.81	77,825	1.94	80,405	2.00	80,160	2.00	64,135	1.60
May	85,295	2.06	84,050	2.03	83,727	2.02	81,590	1.97	82,171	1.98
June	76,420	1.91	78,460	1.96	73,680	1.84	77,515	1.93	75,005	1.87
July	53,975	1.30	76,642	1.85	80,675	1.95	87,415	2.11	76,740	1.85
August	72,217	1.74	109,878	2.65	77,905	1.88	79,590	1.92	63,160	1.52
September	75,280	1.88	83,329	2.08	81,665	2.04	86,079	2.15	94,535	2.36
October	79,865	1.93	102,506	2.47	75,675	1.83	91,203	2.20		
November	78,866	1.97	89,405	2.23	79,550	1.98	74,405	1.86		
December	67,230	1.62	87,135	2.10	76,565	1.85	76,335	1.84		
Average	72,798	1.79	84,524	2.08	80,323	1.97	79,807	1.96	74,020	1.83

4-Year Afverage: 3.5 MGD

Appendix B
Sludge Disposal Correspondence
and Test Results

TRS
TERRA RENEWAL SERVICES

Terra Renewal Services, Inc.
Route 1, Box 55C
P.O. Box 150
Dardanelle, AR 72834
(479) 229-3656
Fax: (479) 229-3734
www.terrarenewal.com

October 25, 2002

Mr. Clyde H. Burnett, P.E., DEE
Carter-Burgess
10809 Executive Center, Suite 204
Little Rock, AR 72211-6021

RE: Removal and Land Application of Wastewater Biosolids from Ponds

Dear Mr. Burnett:

I investigated the ponds at the Pine Bluff sewage treatment plant on October 15, 2002. This shall present the results of my limited investigation and our cost estimate to remove, haul and land apply the biosolids for beneficial use as fertilizer.

The north aerated pond did not have an appreciable amount of settled sludge on its bottom except in the middle, where it had about three feet of accumulation. Its total depth is fifteen feet. It is assumed that the south aerated pond is similar.

The majority of the biosolids in the primary ponds is accumulated along the north banks of the ponds. It is assumed that this accumulation is due to the algae blooms that occur in the warm season and the fact that the prevailing south winds during that season pushes the algae to the north banks where it settles out and decomposes. The south primary pond has about three feet of accumulation in an area with approximate dimensions of 2,300 feet by 50 feet, which calculates to be about 2.6 million gallons. 12,800 cy
The north primary pond has about four feet of accumulation in an area with approximate dimensions of 2,200 feet by 150 feet, which calculates to be about 9.8 48,900 cy
million gallons. The total volume of biosolids along the north banks of the two primary ponds is approximately 12.4 million gallons. 61,700 cy TOTAL

It is proposed to use a floating dredge with floating pipeline to remove the biosolids from the primary ponds and pump it to a mobile tank, from which it will be transferred to tanker trailers and hauled to farm sites. The biosolids will be transferred by vacuum to 4,200-gallon spreader buggies pulled and powered by 4WD farm tractors and top-spread for beneficial use as fertilizer according to a State Water Permit issued to TRS.

TRS proposes to contact farmers and secure adequate pasture and/or farm land in the area of the sewage plant. TRS will prepare a management plan and apply to the Arkansas Department of Environmental Quality (ADEQ) for a permit to apply the biosolids for beneficial use as fertilizer. It is expected that it will require at least 450 acres to beneficially use the biosolids based upon an agronomic rate for nitrogen. It is expected that, due to the long digestion time, the residuals meet the criteria for classification as Class B biosolids. TRS will be responsible for all sampling, analysis, engineering, and field work required to prepare the management plan and permit application. TRS will be the holder of the permit and solely responsible for compliance with the permit and other regulations. TRS will keep records and prepare a final report to ADEQ.

Our cost estimate is three and one-half cents per gallon ($0.035/gal) removed and land applied. It should be noted that, when dredging, a significant amount of free water is pumped along with the sludge; therefore, it may require removal of a total of about 15 million gallons to remove the biosolids. = $525,000

Thank you for the opportunity to present this proposal. Please contact Rick Thone or me at 479-229-3656 if we may assist you.

Yours sincerely,

SW Smith

Steven W. "Bo" Smith, P.E.
President

AMERICAN INTERPLEX CORPORATION LABORATORIES

8600 Kanis Road
Little Rock, AR 72204-2322
(501) 224-5060
FAX (501) 224-5072

REPORT

Terra Renewal Services, Inc.
ATTN: Mr. Mike Cook
Post Office Box 150
Dardanelle, AR 72834

October 25, 2002
Control No. 69080

Project Description: Three (3) sludge sample(s) received on October 15, 2002
Sludge
P.O. No. 12189

Dear Mr. Mike Cook:

Please find enclosed analytical results for the sample(s) submitted to American Interplex Corporation (AIC) on October 15, 2002. The following results are applicable only to samples identified by the control number designated above. Accurate assessment of the data requires access to the entire document. Each section of the report has been reviewed and approved by the appropriate laboratory director or a qualified designee.

Data is presented on a dry weight basis.

If you have any questions, please reference Control No. 69080.

AMERICAN INTERPLEX CORPORATION

By ______________________
John Overbey
Laboratory Director

KW/lims

Enclosure(s): Chain of Custody

cc: City of Pine Bluff Wastewater Utility
ATTN: Mr. Ken Johnson
1520 South Ohio Street
Pine Bluff, AR 71601

AMERICAN INTERPLEX CORPORATION
LABORATORIES

8600 Kanis Road
Little Rock, AR 72204-2322
(501) 224-5060
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REPORT

Terra Renewal Services, Inc.
Post Office Box 150
Dardanelle, AR 72834

October 25, 2002
Control No. 69080

ATTN: Mr. Mike Cook

Project Description: Three (3) sludge sample(s) received on October 15, 2002
Sludge
P.O. No. 12189

Sample Identification: 1 North Primary Pond 10-15-02
AIC No. 69080-1

Parameter	Method	Result	Batch	Time Analyzed By
Fecal Coliform	SM 9221E1	650 MPN/g	B4884	15OCT02 1528 214
Total Solids	SM 2540 G	4.6 %	W8434	15OCT02 1555 221

Sample Identification: 2 North Primary Pond 10-15-02
AIC No. 69080-2

Parameter	Method	Result	Batch	Time Analyzed By
Fecal Coliform	SM 9221E1	5100 MPN/g	B4884	15OCT02 1528 214
Total Solids	SM 2540 G	3.4 %	W8434	15OCT02 1555 221

Sample Identification: 1 S. Primary Pond 10-15-02
AIC No. 69080-3

Parameter	Method	Result	Batch	Time Analyzed By
Fecal Coliform	SM 9221E1	6700 MPN/g	B4884	15OCT02 1528 214
Total Solids	SM 2540 G	4.5 %	W8434	15OCT02 1555 221

Sample Identification: 1 North Primary Pond, 2 North Primary Pond, 1 S. Primary Pond 10-15-02
AIC No. 69080-4

Parameter	Method	Result	Batch	Time Analyzed By
Phosphorus	EPA 3051, 6010B	6300 mg/Kg	S9187	18OCT02 0920 65
Ammonia as N	SM 4500 NH3-B,G	5100 mg/Kg	W8436	16OCT02 0807 93
Total Kjeldahl Nitrogen	SM 4500 NH3-CG	33000 mg/Kg	W8435	16OCT02 0806 93
Total Solids	SM 2540 G	4.2 %	W8442	18OCT02 1520 93

Note: Equivalent aliquots of sample were composited for analysis.

AMERICAN INTERPLEX CORPORATION
LABORATORIES

8600 Kanis Road
Little Rock, AR 72204-2322
(501) 224-5060
FAX (501) 224-5072

Q C
R E P O R T

Terra Renewal Services, Inc.
Post Office Box 150
Dardanelle, AR 72834

October 25, 2002
Control No. 69080

Parameter	% Recovery	Relative % Difference	Batch
Phosphorus	86.4	3.19	S9187
Ammonia as N	97.8	1.98	W8436
Total Kjeldahl Nitrogen	102	9.30	W8435
Total Solids	-	3.40	W8442

Data has been validated using standard quality control measures (blank, laboratory control, spike and spike duplicate) performed on at least 10% of samples analyzed. Quality Assurance, instrumentation maintenance and calibration were performed in accordance with guidelines established by the USEPA.
SM method = Standard Methods for the Examination of Water and Wastewaster, 19th edition, 1995.

KW/lims

Appendix C
Detailed Cost Estimates

Table 1A
Upgraded Aerated Lagoon System
Using Surface Aerators
Life Cycle Cost Estimate

1 *Capital Costs*

Item	Size/No.	Unit	Unit Cost	Raw Cost	Installation Factor	Installation Cost	Total Cost
Mobilization	1	LS	$90,000	$90,000	NA	NA	$90,000
Aerated Pond Modifications							
Install floating baffles	750	LF	$50	$37,500	Incl	Incl	$37,500
New 75 HP surface aerators	22	EA	$22,500	$495,000	35%	$173,250	$668,250
New 3000A switchboard & MCC	2	LS	$35,000	$70,000	135%	$94,500	$164,500
Conduit, trenching, branch circuits	1	LS	$40,000	$40,000	135%	$54,000	$94,000
Refurbish existing aerators	12	EA	$12,000	$144,000	35%	$50,400	$194,400
Subtotal							$1,158,650
Primary/Polishing Pond Modifications							
Install floating baffles	4,350	LF	$50	$217,500	Incl	Incl	$217,500
New 50 HP surface aerators	4	EA	$20,000	$80,000	35%	$28,000	$108,000
New 500A switchboard & MCC	1	LS	$10,000	$10,000	135%	$13,500	$23,500
Conduit, trenching, branch circuits	1	LS	$20,000	$20,000	135%	$27,000	$47,000
Install mulit-port drawoffs	3	EA	$5,000	$5,000	*Incl*	*Incl*	*$5,000*
36" DI outfall extension	1,200	LF	$100	$120,000	Incl	Incl	$120,000
Subtotal							$521,000
Miscellaneous	1	LS	$50,000	$50,000	NA	NA	$50,000
						Subtotal	$1,819,650
						Contractor Overhead & Profit, 15%	$273,000
						Contingencies, 20%	$364,000
						Total Estimated Construction Cost	**$2,456,650**

2 *Operation, Maintenance and Replacement Cost*

	Amount	Unit	Unit cost	Annual OM&R
Maintenance (1.0% of capital costs) (	1	LS	1.0%	$24,567
Labor		FTE		$0
Power	2,050	KW	$0.07	$1,257,060
Chemicals				$0
Testing				$0
Miscellaneous				$0
			Subtotal	$1,282,000
			Debt Service (2)	$189,000
			Replacement Reserve (3)	$82,000
			Total Annual OM&R Cost	***$1,553,000***

Notes

(1) Includes materials, office expenses, training & licensing, outside services.
(2) Based on financing total capital cost fo 20 years at 4.5%.
(3) Based on straight line depreciation *for 30 years.*

3 *Net Present Worth*

			Present Worth
Annual interest rate	4.5%		
Project life	30	years	
Present worth factor	16.28889		
Present worth of Annual OM&R cost			$25,296,644
Capital cost			$2,456,650

Total Present Worth $27,753,294

Table 1B
Upgraded Aerated Lagoon System
Using Diffused Air
Life Cycle Cost Estimate

1 Capital Costs

Item	Size/No.	Unit	Unit Cost	Raw Cost	Installation Factor	Installation Cost	Total Cost
Mobilization	1	LS	$160,000	$160,000	NA	NA	$160,000
Aerated Pond Modifications							
Demolition	1	LS	$25,000	$25,000	Incl	Incl	$25,000
N & S aerated pond cleaning	2	LS	$25,000	$50,000	Incl	Incl	$50,000
Install floating baffles	750	LF	$50	$37,500	Incl	Incl	$37,500
New fine bubble diffused air system	1	LS	$1,500,000	$1,500,000	20%	$300,000	$1,800,000
Construct building pad	3,500	CY	$7	$24,500	Incl	Incl	$24,500
Blower building	1,250	SF	$75	$93,750	Incl	Incl	$93,750
Centrifugal blowers	5	LS	$82,500	$412,500	35%	$144,375	$556,875
Air piping	1	LS	$100,000	$100,000	Incl	Incl	$100,000
Electrical modifications	1	LS	$125,000	$125,000	Incl	Incl	$125,000
Subtotal							$2,737,625
Primary/Polishing Pond Modifications							
Install floating baffles	4,350	LF	$50	$217,500	Incl	Incl	$217,500
Refurbish existing aerators	3	EA	$12,000	$36,000	35%	$12,600	$48,600
New 500A switchboard & MCC	1	LS	$10,000	$10,000	135%	$13,500	$23,500
Conduit, trenching, branch circuits	1	LS	$20,000	$20,000	135%	$27,000	$47,000
Install mulit-port drawoffs	3	EA	$5,000	$5,000	Incl	Incl	$5,000
36" DI outfall extension	1,200	LF	$100	$120,000	Incl	Incl	$120,000
Subtotal							$461,600
Miscellaneous	1	LS	$50,000	$50,000	NA	NA	$50,000

Subtotal	$3,409,225
Contractor Overhead & Profit, 15%	$511,000
Contingencies, 20%	$682,000
Total Estimated Construction Cost	**$4,602,225**

2 Operation, Maintenance and Replacement Cost

	Amount	Unit	Unit cost	Annual OM&R
Maintenance (1.0% of capital costs) (	1	LS	1.0%	$46,022
Labor		FTE		$0
Power	1,100	KW	$0.07	$674,520
Chemicals				$0
Testing				$0
Miscellaneous				$0

Subtotal	*$721,000*
Debt Service (2)	$354,000
Replacement Reserve (3)	$153,000
Total Annual OM&R Cost	**$1,228,000**

Notes

(1) Includes materials, office expenses, training & licensing, outside services.

(2) Based on financing total capital cost fo 20 years at 4.5%.

(3) Based on straight line depreciation for 30 years.

3 Net Present Worth

			Present Worth
Annual interest rate	4.5%		
Project life	30	years	
Present worth factor	16.28889		
Present worth of Annual OM&R cost			$20,002,755
Capital cost			$4,602,225

Total Present Worth $24,604,980

Table 2
Anaerobic Lagoon with Upgraded Aerated System Life Cycle Cost Estimate

1 Capital Costs

Item	Size/No.	Unit	Unit Cost	Raw Cost	Installation Factor	Installation Cost	Total Cost
Mobilization	1	LS	$90,000	$90,000	NA	NA	$90,000
Anaerobic Ponds							
S. Aerated Pond cleaning	1	LS	*$25,000*	*$25,000*	*Incl*	*Incl*	*$25,000*
New anerobic cell dikes	70,000	CY	$7	$490,000	Incl	Incl	$490,000
Inlet modifications	1	LS	$10,000	$10,000	Incl	Incl	$10,000
Stone riprap	200	CY	$25	$5,000	Incl	Incl	$5,000
Subtotal							$530,000
Aerated Pond Modifications							
Install floating baffles	750	LF	$50	$37,500	Incl	Incl	$37,500
New 75 HP surface aerators	10	EA	$22,500	$225,000	35%	$78,750	$303,750
New 3000A switchboard & MCC	1	LS	$35,000	$35,000	135%	$47,250	$82,250
Conduit, trenching, branch circuits	1	LS	$20,000	$20,000	135%	$27,000	$47,000
Refurbish existing aerators	12	EA	$12,000	$144,000	35%	$50,400	$194,400
Subtotal							$664,900
Primary/Polishing Pond Modifications							
Install floating baffles	4,350	LF	$50	$217,500	Incl	Incl	$217,500
New 50 HP surface aerators	4	EA	$20,000	$80,000	35%	$28,000	$108,000
New 500A switchboard & MCC	1	LS	$10,000	$10,000	135%	$13,500	$23,500
Conduit, trenching, branch circuits	1	LS	$20,000	$20,000	135%	$27,000	$47,000
Install mulit-port drawoffs	3	EA	$5,000	$5,000	Incl	Incl	$5,000
36" DI outfall extension	1,200	LF	$100	$120,000	Incl	Incl	$120,000
Subtotal							$521,000
Miscellaneous	1	LS	$50,000	$50,000	NA	NA	$50,000

Subtotal	$1,855,900
Contractor Overhead & Profit, 15%	$278,000
Contingencies, 20%	$371,000
Total Estimated Construction Cost	**$2,504,900**

2 Operation, Maintenance and Replacement Cost

	Amount	Unit	Unit cost	Annual OM&R
Maintenance (1.0% of capital costs) (	1	LS	1.0%	$25,049
Labor		FTE		$0
Power	1,380	KW	$0.07	$846,216
Chemicals				$0
Testing				$0
Miscellaneous				$0

Subtotal	$871,000
Debt Service (2)	$193,000
Replacement Reserve (3)	$83,000
Total Annual OM&R Cost	**$1,147,000**

Notes
(1) Includes materials, office expenses, training & licensing, outside services.
(2) Based on financing total capital cost fo 20 years at 4.5%.
(3) Based on straight line depreciation for 30 years.

3 Net Present Worth

			Present Worth
Annual interest rate	4.5%		
Project life	30	years	
Present worth factor	16.28889		
Present worth of Annual OM&R cost			$18,683,355
Capital cost			$2,504,900

Total Present Worth $21,188,255

Table 3
Upgraded Aerated Lagoon System with Pretreatment for Grease Removal
Life Cycle Cost Estimate

1 *Capital Costs*

Item	Size/No.	Unit	Unit Cost	Raw Cost	Installation Factor	Installation Cost	Total Cost
Mobilization	1	LS	$80,000	$80,000	NA	NA	$80,000
Oil & Grease Removal Facility							
Construct building pad	3,500	CY	$7	$24,500	Incl	Incl	$24,500
Concrete structure	950	CY	$400	$380,000	Incl	Incl	$380,000
Grit & grease removal unit	1	LS	$197,000	$197,000	Incl	Incl	$197,000
Grit pumps	2	EA	$15,000	$30,000	Incl	Incl	$30,000
Grit piping	1	LS	$25,000	$25,000	Incl	Incl	$25,000
Electrical	1	LS	$75,000	$75,000	Incl	Incl	$75,000
Miscellaneous	1	LS	$25,000	$25,000	Incl	Incl	$25,000
Subtotal							$756,500
Aerated Pond Modifications							
Install floating baffles	750	LF	$50	$37,500	Incl	Incl	$37,500
New 75 HP surface aerators	17	EA	$22,500	$382,500	35%	$133,875	$516,375
New 2500A switchboard & MCC	2	LS	$30,000	$60,000	135%	$81,000	$141,000
Conduit, trenching, branch circuits	1	LS	$35,000	$35,000	135%	$47,250	$82,250
Refurbish existing aerators	12	EA	$12,000	$144,000	35%	$50,400	$194,400
Subtotal							$971,525
Primary/Polishing Pond Modifications							
Install floating baffles	4,350	LF	$50	$217,500	Incl	Incl	$217,500
New 50 HP surface aerators	4	EA	$20,000	$80,000	35%	$28,000	$108,000
New 500A switchboard & MCC	1	LS	$10,000	$10,000	135%	$13,500	$23,500
Conduit, trenching, branch circuits	1	LS	$20,000	$20,000	135%	$27,000	$47,000
Install mulit-port drawoffs	3	EA	$5,000	$5,000	Incl	Incl	$5,000
36" DI outfall extension	1,200	LF	$100	$120,000	Incl	Incl	$120,000
Subtotal							$521,000
Miscellaneous	1	LS	$50,000	$50,000	NA	NA	$50,000

Subtotal	$2,379,025
Contractor Overhead & Profit, 15%	$357,000
Contingencies, 20%	$476,000
Total Estimated Construction Cost	**$3,212,025**

2 *Operation, Maintenance and Replacement Cost*

	Amount	Unit	Unit cost	Annual OM&R
Maintenance (1.0% of capital costs) (	1	LS	1.0%	$32,120
Labor		FTE		$0
Power	1,800	KW	$0.07	$1,103,760
Chemicals				$0
Testing				$0
Miscellaneous				$0

Subtotal	$1,136,000
Debt Service (2)	$247,000
Replacement Reserve (3)	$107,000
Total Annual OM&R Cost	**$1,490,000**

Notes

(1) Includes materials, office expenses, training & licensing, outside services.
(2) Based on financing total capital cost fo 20 years at 4.5%.
(3) Based on straight line depreciation for 30 years.

3 *Net Present Worth*

			Present Worth
Annual interest rate	4.5%		
Project life	30	years	
Present worth factor	16.28889		
Present worth of Annual OM&R cost			$24,270,444
Capital cost			$3,212,025

Total Present Worth $27,482,469

Table 4
Activated Lagoon System for Complete Nitrification Life Cycle Cost Estimate

1 *Capital Costs*

Item	Size/No.	Unit	Unit Cost	Raw Cost	Installation Factor	Installation Cost	Total Cost
Mobilization	1	LS	$130,000	$130,000	NA	NA	$130,000
Aerated Pond Modifications							
Install floating baffles	750	LF	$50	$37,500	Incl	Incl	$37,500
New 75 HP surface aerators	22	EA	$22,500	$495,000	35%	$173,250	$668,250
New 3000A switchboard & MCC	2	LS	$35,000	$70,000	135%	$94,500	$164,500
Conduit, trenching, branch circuits	1	LS	$40,000	$40,000	135%	$54,000	$94,000
Refurbish existing aerators	12	EA	$12,000	$144,000	35%	$50,400	$194,400
Subtotal							$1,158,650
New Integral Clarifers							
Site preparation	1	LS	$25,000	$25,000	Incl	Incl	$25,000
Install sheet piling	16,000	SF	$12	$192,000	Incl	Incl	$192,000
Clarifier floor slab	60	CY	$300	$18,000	Incl	Incl	$18,000
Rill	20,000	CY	$7	$140,000	Incl	Incl	$140,000
New outlet ports	8	EA	$5,000	$40,000	Incl	Incl	$40,000
Pump platform & bridge	8	EA	$22,000	$176,000	Incl	Incl	$176,000
Air lift pump	8	EA	$5,000	$40,000	Incl	Incl	$40,000
Equipment slab	1	LS	$5,000	$5,000	Incl	Incl	$5,000
40 HP Blowers	2	EA	$25,000	$50,000	35%	$17,500	$67,500
8-in CS air piping	800	LF	$30	$24,000	Incl	Incl	$24,000
8-in DI return sludge piping	800	LF	$40	$32,000	Incl	Incl	$32,000
Valves and fittings	1	LS	$10,000	$10,000	Incl	Incl	$10,000
Electrical	1	LS	$75,000	$75,000	Incl	Incl	$75,000
Miscellaneous	1	LS	$25,000	$25,000	Incl	Incl	$25,000
Subtotal			$50	$0	Incl	Incl	$869,500
Primary/Polishing Pond Modifications							
Install floating baffles	4,350	LF	$50	$217,500	Incl	Incl	$217,500
New 50 HP surface aerators	4	EA	$20,000	$80,000	35%	$28,000	$108,000
New 500A switchboard & MCC	1	LS	$10,000	$10,000	135%	$13,500	$23,500
Conduit, trenching, branch circuits	1	LS	$20,000	$20,000	135%	$27,000	$47,000
Install mulit-port drawoffs	3	EA	$5,000	$5,000	Incl	Incl	$5,000
36" DI outfall extension	1,200	LF	$100	$120,000	Incl	Incl	$120,000
Subtotal							$521,000
Miscellaneous	1	LS	$50,000	$50,000	NA	NA	$50,000

Subtotal	$2,729,150
Contractor Overhead & Profit, 15%	$409,000
Contingencies, 20%	$546,000
Total Estimated Construction Cost	**$3,684,150**

2 *Operation, Maintenance and Replacement Cost*

	Amount	Unit	Unit cost	Annual OM&R
Maintenance (1.0..% of capital costs) (	1	LS	1.0%	$36,842
Labor		FTE		$0
Power	2,050	KW	$0.07	$1,257,060
Chemicals				$0
Testing				$0
Miscellaneous				$0

Subtotal	$1,294,000
Debt Service (2)	$283,000
Replacement Reserve (3)	$123,000
Total Annual OM&R Cost	**$1,700,000**

Notes

(1) Includes materials, office expenses, training & licensing, outside services.
(2) Based on financing total capital cost for 20 years at 4.5%.
(3) Based on straight line depreciation for 30 years.

3 *Net Present Worth*

			Present Worth
Annual interest rate	4.5%		
Project life	30	years	
Present worth factor	16.28889		
Present worth of Annual OM&R cost			$27,691,111
Capital cost			$3,684,150

Total Present Worth $31,375,261

$872,000
$244,000
$106,000
$1,222,000

Carter::Burgess

2/18/2003

Table 5
Phased Upgrade
Using Diffused Air

PHASE 1: USE EXISTING AERATORS AND INSTALL SOME DIFFUSED AIR TO MEET EXISTING LOAD

1 Capital Costs

Item	Size/No.	Unit	Unit Cost	Raw Cost	Installation Factor	Installation Cost	Total Cost
Mobilization	1	LS	$110,000	$110,000	NA	NA	$110,000
Aerated Pond Modifications							
Demolition	1	LS	$15,000	$15,000	Incl	Incl	$15,000
Relocate 4 existing aerators	1	LS	$20,000	$20,000	Incl	Incl	$20,000
N & S aerated pond cleaning	2	LS	$25,000	$50,000	Incl	Incl	$50,000
Install floating baffles	750	LF	$50	$37,500	Incl	Incl	$37,500
New fine bubble diffused air system	1	LS	$825,000	$825,000	20%	$165,000	$990,000
Construct blower pad	3,500	CY	$7	$24,500	Incl	Incl	$24,500
Blower building	1,250	SF	$75	$93,750	Incl	Incl	$93,750
250 HP centrifugal blowers	4	EA	$64,000	$256,000	35%	$89,600	$345,600
Air piping	1	LS	$75,000	$75,000	Incl	Incl	$75,000
Electrical modifications	1	LS	$100,000	$100,000	Incl	Incl	$100,000
Subtotal							$1,666,350
Primary/Polishing Pond Modifications							
Install floating baffles	4,350	LF	$50	$217,500	Incl	Incl	$217,500
New 50 HP surface aerators	4	EA	$20,000	$80,000	35%	$28,000	$108,000
New 500A switchboard & MCC	1	LS	$10,000	$10,000	135%	$13,500	$23,500
Conduit, trenching, branch circuits	1	LS	$20,000	$20,000	135%	$27,000	$47,000
Install mulit-port drawoffs	3	EA	$5,000	$5,000	Incl	Incl	$5,000
36" DI outfall extension	1,200	LF	$100	$120,000	Incl	Incl	$120,000
Subtotal							$521,000
Miscellaneous	1	LS	$50,000	$50,000	NA	NA	$50,000

Subtotal	$2,347,000
Contractor Overhead & Profit, 15%	$352,000
Contingencies, 20%	$469,000
Total Estimated Construction Cost	**$3,168,000**

2 Operation, Maintenance and Replacement Cost

	Amount	Unit	Unit cost	Annual OM&R
Maintenance (1.0% of capital costs) (1)	1	LS	1.0%	$31,680
Additional labor		FTE		$0
Power	1,370	KW	$0.07	$840,084
Chemicals				$0
Testing				$0
Miscellaneous				$0

Subtotal	$872,000
Debt Service (2)	$194,000
Replacement Reserve (3)	$106,000
Total Annual OM&R Cost	**$1,172,000**

Notes

(1) Includes materials, office expenses, training & licensing, outside services.
(2) Based on financing total capital cost for 30 years at 4.5%.
(3) Based on straight line depreciation for 30 years.

Table 5
Phased Upgrade
Using Diffused Air

PHASE 2: ADD ADDITIONAL DIFFUSED AIR TO MEET FUTURE DESIGN LOAD

1 Capital Costs

Item	Size/No.	Unit	Unit Cost	Raw Cost	Installation Factor	Installation Cost	Total Cost
Mobilization	1	LS	$30,000	$30,000	NA	NA	$30,000
Aerated Pond Modifications							
Demolition	1	LS	$10,000	$10,000	Incl	Incl	$10,000
Relocate 4 existing aerators	1	LS	$20,000	$20,000	Incl	Incl	$20,000
Install additional fine bubble aeration	1	LS	$325,000	$325,000	20%	$65,000	$390,000
300 HP centrifugal blower	1	EA	$70,000	$70,000	35%	$24,500	$94,500
Air piping	1	LS	$25,000	$25,000	Incl	Incl	$25,000
Electrical modifications	1	LS	$25,000	$25,000	Incl	Incl	$25,000
Miscellaneous	1	LS	$15,000	$15,000	NA	NA	$15,000
					Subtotal		$610,000
					Contractor Overhead & Profit, 15%		$92,000
					Contingencies, 20%		$122,000
					Total Estimated Construction Cost		**$824,000**

2 Operation, Maintenance and Replacement Cost

	Amount	Unit	Unit cost	Annual OM&R
Maintenance (1.0% of capital costs) (1)	1	LS	1.0%	$8,240
Additional Labor		FTE		$0
Additional Power	126	KW	$0.07	$77,263
Chemicals				$0
Testing				$0
Miscellaneous				$0
			Subtotal	$86,000
			Additional Debt Service (2)	$51,000
			Additional Replacement Reserve (3)	$27,000
			Incremental Increase in Annual OM&R Cost	**$164,000**

Notes
(1) Includes materials, office expenses, training & licensing, outside services.
(2) Based on financing total capital cost for 30 years at 4.5%.
(3) Based on straight line depreciation for 30 years.

PHASE 3: AT END OF USEFUL LIFE OF EXISTING AERATORS REPLACE WITH DIFFUSED AIR

1 Capital Costs

Item	Size/No.	Unit	Unit Cost	Raw Cost	Installation Factor	Installation Cost	Total Cost
Mobilization	1	LS	$40,000	$40,000	NA	NA	$40,000
Aerated Pond Modifications							
Demolition	1	LS	$25,000	$25,000	Incl	Incl	$25,000
Install additional fine bubble aeration	1	LS	$580,000	$580,000	20%	$116,000	$696,000
300 HP centrifugal blower	1	EA	$70,000	$70,000	35%	$24,500	$94,500
Air piping	1	LS	$25,000	$25,000	Incl	Incl	$25,000
Electrical modifications	1	LS	$25,000	$25,000	Incl	Incl	$25,000
Miscellaneous	1	LS	$15,000	$15,000	NA	NA	$15,000
					Subtotal		$921,000
					Contractor Overhead & Profit, 15%		$138,000
					Contingencies, 20%		$184,000
					Total Estimated Construction Cost		**$1,243,000**

2 Operation, Maintenance and Replacement Cost

	Amount	Unit	Unit cost	Annual OM&R
Maintenance (1.0% of capital costs) (1)	1	LS	1.0%	$12,430
Additional Labor		FTE		$0
Net power savings	-331	KW	$0.07	($202,969)
Chemicals				$0
Testing				$0
Miscellaneous				$0
			Subtotal	($191,000)
			Additional Debt Service (2)	$76,000
			Additional Replacement Reserve (3)	$41,000
			Incremental Decrease in Annual OM&R Cost	**($74,000)**

Notes
(1) Includes materials, office expenses, training & licensing, outside services.
(2) Based on financing total capital cost for 30 years at 4.5%.
(3) Based on straight line depreciation for 30 years.

Table 5
Phased Upgrade
Using Diffused Air

PHASE 4: ADD SLUDGE RECIRCULATION TO ACHIEVE COMPLETE AMMONIA REMOVAL

1 Capital Costs

Item	Size/No.	Unit	Unit Cost	Raw Cost	Installation Factor	Installation Cost	Total Cost
Mobilization	1	LS	$40,000	$40,000	NA	NA	$40,000
Site preparation	1	LS	$25,000	$25,000	Incl	Incl	$25,000
Install sheet piling	16,000	SF	$12	$192,000	Incl	Incl	$192,000
Clarifier floor slab	60	CY	$300	$18,000	Incl	Incl	$18,000
Rill	20,000	CY	$7	$140,000	Incl	Incl	$140,000
New outlet ports	8	EA	$5,000	$40,000	Incl	Incl	$40,000
Pump platform & bridge	8	EA	$22,000	$176,000	Incl	Incl	$176,000
Air lift pump	8	EA	$5,000	$40,000	Incl	Incl	$40,000
Equipment slab	1	LS	$5,000	$5,000	Incl	Incl	$5,000
40 HP Blowers	2	EA	$25,000	$50,000	35%	$17,500	$67,500
8-in CS air piping	800	LF	$30	$24,000	Incl	Incl	$24,000
8-in DI return sludge piping	800	LF	$40	$32,000	Incl	Incl	$32,000
Valves and fittings	1	LS	$10,000	$10,000	Incl	Incl	$10,000
Electrical	1	LS	$75,000	$75,000	Incl	Incl	$75,000
Miscellaneous	1	LS	$25,000	$25,000	Incl	Incl	$25,000
					Subtotal		$909,500
					Contractor Overhead & Profit, 15%		$136,000
					Contingencies, 20%		$182,000
					Total Estimated Construction Cost		**$1,227,500**

2 Operation, Maintenance and Replacement Cost

	Amount	Unit	Unit cost	Annual OM&R
Maintenance (1.0% of capital costs) (1)	1	LS	1.0%	$12,275
Additional Labor		FTE		$0
Additional Power	40	KW	$0.07	$24,528
Chemicals				$0
Testing				$0
Miscellaneous				$0
			Subtotal	$37,000
			Additional Debt Service (2)	$75,000
			Additional Replacement Reserve (3)	$41,000
			Incremental Decrease in Annual OM&R Cost	**$153,000**

Notes

(1) Includes materials, office expenses, training & licensing, outside services.
(2) Based on financing total capital cost for 30 years at 4.5%.
(3) Based on straight line depreciation for 30 years.

Phased Upgrade Using Diffused Air
Phase I
Life Cycle Cost Breakdown - Debt Service

Projected Capital Cost	$3,168,000
Projected Annual O & M and Replacement Cost	$1,222,000
Interest rate	4.50%
Term	20
Annual Debt Service Payment	$243,544

Alternative 5 - Phase I				
Year	Projected Debt Service	Projected O&M Cost	Total Projected Costs	**Total Present Value Costs**
1	243,544	1,222,000	1,465,544	$ 1,465,544
2	243,544	1,222,000	1,465,544	$ 1,402,434
3	243,544	1,222,000	1,465,544	$ 1,342,042
4	243,544	1,222,000	1,465,544	$ 1,228,948
5	243,544	1,222,000	1,465,544	$ 1,176,027
6	243,544	1,222,000	1,465,544	$ 1,125,385
7	243,544	1,222,000	1,465,544	$ 1,076,923
8	243,544	1,222,000	1,465,544	$ 1,030,548
9	243,544	1,222,000	1,465,544	$ 986,171
10	243,544	1,222,000	1,465,544	$ 943,704
11	243,544	1,222,000	1,465,544	$ 903,066
12	243,544	1,222,000	1,465,544	$ 864,178
13	243,544	1,222,000	1,465,544	$ 826,965
14	243,544	1,222,000	1,465,544	$ 791,354
15	243,544	1,222,000	1,465,544	$ 757,276
16	243,544	1,222,000	1,465,544	$ 724,666
17	243,544	1,222,000	1,465,544	$ 693,461
18	243,544	1,222,000	1,465,544	$ 663,599
19	243,544	1,222,000	1,465,544	$ 635,023
20	243,544	1,222,000	1,465,544	$ 607,677
21	-	1,222,000	1,222,000	$ 484,874
22	-	1,222,000	1,222,000	$ 463,994
23	-	1,222,000	1,222,000	$ 444,014
24	-	1,222,000	1,222,000	$ 424,894
25	-	1,222,000	1,222,000	$ 406,597
26	-	1,222,000	1,222,000	$ 389,088
27	-	1,222,000	1,222,000	$ 372,333
28	-	1,222,000	1,222,000	$ 356,299
29	-	1,222,000	1,222,000	$ 340,956
30	-	1,222,000	1,222,000	$ 326,274
31	-	-	-	$ -
32	-	-	-	$ -
33	-	-	-	$ -
Total	$ 4,870,872.50	$ 36,660,000.00	$ 41,530,872.50	$ 23,254,315

Phased Upgrade Using Diffused Air
Phase I
Life Cycle Cost Breakdown - Cash Basis

Projected Capital Cost	$3,168,000
Projected Annual O & M and Replacement Cost	$1,222,000
Interest rate	4.50%
Term	20

Alternative 5 - Phase I				
Year	Projected Capital Cost	Projected O&M Cost	Total Projected Costs	**Total Present Value Costs**
1	3,168,000	1,222,000	4,390,000	$ 4,390,000
2	-	1,222,000	1,222,000	$ 1,169,378
3	-	1,222,000	1,222,000	$ 1,119,022
4	-	1,222,000	1,222,000	$ 1,024,722
5	-	1,222,000	1,222,000	$ 980,595
6	-	1,222,000	1,222,000	$ 938,369
7	-	1,222,000	1,222,000	$ 897,960
8	-	1,222,000	1,222,000	$ 859,292
9	-	1,222,000	1,222,000	$ 822,289
10	-	1,222,000	1,222,000	$ 786,880
11	-	1,222,000	1,222,000	$ 752,995
12	-	1,222,000	1,222,000	$ 720,569
13	-	1,222,000	1,222,000	$ 689,540
14	-	1,222,000	1,222,000	$ 659,847
15	-	1,222,000	1,222,000	$ 631,432
16	-	1,222,000	1,222,000	$ 604,242
17	-	1,222,000	1,222,000	$ 578,222
18	-	1,222,000	1,222,000	$ 553,322
19	-	1,222,000	1,222,000	$ 529,495
20	-	1,222,000	1,222,000	$ 506,694
21	-	1,222,000	1,222,000	$ 484,874
22	-	1,222,000	1,222,000	$ 463,994
23	-	1,222,000	1,222,000	$ 444,014
24	-	1,222,000	1,222,000	$ 424,894
25	-	1,222,000	1,222,000	$ 406,597
26	-	1,222,000	1,222,000	$ 389,088
27	-	1,222,000	1,222,000	$ 372,333
28	-	1,222,000	1,222,000	$ 356,299
29	-	1,222,000	1,222,000	$ 340,956
30	-	1,222,000	1,222,000	$ 326,274
31	-	-	-	$ -
32	-	-	-	$ -
33	-	-	-	$ -
Total	$ 3,168,000.00	$ 36,660,000.00	$ 39,828,000.00	$ 23,224,187

Phased Upgrade Using Diffused Air
Phase I
Expected Depriciation

Item	Total Cost	Equipment	Depreciation Amount	Structural	Depreciation Amount
		Expected Life in Years			
		7		**20**	
Mobilization	**$110,000**	Y	15,714.29	N	-
Aerated Pond Modifications					
Demolition	$15,000		-	Y	750.00
Relocate 4 existing aerators	$20,000	Y			
N & S aerated pond cleaning	$50,000		-	Y	1,000.00
Install floating baffles	$37,500	Y	7,142.86		-
New fine bubble diffused air system	$990,000	Y	5,357.14		-
Construct building pad	$24,500		-	Y	49,500.00
Blower building	$93,750			Y	
Centrifugal blowers	$345,600	Y			
Air piping	$75,000	Y			
Electrical modifications	$100,000	Y	10,714.29		-
Subtotal	**$1,751,000**			Y	5,000.00
					-
Primary/Polishing Pond Modifications					-
Install floating baffles	$217,500	Y	31,071.43		-
Refurbish existing aerators	$108,000	Y	15,428.57		-
New 500A switchboard & MCC	$23,500	Y	3,357.14		-
Conduit, trenching, branch circuits	$47,000	Y	6,714.29		-
Install mulit-port drawoffs	$5,000	Y	714.29		-
36" DI outfall extension	$120,000	Y	17,142.86		-
Subtotal	**$521,000**				-
					-
Miscellaneous	$50,000	Y	7,142.86		-
Subtotal	**$869,500**				
Primary/Polishing Pond Modifications					
Install floating baffles	$217,500	Y	31,071.43	N	-
New 50 HP surface aerators	$108,000	Y	15,428.57	N	-
New 500A switchboard & MCC	$23,500	Y	3,357.14	N	-
Conduit, trenching, branch circuits	$47,000	Y	6,714.29	N	-
Install mulit-port drawoffs	$5,000	Y	714.29	N	-
36" DI outfall extension	$120,000	Y	17,142.86	N	-
Subtotal	**$521,000**				
Miscellaneous	**$50,000**	Y	7,142.86	N	-

ADEQ

ARKANSAS
Department of Environmental Quality

Front Desk
Hand Delivery Receipt

Date	11-29-12
Sender	
Received By	RECEIVED NOV 2 0 2012 KA 4504

INF-A BOD & TSS SUMMARY

09/01/10 TO 09/30/12

Month	BOD CONCENT RATN Mg/L	TSS CONCENT RATN Mg/L
Sep 2010	160.64	78.15
Oct 2010	178.27	102.82
Nov 2010	151.62	101.83
Dec 2010	143.77	72.08
Jan 2011	180.08	97.83
Feb 2011	162.84	119.00
Mar 2011	172.57	93.47
Apr 2011	120.24	85.08
May 2011	136.50	53.22
Jun 2011	143.26	91.09
Jul 2011	117.89	56.75
Aug 2011	107.67	67.30
Sep 2011	126.31	54.18
Oct 2011	153.51	74.27
Nov 2011	173.72	110.00
Dec 2011	191.27	101.91
Jan 2012	269.19	180.15
Feb 2012	214.92	177.25
Mar 2012	175.72	87.67
Apr 2012	190.86	119.82
May 2012	219.67	133.33
Jun 2012	240.66	282.17
Jul 2012	156.21	146.50
Aug 2012	115.28	100.25
Sep 2012	86.80	77.17
Minimum	86.80	53.22
Maximum	269.19	282.17
Total	4,089.49	2,663.30
Average	163.58	106.53
Geo Mean	158.32	98.31

Attn: Rufus Torrence 682-0626

Hand Delivered by Vincent Miles on 11-29-2012

INF-C BOD & TSS SUMMARY

09/01/10 TO 09/30/12

Month	BOD CONCENTRATION MG/L	TSS CONCENTRATION MG/L
Sep 2010	501.62	156.00
Oct 2010	766.71	217.58
Nov 2010	462.48	134.25
Dec 2010	605.87	175.92
Jan 2011	685.13	233.00
Feb 2011	570.28	200.42
Mar 2011	594.11	188.40
Apr 2011	385.68	140.00
May 2011	474.74	129.23
Jun 2011	585.87	183.85
Jul 2011	452.59	145.82
Aug 2011	492.65	161.54
Sep 2011	481.85	161.42
Oct 2011	414.93	119.31
Nov 2011	322.15	160.36
Dec 2011	426.18	120.33
Jan 2012	490.17	112.92
Feb 2012	510.34	170.17
Mar 2012	382.96	84.17
Apr 2012	455.64	208.75
May 2012	413.08	123.33
Jun 2012	379.23	151.17
Jul 2012	454.83	169.17
Aug 2012	620.72	397.23
Sep 2012	385.90	213.73
Minimum	322.15	84.17
Maximum	766.71	397.23
Total	12,315.71	4,258.05
Average	492.63	170.32
Geo Mean	482.51	162.46

INF-A BOD & TSS REPORT

9/1/2010 to 9/30/2012

Date	BOD CONCENTRATION Mg/L	TSS CONCENTRATION Mg/L
9/1/2010	139.86	209.00
9/2/2010		
9/3/2010		
9/4/2010		
9/5/2010		
9/6/2010		
9/7/2010	117.85	60.00
9/8/2010	269.45	49.00
9/9/2010		39.00
9/10/2010		
9/11/2010		
9/12/2010		
9/13/2010	130.71	34.00
9/14/2010	100.58	43.00
9/15/2010	148.25	56.00
9/16/2010		
9/17/2010		
9/18/2010		
9/19/2010		
9/20/2010	170.84	87.00
9/21/2010	76.51	29.00
9/22/2010	107.15	42.00
9/23/2010		
9/24/2010		
9/25/2010		
9/26/2010		
9/27/2010	286.52	117.00
9/28/2010	213.52	110.00
9/29/2010	166.40	141.00
9/30/2010		
10/1/2010		
10/2/2010		
10/3/2010		
10/4/2010	133.31	46.00
10/5/2010	158.76	51.00
10/6/2010	191.74	48.00
10/7/2010		
10/8/2010		
10/9/2010		
10/10/2010		
10/11/2010		
10/12/2010	217.30	94.00
10/13/2010	224.55	152.00
10/14/2010	210.59	111.00
10/15/2010		
10/16/2010		
10/17/2010		
10/18/2010	357.41	289.00
10/19/2010		
10/20/2010	172.43	49.00
10/21/2010		
10/22/2010		

INF-A BOD & TSS REPORT

9/1/2010 to 9/30/2012

Date	BOD CONCENTRATION Mg/L	TSS CONCENTRATION Mg/L
10/23/2010		
10/24/2010		
10/25/2010	80.87	92.00
10/26/2010	130.88	113.00
10/27/2010	83.15	86.00
10/28/2010		
10/29/2010		
10/30/2010		
10/31/2010		
11/1/2010	168.23	51.00
11/2/2010	137.75	43.00
11/3/2010	58.22	97.00
11/4/2010		
11/5/2010		
11/6/2010		
11/7/2010		
11/8/2010	150.06	107.00
11/9/2010	470.64	213.00
11/10/2010	172.35	
11/11/2010		
11/12/2010		
11/13/2010		
11/14/2010		
11/15/2010	125.49	55.00
11/16/2010	68.33	44.00
11/17/2010	97.21	43.00
11/18/2010		
11/19/2010		
11/20/2010		
11/21/2010		
11/22/2010	144.33	152.00
11/23/2010	266.45	362.00
11/24/2010	93.74	
11/25/2010		
11/26/2010		
11/27/2010		
11/28/2010		
11/29/2010	105.75	36.00
11/30/2010	64.14	19.00
12/1/2010	149.04	39.00
12/2/2010		
12/3/2010		
12/4/2010		
12/5/2010		
12/6/2010	160.88	120.00
12/7/2010	169.21	111.00
12/8/2010	175.15	97.00
12/9/2010		
12/10/2010		
12/11/2010		
12/12/2010		
12/13/2010	82.29	62.00

INF-A BOD & TSS REPORT

9/1/2010 to 9/30/2012

Date	BOD CONCENTRATION Mg/L	TSS CONCENTRATION Mg/L
12/14/2010	114.17	47.00
12/15/2010	101.68	41.00
12/16/2010		
12/17/2010		
12/18/2010		
12/19/2010		
12/20/2010	166.19	113.00
12/21/2010	170.12	41.00
12/22/2010	169.18	85.00
12/23/2010		
12/24/2010		
12/25/2010		
12/26/2010		
12/27/2010	145.74	51.00
12/28/2010	138.14	62.00
12/29/2010	127.28	68.00
12/30/2010		
12/31/2010		
1/1/2011		
1/2/2011		
1/3/2011	269.75	103.00
1/4/2011	202.45	155.00
1/5/2011	248.09	132.00
1/6/2011		
1/7/2011		
1/8/2011		
1/9/2011		
1/10/2011		
1/11/2011		
1/12/2011	202.17	83.00
1/13/2011	137.17	37.00
1/14/2011		
1/15/2011		
1/16/2011		
1/17/2011		
1/18/2011	173.94	87.00
1/19/2011	141.41	118.00
1/20/2011	115.85	191.00
1/21/2011		
1/22/2011		
1/23/2011		
1/24/2011	174.52	43.00
1/25/2011	153.08	72.00
1/26/2011	162.47	42.00
1/27/2011		
1/28/2011		
1/29/2011		
1/30/2011		
1/31/2011		111.00
2/1/2011	152.67	395.00
2/2/2011	71.99	28.00
2/3/2011		

INF-A BOD & TSS REPORT

9/1/2010 to 9/30/2012

Date	BOD CONCENTRATION Mg/L	TSS CONCENTRATION Mg/L
2/4/2011		
2/5/2011		
2/6/2011		
2/7/2011	155.44	64.00
2/8/2011	106.53	77.00
2/9/2011		
2/10/2011		
2/11/2011		43.00
2/12/2011		
2/13/2011		
2/14/2011	191.33	156.00
2/15/2011	182.20	120.00
2/16/2011	190.14	155.00
2/17/2011		
2/18/2011		
2/19/2011		
2/20/2011		
2/21/2011	138.27	24.00
2/22/2011	258.51	66.00
2/23/2011	181.31	42.00
2/24/2011		
2/25/2011		
2/26/2011		
2/27/2011		
2/28/2011		258.00
3/1/2011	153.83	126.00
3/2/2011	147.78	110.00
3/3/2011		
3/4/2011		
3/5/2011		
3/6/2011		
3/7/2011	272.63	80.00
3/8/2011	94.70	60.00
3/9/2011	125.85	42.00
3/10/2011		
3/11/2011		
3/12/2011		
3/13/2011		
3/14/2011	311.67	127.00
3/15/2011	157.15	101.00
3/16/2011	217.94	135.00
3/17/2011	206.80	161.00
3/18/2011		
3/19/2011		
3/20/2011		
3/21/2011	145.37	59.00
3/22/2011	181.59	54.00
3/23/2011	157.02	60.00
3/24/2011		
3/25/2011		
3/26/2011		
3/27/2011		

INF-A BOD & TSS REPORT

9/1/2010 to 9/30/2012

Date	BOD CONCENTRATION Mg/L	TSS CONCENTRATION Mg/L
3/28/2011	138.75	85.00
3/29/2011	152.38	109.00
3/30/2011	125.13	93.00
3/31/2011		
4/1/2011		
4/2/2011		
4/3/2011		
4/4/2011	115.96	64.00
4/5/2011	106.87	59.00
4/6/2011	178.12	45.00
4/7/2011		
4/8/2011		
4/9/2011		
4/10/2011		
4/11/2011	218.95	290.00
4/12/2011	150.06	129.00
4/13/2011	109.69	73.00
4/14/2011		
4/15/2011		
4/16/2011		
4/17/2011		
4/18/2011	81.19	46.00
4/19/2011	124.82	39.00
4/20/2011	43.52	36.00
4/21/2011		
4/22/2011		
4/23/2011		
4/24/2011		
4/25/2011	120.04	147.00
4/26/2011		30.00
4/27/2011	73.38	63.00
4/28/2011		
4/29/2011		
4/30/2011		
5/1/2011		
5/2/2011		
5/3/2011		
5/4/2011		
5/5/2011		
5/6/2011		
5/7/2011		
5/8/2011		
5/9/2011	111.08	78.00
5/10/2011	158.20	61.00
5/11/2011	96.34	56.00
5/12/2011		
5/13/2011		
5/14/2011		
5/15/2011		
5/16/2011		
5/17/2011	184.27	81.00
5/18/2011	182.83	44.00

INF-A BOD & TSS REPORT

9/1/2010 to 9/30/2012

Date	BOD CONCENTRATION Mg/L	TSS CONCENTRATION Mg/L
5/19/2011		
5/20/2011		
5/21/2011		
5/22/2011		
5/23/2011	101.80	27.00
5/24/2011	178.28	28.00
5/25/2011	91.30	34.00
5/26/2011		
5/27/2011		
5/28/2011		
5/29/2011		
5/30/2011		
5/31/2011	124.44	70.00
6/1/2011	160.54	32.00
6/2/2011	134.17	41.00
6/3/2011		
6/4/2011		
6/5/2011		
6/6/2011	177.78	
6/7/2011	169.87	112.00
6/8/2011		
6/9/2011		
6/10/2011		
6/11/2011		
6/12/2011		
6/13/2011	76.40	53.00
6/14/2011		350.00
6/15/2011	146.48	57.00
6/16/2011		
6/17/2011		
6/18/2011		
6/19/2011		
6/20/2011	153.06	122.00
6/21/2011	95.92	63.00
6/22/2011	141.83	67.00
6/23/2011		
6/24/2011		
6/25/2011		
6/26/2011		
6/27/2011		
6/28/2011	258.03	
6/29/2011	61.77	82.00
6/30/2011		23.00
7/1/2011		
7/2/2011		
7/3/2011		
7/4/2011		
7/5/2011	166.46	67.00
7/6/2011	113.41	102.00
7/7/2011		
7/8/2011		
7/9/2011		

INF-A BOD & TSS REPORT

9/1/2010 to 9/30/2012

Date	BOD CONCENTRATION Mg/L	TSS CONCENTRATION Mg/L
7/10/2011		
7/11/2011	105.28	47.00
7/12/2011	87.71	46.00
7/13/2011		
7/14/2011		
7/15/2011		
7/16/2011		
7/17/2011		
7/18/2011	126.67	48.00
7/19/2011	94.42	
7/20/2011		37.00
7/21/2011		
7/22/2011		
7/23/2011		
7/24/2011		
7/25/2011		
7/26/2011	162.56	58.00
7/27/2011		
7/28/2011	86.60	49.00
7/29/2011		
7/30/2011		
7/31/2011		
8/1/2011	91.38	62.00
8/2/2011	85.41	72.00
8/3/2011	96.92	65.00
8/4/2011		
8/5/2011		
8/6/2011		
8/7/2011		
8/8/2011		
8/9/2011	54.34	
8/10/2011	177.77	36.00
8/11/2011		50.00
8/12/2011		
8/13/2011		
8/14/2011		
8/15/2011		78.00
8/16/2011	172.34	124.00
8/17/2011		
8/18/2011		
8/19/2011		
8/20/2011		
8/21/2011		
8/22/2011		104.00
8/23/2011	111.30	42.00
8/24/2011		
8/25/2011		
8/26/2011		
8/27/2011		
8/28/2011		
8/29/2011	71.92	40.00
8/30/2011		

INF-A BOD & TSS REPORT

9/1/2010 to 9/30/2012

Date	BOD CONCENTRATION Mg/L	TSS CONCENTRATION Mg/L
8/31/2011		
9/1/2011		
9/2/2011		
9/3/2011		
9/4/2011		
9/5/2011		
9/6/2011	168.96	83.00
9/7/2011	266.03	56.00
9/8/2011		66.00
9/9/2011		
9/10/2011		
9/11/2011		
9/12/2011	123.25	40.00
9/13/2011	129.32	58.00
9/14/2011		42.00
9/15/2011		
9/16/2011		
9/17/2011		
9/18/2011		
9/19/2011	87.72	45.00
9/20/2011	61.24	37.00
9/21/2011	86.22	41.00
9/22/2011		
9/23/2011		
9/24/2011		
9/25/2011		
9/26/2011	96.60	66.00
9/27/2011	117.48	62.00
9/28/2011		
9/29/2011		
9/30/2011		
10/1/2011		
10/2/2011		
10/3/2011		45.00
10/4/2011		
10/5/2011		90.00
10/6/2011		
10/7/2011		
10/8/2011		
10/9/2011		
10/10/2011		
10/11/2011		
10/12/2011	68.63	72.00
10/13/2011		35.00
10/14/2011		
10/15/2011		
10/16/2011		
10/17/2011		62.00
10/18/2011	68.99	45.00
10/19/2011	187.32	50.00
10/20/2011		
10/21/2011		

INF-A BOD & TSS REPORT

9/1/2010 to 9/30/2012

Date	BOD CONCENTRATION Mg/L	TSS CONCENTRATION Mg/L
10/22/2011		
10/23/2011		
10/24/2011	117.19	35.00
10/25/2011	220.11	232.00
10/26/2011	170.59	62.00
10/27/2011		
10/28/2011		
10/29/2011		
10/30/2011		
10/31/2011	241.77	89.00
11/1/2011	193.08	69.00
11/2/2011	236.37	100.00
11/3/2011		
11/4/2011		
11/5/2011		
11/6/2011		
11/7/2011	137.77	50.00
11/8/2011	141.37	83.00
11/9/2011	159.34	52.00
11/10/2011		
11/11/2011		
11/12/2011		
11/13/2011		
11/14/2011	234.41	88.00
11/15/2011	115.28	61.00
11/16/2011		30.00
11/17/2011		
11/18/2011		
11/19/2011		
11/20/2011		
11/21/2011		134.00
11/22/2011	245.75	511.00
11/23/2011	160.21	53.00
11/24/2011		
11/25/2011		
11/26/2011		
11/27/2011		
11/28/2011	113.59	52.00
11/29/2011		44.00
11/30/2011		213.00
12/1/2011		
12/2/2011		
12/3/2011		
12/4/2011		
12/5/2011	51.91	76.00
12/6/2011		76.00
12/7/2011	119.09	84.00
12/8/2011		
12/9/2011		
12/10/2011		
12/11/2011		
12/12/2011	217.81	79.00

INF-A BOD & TSS REPORT

9/1/2010 to 9/30/2012

Date	BOD CONCENTRATION Mg/L	TSS CONCENTRATION Mg/L
12/13/2011	453.08	74.00
12/14/2011	192.08	96.00
12/15/2011		
12/16/2011		
12/17/2011		
12/18/2011		
12/19/2011	279.10	210.00
12/20/2011	106.82	58.00
12/21/2011	145.48	120.00
12/22/2011		
12/23/2011		
12/24/2011		
12/25/2011		
12/26/2011		
12/27/2011		
12/28/2011	186.02	144.00
12/29/2011	161.35	104.00
12/30/2011		
12/31/2011		
1/1/2012		
1/2/2012	232.58	160.00
1/3/2012	193.98	128.00
1/4/2012	292.37	208.00
1/5/2012		
1/6/2012		
1/7/2012		
1/8/2012		
1/9/2012		93.00
1/10/2012	153.92	143.00
1/11/2012		40.00
1/12/2012		
1/13/2012		
1/14/2012		
1/15/2012		
1/16/2012	303.02	288.00
1/17/2012	194.62	630.00
1/18/2012	258.92	238.00
1/19/2012		
1/20/2012		
1/21/2012		
1/22/2012		
1/23/2012	130.56	48.00
1/24/2012	383.94	114.00
1/25/2012	389.88	56.00
1/26/2012		
1/27/2012		
1/28/2012		
1/29/2012		
1/30/2012	169.68	196.00
1/31/2012	526.81	
2/1/2012	96.91	
2/2/2012		

INF-A BOD & TSS REPORT

9/1/2010 to 9/30/2012

Date	BOD CONCENTRATION Mg/L	TSS CONCENTRATION Mg/L
2/3/2012		
2/4/2012		
2/5/2012		
2/6/2012	110.68	70.00
2/7/2012	264.88	291.00
2/8/2012	364.44	44.00
2/9/2012		
2/10/2012		
2/11/2012		
2/12/2012		
2/13/2012	192.12	248.00
2/14/2012		146.00
2/15/2012	290.00	382.00
2/16/2012		
2/17/2012		
2/18/2012		
2/19/2012	72.83	
2/20/2012	257.31	45.00
2/21/2012	144.35	86.00
2/22/2012		112.00
2/23/2012		
2/24/2012		
2/25/2012		
2/26/2012		
2/27/2012	381.29	200.00
2/28/2012	358.96	420.00
2/29/2012	45.29	83.00
3/1/2012		
3/2/2012		
3/3/2012		
3/4/2012		
3/5/2012	194.62	69.00
3/6/2012	210.42	52.00
3/7/2012	154.87	82.00
3/8/2012		
3/9/2012		
3/10/2012		
3/11/2012		
3/12/2012	61.19	38.00
3/13/2012	99.74	104.00
3/14/2012	186.33	78.00
3/15/2012		
3/16/2012		
3/17/2012		
3/18/2012		
3/19/2012	128.98	235.00
3/20/2012		103.00
3/21/2012	435.70	38.00
3/22/2012		
3/23/2012		
3/24/2012		
3/25/2012		

INF-A BOD & TSS REPORT

9/1/2010 to 9/30/2012

Date	BOD CONCENTRATION Mg/L	TSS CONCENTRATION Mg/L
3/26/2012	241.87	61.00
3/27/2012	170.07	32.00
3/28/2012	49.18	160.00
3/29/2012		
3/30/2012		
3/31/2012		
4/1/2012		
4/2/2012	155.27	59.00
4/3/2012	134.27	78.00
4/4/2012	333.19	314.00
4/5/2012		
4/6/2012		
4/7/2012		
4/8/2012		
4/9/2012		
4/10/2012		
4/11/2012	105.35	69.00
4/12/2012		42.00
4/13/2012		
4/14/2012		
4/15/2012		
4/16/2012	146.87	
4/17/2012	191.40	199.00
4/18/2012	160.80	120.00
4/19/2012		87.00
4/20/2012		
4/21/2012		
4/22/2012		
4/23/2012	126.63	
4/24/2012		106.00
4/25/2012		127.00
4/26/2012		117.00
4/27/2012		
4/28/2012		
4/29/2012		
4/30/2012	363.95	
5/1/2012	364.32	66.00
5/2/2012	138.38	66.00
5/3/2012		
5/4/2012		
5/5/2012		
5/6/2012		
5/7/2012	175.57	76.00
5/8/2012	198.44	224.00
5/9/2012	214.57	184.00
5/10/2012		
5/11/2012		
5/12/2012		
5/13/2012		
5/14/2012	214.84	207.00
5/15/2012	159.48	59.00
5/16/2012	123.83	35.00

INF-A BOD & TSS REPORT

9/1/2010 to 9/30/2012

Date	BOD CONCENTRATION Mg/L	TSS CONCENTRATION Mg/L
5/17/2012		
5/18/2012		
5/19/2012		
5/20/2012		
5/21/2012	238.72	185.00
5/22/2012	342.61	
5/23/2012	297.77	310.00
5/24/2012		
5/25/2012		
5/26/2012		
5/27/2012		
5/28/2012		
5/29/2012	164.52	35.00
5/30/2012	222.71	153.00
5/31/2012		
6/1/2012		
6/2/2012		
6/3/2012		
6/4/2012	176.90	254.00
6/5/2012	230.62	262.00
6/6/2012	254.59	258.00
6/7/2012		
6/8/2012		
6/9/2012		
6/10/2012		
6/11/2012	212.46	220.00
6/12/2012	225.91	442.00
6/13/2012	380.99	286.00
6/14/2012		
6/15/2012		
6/16/2012		
6/17/2012		
6/18/2012		452.00
6/19/2012	251.12	344.00
6/20/2012	278.65	239.00
6/21/2012		
6/22/2012		
6/23/2012		
6/24/2012	216.79	
6/25/2012	228.96	193.00
6/26/2012		282.00
6/27/2012	190.31	154.00
6/28/2012		
6/29/2012		
6/30/2012		
7/1/2012		
7/2/2012	3.26	378.00
7/3/2012	179.46	199.00
7/4/2012	204.67	135.00
7/5/2012		
7/6/2012		
7/7/2012		

INF-A BOD & TSS REPORT

9/1/2010 to 9/30/2012

Date	BOD CONCENTRATION Mg/L	TSS CONCENTRATION Mg/L
7/8/2012		
7/9/2012	122.76	37.00
7/10/2012	206.29	215.00
7/11/2012	102.82	54.00
7/12/2012		
7/13/2012		
7/14/2012		
7/15/2012		
7/16/2012	97.45	128.00
7/17/2012	118.82	53.00
7/18/2012	192.07	167.00
7/19/2012		
7/20/2012		
7/21/2012		
7/22/2012		
7/23/2012	150.92	99.00
7/24/2012	94.34	50.00
7/25/2012	354.51	243.00
7/26/2012		
7/27/2012		
7/28/2012		
7/29/2012		
7/30/2012	194.60	
7/31/2012	164.93	
8/1/2012	220.74	260.00
8/2/2012		
8/3/2012		
8/4/2012		
8/5/2012		
8/6/2012	131.00	59.00
8/7/2012		218.00
8/8/2012		
8/9/2012		
8/10/2012		
8/11/2012		
8/12/2012		
8/13/2012	107.31	146.00
8/14/2012	109.22	85.00
8/15/2012	124.03	77.00
8/16/2012		
8/17/2012		
8/18/2012		
8/19/2012		
8/20/2012	87.76	74.00
8/21/2012	114.07	85.00
8/22/2012	134.38	41.00
8/23/2012		
8/24/2012		
8/25/2012		
8/26/2012		
8/27/2012	62.40	56.00
8/28/2012	86.53	62.00

INF-A BOD & TSS REPORT

9/1/2010 to 9/30/2012

Date	BOD CONCENTRATION Mg/L	TSS CONCENTRATION Mg/L
8/29/2012	90.61	40.00
8/30/2012		
8/31/2012		
9/1/2012		
9/2/2012		
9/3/2012	73.72	55.00
9/4/2012	47.33	34.00
9/5/2012	173.39	100.00
9/6/2012		
9/7/2012		
9/8/2012		
9/9/2012		
9/10/2012	50.17	38.00
9/11/2012		210.00
9/12/2012	91.22	66.00
9/13/2012		
9/14/2012		
9/15/2012		
9/16/2012		
9/17/2012		86.00
9/18/2012		27.00
9/19/2012	94.90	92.00
9/20/2012		
9/21/2012		
9/22/2012		
9/23/2012		
9/24/2012	85.81	52.00
9/25/2012		130.00
9/26/2012	77.85	36.00
9/27/2012		
9/28/2012		
9/29/2012		
9/30/2012		

Minimum	3.26	19.00
Maximum	526.81	630.00
Average	166.61	108.28
Sum	44,983.52	31,725.00
Geo Mean	147.90	83.79

INF-C BOD & TSS REPORT

9/1/2010 to 9/30/2012

Date	BOD CONCENTRATION MG/L	TSS CONCENTRATION MG/L
9/1/2010	388.16	124.00
9/2/2010		
9/3/2010		
9/4/2010		
9/5/2010		
9/6/2010		
9/7/2010	351.05	139.00
9/8/2010		301.00
9/9/2010		69.00
9/10/2010		
9/11/2010		
9/12/2010		
9/13/2010	528.97	161.00
9/14/2010	464.76	64.00
9/15/2010	580.98	186.00
9/16/2010		
9/17/2010		
9/18/2010		
9/19/2010		
9/20/2010	544.72	77.00
9/21/2010	438.33	89.00
9/22/2010	491.53	104.00
9/23/2010		
9/24/2010		
9/25/2010		
9/26/2010		
9/27/2010	380.16	168.00
9/28/2010	826.04	338.00
9/29/2010	523.11	208.00
9/30/2010		
10/1/2010		
10/2/2010		
10/3/2010		
10/4/2010	645.45	64.00
10/5/2010	992.02	170.00
10/6/2010	889.52	181.00
10/7/2010		
10/8/2010		
10/9/2010		
10/10/2010		
10/11/2010		
10/12/2010	1,073.20	294.00
10/13/2010	842.80	352.00
10/14/2010	923.54	374.00
10/15/2010		
10/16/2010		
10/17/2010		
10/18/2010	593.82	57.00
10/19/2010		196.00
10/20/2010	941.70	177.00
10/21/2010		
10/22/2010		

INF-C BOD & TSS REPORT

9/1/2010 to 9/30/2012

Date	BOD CONCENTRATION MG/L	TSS CONCENTRATION MG/L
10/23/2010		
10/24/2010		
10/25/2010	262.27	156.00
10/26/2010	661.50	282.00
10/27/2010	607.96	308.00
10/28/2010		
10/29/2010		
10/30/2010		
10/31/2010		
11/1/2010	650.81	134.00
11/2/2010	1,009.00	197.00
11/3/2010	466.49	119.00
11/4/2010		
11/5/2010		
11/6/2010		
11/7/2010		
11/8/2010	369.17	206.00
11/9/2010	740.96	103.00
11/10/2010	538.37	
11/11/2010		
11/12/2010		
11/13/2010		
11/14/2010		
11/15/2010	278.13	94.00
11/16/2010	231.00	60.00
11/17/2010	185.91	48.00
11/18/2010		
11/19/2010		
11/20/2010		
11/21/2010		
11/22/2010	627.37	336.00
11/23/2010	346.64	212.00
11/24/2010	481.38	
11/25/2010		
11/26/2010		
11/27/2010		
11/28/2010		
11/29/2010	151.38	47.00
11/30/2010	398.15	55.00
12/1/2010	571.11	73.00
12/2/2010		
12/3/2010		
12/4/2010		
12/5/2010		
12/6/2010	356.23	210.00
12/7/2010	771.88	240.00
12/8/2010	726.45	248.00
12/9/2010		
12/10/2010		
12/11/2010		
12/12/2010		
12/13/2010	185.41	125.00

INF-C BOD & TSS REPORT

9/1/2010 to 9/30/2012

Date	BOD CONCENTRATION MG/L	TSS CONCENTRATION MG/L
12/14/2010	446.20	68.00
12/15/2010	541.43	74.00
12/16/2010		
12/17/2010		
12/18/2010		
12/19/2010		
12/20/2010	669.43	332.00
12/21/2010	1,116.46	217.00
12/22/2010	1,222.76	420.00
12/23/2010		
12/24/2010		
12/25/2010		
12/26/2010		
12/27/2010	312.72	75.00
12/28/2010	504.92	70.00
12/29/2010	451.26	135.00
12/30/2010		
12/31/2010		
1/1/2011		
1/2/2011		
1/3/2011	418.50	216.00
1/4/2011	601.65	250.00
1/5/2011	1,086.36	286.00
1/6/2011		
1/7/2011		
1/8/2011		
1/9/2011		
1/10/2011		
1/11/2011		
1/12/2011	235.17	49.00
1/13/2011	568.00	70.00
1/14/2011		
1/15/2011		
1/16/2011		
1/17/2011		
1/18/2011	1,130.34	484.00
1/19/2011	649.77	512.00
1/20/2011	689.83	430.00
1/21/2011		
1/22/2011		
1/23/2011		
1/24/2011	405.56	108.00
1/25/2011	1,243.52	102.00
1/26/2011	507.78	101.00
1/27/2011		
1/28/2011		
1/29/2011		
1/30/2011		
1/31/2011		188.00
2/1/2011	331.92	324.00
2/2/2011	485.64	62.00
2/3/2011		

INF-C BOD & TSS REPORT

9/1/2010 to 9/30/2012

Date	BOD CONCENTRATION MG/L	TSS CONCENTRATION MG/L
2/4/2011		
2/5/2011		
2/6/2011		
2/7/2011	430.88	156.00
2/8/2011	825.92	317.00
2/9/2011		
2/10/2011		243.00
2/11/2011		
2/12/2011		
2/13/2011		
2/14/2011	656.41	324.00
2/15/2011	540.48	202.00
2/16/2011	876.24	386.00
2/17/2011		
2/18/2011		
2/19/2011		
2/20/2011		
2/21/2011	313.65	54.00
2/22/2011	781.36	167.00
2/23/2011	460.30	56.00
2/24/2011		
2/25/2011		
2/26/2011		
2/27/2011		
2/28/2011		114.00
3/1/2011	845.64	260.00
3/2/2011	758.00	164.00
3/3/2011		
3/4/2011		
3/5/2011		
3/6/2011		
3/7/2011	310.25	57.00
3/8/2011	468.01	77.00
3/9/2011	366.83	77.00
3/10/2011		
3/11/2011		
3/12/2011		
3/13/2011		
3/14/2011	581.27	136.00
3/15/2011	663.09	252.00
3/16/2011	696.87	236.00
3/17/2011	824.80	280.00
3/18/2011		
3/19/2011		
3/20/2011		
3/21/2011	563.50	200.00
3/22/2011	104.23	216.00
3/23/2011	1,107.66	441.00
3/24/2011		
3/25/2011		
3/26/2011		
3/27/2011		

INF-C BOD & TSS REPORT

9/1/2010 to 9/30/2012

Date	BOD CONCENTRATION MG/L	TSS CONCENTRATION MG/L
3/28/2011	336.67	88.00
3/29/2011	767.74	234.00
3/30/2011	517.14	108.00
3/31/2011		
4/1/2011		
4/2/2011		
4/3/2011		
4/4/2011	271.42	68.00
4/5/2011	475.67	69.00
4/6/2011	659.68	113.00
4/7/2011		
4/8/2011		
4/9/2011		
4/10/2011		
4/11/2011	428.72	192.00
4/12/2011	662.67	254.00
4/13/2011	512.05	286.00
4/14/2011		
4/15/2011		
4/16/2011		
4/17/2011		
4/18/2011	511.14	78.00
4/19/2011	438.19	98.00
4/20/2011	142.63	73.00
4/21/2011		
4/22/2011		
4/23/2011		
4/24/2011		
4/25/2011	173.46	234.00
4/26/2011	222.22	151.00
4/27/2011	130.32	64.00
4/28/2011		
4/29/2011		
4/30/2011		
5/1/2011		
5/2/2011	227.62	108.00
5/3/2011	394.16	72.00
5/4/2011	533.79	120.00
5/5/2011		
5/6/2011		
5/7/2011		
5/8/2011		
5/9/2011	267.58	50.00
5/10/2011	429.01	68.00
5/11/2011	395.82	129.00
5/12/2011		
5/13/2011		
5/14/2011		
5/15/2011		
5/16/2011	703.15	139.00
5/17/2011	743.61	93.00
5/18/2011	695.78	179.00

INF-C BOD & TSS REPORT

9/1/2010 to 9/30/2012

Date	BOD CONCENTRATION MG/L	TSS CONCENTRATION MG/L
5/19/2011		
5/20/2011		
5/21/2011		
5/22/2011		
5/23/2011	313.20	134.00
5/24/2011	942.14	252.00
5/25/2011	451.67	88.00
5/26/2011		
5/27/2011		
5/28/2011		
5/29/2011		
5/30/2011		
5/31/2011	74.13	248.00
6/1/2011	841.36	178.00
6/2/2011		224.00
6/3/2011		
6/4/2011		
6/5/2011		
6/6/2011		
6/7/2011	1,129.04	350.00
6/8/2011	867.30	392.00
6/9/2011		
6/10/2011		
6/11/2011		
6/12/2011		
6/13/2011	621.12	158.00
6/14/2011	144.61	46.00
6/15/2011	674.86	163.00
6/16/2011		
6/17/2011		
6/18/2011		
6/19/2011		
6/20/2011	350.89	184.00
6/21/2011	543.93	284.00
6/22/2011	424.18	98.00
6/23/2011		
6/24/2011		
6/25/2011		
6/26/2011		
6/27/2011	481.36	90.00
6/28/2011	297.31	86.00
6/29/2011	654.47	137.00
6/30/2011		
7/1/2011		
7/2/2011		
7/3/2011		
7/4/2011		
7/5/2011	481.36	262.00
7/6/2011	548.27	152.00
7/7/2011		
7/8/2011		
7/9/2011		

INF-C BOD & TSS REPORT

9/1/2010 to 9/30/2012

Date	BOD CONCENTRATION MG/L	TSS CONCENTRATION MG/L
7/10/2011		
7/11/2011	481.36	119.00
7/12/2011	349.65	116.00
7/13/2011		91.00
7/14/2011		
7/15/2011		
7/16/2011		
7/17/2011		
7/18/2011	224.30	64.00
7/19/2011	338.40	86.00
7/20/2011	534.39	199.00
7/21/2011		
7/22/2011		
7/23/2011		
7/24/2011		
7/25/2011	445.52	143.00
7/26/2011	510.23	208.00
7/27/2011	612.46	164.00
7/28/2011		
7/29/2011		
7/30/2011		
7/31/2011		
8/1/2011	213.94	122.00
8/2/2011	473.35	180.00
8/3/2011	537.29	181.00
8/4/2011		
8/5/2011		
8/6/2011		
8/7/2011		
8/8/2011		312.00
8/9/2011	650.04	278.00
8/10/2011	1,175.54	306.00
8/11/2011		
8/12/2011		
8/13/2011		
8/14/2011		
8/15/2011	141.63	236.00
8/16/2011	375.60	90.00
8/17/2011	496.76	136.00
8/18/2011		
8/19/2011		
8/20/2011		
8/21/2011		
8/22/2011	449.34	76.00
8/23/2011	610.90	47.00
8/24/2011	238.34	58.00
8/25/2011		
8/26/2011		
8/27/2011		
8/28/2011		
8/29/2011	250.76	78.00
8/30/2011	810.66	

INF-C BOD & TSS REPORT

9/1/2010 to 9/30/2012

Date	BOD CONCENTRATION MG/L	TSS CONCENTRATION MG/L
8/31/2011	472.89	
9/1/2011		
9/2/2011		
9/3/2011		
9/4/2011		
9/5/2011		
9/6/2011	371.93	122.00
9/7/2011		221.00
9/8/2011		188.00
9/9/2011		
9/10/2011		
9/11/2011		
9/12/2011	444.69	150.00
9/13/2011	451.93	134.00
9/14/2011	477.71	150.00
9/15/2011		
9/16/2011		
9/17/2011		
9/18/2011		
9/19/2011	224.19	94.00
9/20/2011	491.08	228.00
9/21/2011	642.52	232.00
9/22/2011		
9/23/2011		
9/24/2011		
9/25/2011		
9/26/2011	410.76	96.00
9/27/2011	739.70	192.00
9/28/2011	563.97	130.00
9/29/2011		
9/30/2011		
10/1/2011		
10/2/2011		
10/3/2011		100.00
10/4/2011	305.44	39.00
10/5/2011	347.67	252.00
10/6/2011		
10/7/2011		
10/8/2011		
10/9/2011		
10/10/2011		
10/11/2011	630.89	120.00
10/12/2011	509.14	154.00
10/13/2011	284.94	90.00
10/14/2011		
10/15/2011		
10/16/2011		
10/17/2011	449.80	136.00
10/18/2011	307.82	88.00
10/19/2011	416.28	126.00
10/20/2011		
10/21/2011		

INF-C BOD & TSS REPORT

9/1/2010 to 9/30/2012

Date	BOD CONCENTRATION MG/L	TSS CONCENTRATION MG/L
10/22/2011		
10/23/2011		
10/24/2011	271.79	82.00
10/25/2011	382.21	128.00
10/26/2011	440.85	110.00
10/27/2011		
10/28/2011		
10/29/2011		
10/30/2011		
10/31/2011	632.34	126.00
11/1/2011	494.36	92.00
11/2/2011	562.73	122.00
11/3/2011		
11/4/2011		
11/5/2011		
11/6/2011		
11/7/2011	219.81	71.00
11/8/2011	263.67	87.00
11/9/2011	417.01	84.00
11/10/2011		
11/11/2011		
11/12/2011		
11/13/2011		
11/14/2011	166.66	60.00
11/15/2011	97.43	44.00
11/16/2011	77.24	32.00
11/17/2011		
11/18/2011		
11/19/2011		
11/20/2011		
11/21/2011		
11/22/2011	109.37	102.00
11/23/2011	101.25	685.00
11/24/2011	242.28	74.00
11/25/2011		
11/26/2011		
11/27/2011		
11/28/2011	1,114.02	535.00
11/29/2011		95.00
11/30/2011		162.00
12/1/2011		
12/2/2011		
12/3/2011		
12/4/2011		
12/5/2011		
12/6/2011	318.85	43.00
12/7/2011	589.26	100.00
12/8/2011		158.00
12/9/2011		
12/10/2011		
12/11/2011		
12/12/2011	348.61	106.00

INF-C BOD & TSS REPORT

9/1/2010 to 9/30/2012

Date	BOD CONCENTRATION MG/L	TSS CONCENTRATION MG/L
12/13/2011	406.08	163.00
12/14/2011	521.74	131.00
12/15/2011		
12/16/2011		
12/17/2011		
12/18/2011		
12/19/2011	507.20	157.00
12/20/2011	564.74	119.00
12/21/2011	515.13	172.00
12/22/2011		
12/23/2011		
12/24/2011		
12/25/2011		
12/26/2011		
12/27/2011	80.72	46.00
12/28/2011	515.24	150.00
12/29/2011	320.44	99.00
12/30/2011		
12/31/2011		
1/1/2012		
1/2/2012	153.28	72.00
1/3/2012	313.26	124.00
1/4/2012	649.24	236.00
1/5/2012		
1/6/2012		
1/7/2012		
1/8/2012		
1/9/2012	520.65	96.00
1/10/2012	461.04	14.00
1/11/2012	937.74	100.00
1/12/2012		
1/13/2012		
1/14/2012		
1/15/2012		
1/16/2012	424.54	118.00
1/17/2012	262.72	118.00
1/18/2012	260.92	84.00
1/19/2012		
1/20/2012		
1/21/2012		
1/22/2012		
1/23/2012	307.12	74.00
1/24/2012	647.91	174.00
1/25/2012	857.76	174.00
1/26/2012		
1/27/2012		
1/28/2012		
1/29/2012		
1/30/2012	172.59	84.00
1/31/2012	893.62	
2/1/2012	434.17	
2/2/2012		

INF-C BOD & TSS REPORT

9/1/2010 to 9/30/2012

Date	BOD CONCENTRATION MG/L	TSS CONCENTRATION MG/L
2/3/2012		
2/4/2012		
2/5/2012		
2/6/2012	400.75	46.00
2/7/2012	698.32	325.00
2/8/2012	384.74	110.00
2/9/2012		
2/10/2012		
2/11/2012		
2/12/2012		
2/13/2012	319.60	120.00
2/14/2012	651.50	102.00
2/15/2012		238.00
2/16/2012		
2/17/2012		
2/18/2012		
2/19/2012		
2/20/2012	241.20	50.00
2/21/2012	453.61	112.00
2/22/2012	323.39	134.00
2/23/2012		
2/24/2012		
2/25/2012		
2/26/2012		
2/27/2012	708.94	276.00
2/28/2012	761.91	316.00
2/29/2012	745.94	213.00
3/1/2012		
3/2/2012		
3/3/2012		
3/4/2012		
3/5/2012	343.78	69.00
3/6/2012	1,045.10	52.00
3/7/2012	421.82	82.00
3/8/2012		
3/9/2012		
3/10/2012		
3/11/2012		
3/12/2012	80.53	55.00
3/13/2012	289.39	107.00
3/14/2012	269.59	66.00
3/15/2012		
3/16/2012		
3/17/2012		
3/18/2012		
3/19/2012	723.13	66.00
3/20/2012	379.52	45.00
3/21/2012	310.70	65.00
3/22/2012		
3/23/2012		
3/24/2012		
3/25/2012		

INF-C BOD & TSS REPORT

9/1/2010 to 9/30/2012

Date	BOD CONCENTRATION MG/L	TSS CONCENTRATION MG/L
3/26/2012	96.75	240.00
3/27/2012	165.37	136.00
3/28/2012	469.83	27.00
3/29/2012		
3/30/2012		
3/31/2012		
4/1/2012		
4/2/2012	548.55	64.00
4/3/2012	382.80	116.00
4/4/2012	538.79	210.00
4/5/2012	722.10	278.00
4/6/2012		
4/7/2012		
4/8/2012		
4/9/2012		
4/10/2012		
4/11/2012	419.16	270.00
4/12/2012		102.00
4/13/2012		
4/14/2012		
4/15/2012		
4/16/2012	309.37	
4/17/2012	344.80	220.00
4/18/2012	568.20	160.00
4/19/2012		279.00
4/20/2012		
4/21/2012		
4/22/2012		
4/23/2012	366.90	
4/24/2012		306.00
4/25/2012		230.00
4/26/2012		270.00
4/27/2012		
4/28/2012		
4/29/2012		
4/30/2012	355.72	
5/1/2012	473.98	63.00
5/2/2012	920.60	180.00
5/3/2012		
5/4/2012		
5/5/2012		
5/6/2012		
5/7/2012	213.58	101.00
5/8/2012	129.77	82.00
5/9/2012	212.47	80.00
5/10/2012		
5/11/2012		
5/12/2012		
5/13/2012		
5/14/2012	306.01	107.00
5/15/2012	555.00	181.00
5/16/2012	947.58	316.00

INF-C BOD & TSS REPORT

9/1/2010 to 9/30/2012

Date	BOD CONCENTRATION MG/L	TSS CONCENTRATION MG/L
5/17/2012		
5/18/2012		
5/19/2012		
5/20/2012		
5/21/2012	293.39	77.00
5/22/2012	357.42	
5/23/2012	427.54	192.00
5/24/2012		
5/25/2012		
5/26/2012		
5/27/2012		
5/28/2012		
5/29/2012	226.03	48.00
5/30/2012	306.63	53.00
5/31/2012		
6/1/2012		
6/2/2012		
6/3/2012		
6/4/2012	253.13	129.00
6/5/2012	127.75	56.00
6/6/2012	525.39	182.00
6/7/2012		
6/8/2012		
6/9/2012		
6/10/2012		
6/11/2012	269.69	203.00
6/12/2012	417.81	177.00
6/13/2012	158.74	94.00
6/14/2012		
6/15/2012		
6/16/2012		
6/17/2012		
6/18/2012	328.10	142.00
6/19/2012	549.25	212.00
6/20/2012	592.80	181.00
6/21/2012		
6/22/2012		
6/23/2012		
6/24/2012	320.06	
6/25/2012	439.94	108.00
6/26/2012		111.00
6/27/2012	568.12	219.00
6/28/2012		
6/29/2012		
6/30/2012		
7/1/2012		
7/2/2012	427.14	284.00
7/3/2012	567.26	192.00
7/4/2012		0.00
7/5/2012		
7/6/2012		
7/7/2012		

INF-C BOD & TSS REPORT

9/1/2010 to 9/30/2012

Date	BOD CONCENTRATION MG/L	TSS CONCENTRATION MG/L
7/8/2012		
7/9/2012	755.02	374.00
7/10/2012	560.65	216.00
7/11/2012	613.50	129.00
7/12/2012		
7/13/2012		
7/14/2012		
7/15/2012		
7/16/2012	311.63	36.00
7/17/2012	524.33	186.00
7/18/2012	378.20	136.00
7/19/2012		
7/20/2012		
7/21/2012		
7/22/2012		
7/23/2012	284.22	139.00
7/24/2012		235.00
7/25/2012	354.27	103.00
7/26/2012		
7/27/2012		
7/28/2012		
7/29/2012		
7/30/2012	275.64	
7/31/2012	406.14	
8/1/2012	368.97	106.00
8/2/2012		
8/3/2012		
8/4/2012		
8/5/2012		
8/6/2012		670.00
8/7/2012	490.29	528.00
8/8/2012		414.00
8/9/2012		
8/10/2012		
8/11/2012		
8/12/2012		
8/13/2012	370.51	182.00
8/14/2012	1,141.30	282.00
8/15/2012	681.51	192.00
8/16/2012		
8/17/2012		
8/18/2012		
8/19/2012		
8/20/2012		542.00
8/21/2012	1,101.92	282.00
8/22/2012	557.15	1,104.00
8/23/2012		
8/24/2012		
8/25/2012		
8/26/2012		
8/27/2012	472.19	290.00
8/28/2012	472.27	304.00

INF-C BOD & TSS REPORT

9/1/2010 to 9/30/2012

Date	BOD CONCENTRATION MG/L	TSS CONCENTRATION MG/L
8/29/2012	551.06	268.00
8/30/2012		
8/31/2012		
9/1/2012		
9/2/2012		
9/3/2012	150.08	93.00
9/4/2012	691.96	224.00
9/5/2012		814.00
9/6/2012		
9/7/2012		
9/8/2012		
9/9/2012		
9/10/2012	261.14	202.00
9/11/2012	408.49	254.00
9/12/2012	402.72	176.00
9/13/2012		
9/14/2012		
9/15/2012		
9/16/2012		
9/17/2012	571.70	168.00
9/18/2012	347.76	182.00
9/19/2012	357.35	116.00
9/20/2012		
9/21/2012		
9/22/2012		
9/23/2012		
9/24/2012	203.45	60.00
9/25/2012	279.37	62.00
9/26/2012	570.83	
9/27/2012		
9/28/2012		
9/29/2012		
9/30/2012		

Minimum	74.13	0.00
Maximum	1,243.52	1,104.00
Average	491.68	170.61
Sum	146,027.48	53,059.00
Geo Mean	430.97	136.69