Rehoboth Beach Wastewater

Treatment Plant

Alternative Discharge Cost Evaluation

March 2009

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Environmental Engineers & Scientists

Alternative Discharge Cost Evaluation
for
Rehoboth Beach Wastewater Treatment Plant

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1. INTRODUCTION

1.1 BACKGROUND

The City of Rehoboth Beach Wastewater Treatment Plant (WWTP) receives wastewater from the City and surrounding areas of Henlopen Acres, Dewey Beach and North Shores and discharges the treated effluent to the Lewes-Rehoboth Canal. The original WWTP was completed in 1987 and was designed to provide a secondary level of treatment. Nutrient removal was not a requirement of the discharge permit.

In 1993 DNREC issued a new NPDES permit requiring Biological Nutrient Removal (BNR) at the Rehoboth Beach WWTP that was driven by and consistent with the "Comprehensive Conservation and Management Plan (CCMP) for Delaware's Inland Bays". This plan established goals for nutrient reductions throughout the Rehoboth Bays watershed. A final cap on nutrients was established based on the 1989 baseline load. The final cap was established as a 30% reduction in nitrogen and a 70% reduction in phosphorus to be monitored on a rolling annual average. Interim goals of a 15% and 30% reduction in nitrogen and phosphorus discharge were also established. Therefore, the plant was upgraded in two phases, in 1994 and 1997, to reduce the nitrogen and phosphorus discharge as required by the permit.

In 1996 portions of the Indian River, and the Rehoboth Bay were listed as water quality impaired and thus required the development of a TMDL. The TMDL was issued in August, 1998 and required that "all point source discharges which are currently discharging into the Indian River, Indian River Bay, and Rehoboth Bay and their tributaries shall be eliminated systematically". Thus the City of Rehoboth Beach had to find an alternate method to discharge their treated wastewater effluent.

In August 2005, the terms of a consent order, which addressed the TMDL were finalized and a revised discharge permit for the WWTP was issued. The consent order establishes a firm date of December 31, 2014 for the discharge to be eliminated from the Lewes-Rehoboth Canal and the new disposal method to be fully operational.

A study was completed in August 2005 which evaluated the following alternatives for the disposal of treated effluent:

- Land application
- Rapid infiltration beds
- Ground water injection
- Ocean outfall

Land application was eliminated from further consideration since, after an extensive land search taking over 2 years, sufficient property to be used for the spray sites, could not be located within a reasonable distance from the wastewater treatment plant. Initially, a total of 46 properties were contacted using a professional realty firm. Several attempts were made through the mail and by phone to contact the landowners and to solicit their interest. Most refused or did not respond. Only three expressed any interest in learning more. However, their interest was based on being able to continue to farm vegetable crops for human consumption which would not be permitted if used for spray irrigation. The search was then expanded by increasing the allowable distance from the RBWWTP. Also, land preserved for agricultural use by the Delaware Agricultural Lands Preservation Act, was pursued. A contingent offer was made on one relatively small property but the offer was not accepted. A number of additional properties would have been required in order for land application to be viable. Thus the search for land was not successful. The required amount of land was not available.

Rapid Infiltration Beds (RIBs) were eliminated because of potential serious problems with ground water mounding and because they would introduce nitrogen to the ground water which would then eventually flow to the Inland Bays. Any introduction of nitrogen to the Inland Bays would violate the intent of the consent order.

Ground water injection was eliminated because of regulatory issues, cost and the high level of risk associated with these technologies. The ocean outfall was identified as the most cost-effective and technically feasible alternative and was recommended.

A series of public meetings and workshops were held in 2007 to explain the results of the study and to solicit feedback. During this time, several private utility companies contacted the City and expressed an interest in providing wastewater treatment and disposal services using land application. Each of these utilities indicated that they had access to the land required for land application. The terms and conditions and the costs associated with these proposals was not defined. In order for the City to judge the efficacy of the proposals and to compare the user charges that would be required to fund this approach, a detailed Request for Proposal (RFP) was developed (Appendix A). The RFP presented the technical design criteria, identified the relevant legal, administrative and regulatory issues and defined the contract terms. The RFP was issued August 5, 2008, and a pre-proposal meeting was held on August 19, 2008. One response was received as described in Section 1.2.

In addition, in order to accurately judge the cost-effectiveness of land application versus the ocean outfall alternative, it was necessary to further develop the capital cost estimate for construction of the outfall. The approach used to verify the estimated cost was to contact qualified marine construction firms. The cost estimate would be non-binding and based on the current conceptual design.

1.2 RESULTS OF REQUEST FOR PROPOSAL EFFORT

The City received no proposal that was responsive to its RFP. Tidewater did not submit although they expressed considerable interest to do so prior to and during the bid phase. Artesian Resources did suggest an approach that would include the participation of Sussex County on behalf of their West Rehoboth Sanitary District. The Artesian approach was based on conveying raw wastewater from the RBWWTP to the Sussex County's Wolfe Neck Regional Wastewater Facility (WNRWF) where it would be equalized and treated. Excess flows, from either the County or the City, greater than the capacity of the WNRWF would be pumped to the Artesian Northern Sussex Regional Water Recharge Facility (ANSRWRF). The approach relied on the successful creation of a partnership between Sussex County, Artesian and the City of Rehoboth Beach.

A phased approach was proposed. In Phase 1, the ANSRWRF would have a treatment capacity of 4.0 mgd of which 2.0 mgd would be available for the County and the City (2.0 mgd already committed to Georgetown and the northern Sussex County area). Phase 2 would provide an additional 2.0 mgd of capacity for the County. The total estimated cost for Phase 1 was $45 million. Artesian proposed to contribute $15 million. The County and the City would split the remaining $30 million in proportion to flow. Thus the City would pay $18 million (1.2 mgd annualized flow) and the County would contribute $ 12 million.

Several issues were identified that have prevented the land application alternative, as proposed by Artesian, from moving forward. The most significant issues appear to be:

- Uncertainty regarding future total cost. The ocean outfall alternative would be capable of disposing of the total design capacity of the RBWWTP whereas the Artesian proposal provided for only the current annualized flow requirements for the City (1.2 mgd)
- The Artesian land application site could be expanded but the cost estimates were very conceptual and in today's dollars.
- Artesian established a user fee that was based on a guaranteed delivery of 2.0 mgd to their facility.
- The cost sharing terms and conditions are unknown

Negotiations between Artesian, the County and the City did not proceed. However, the County offered to develop an alternative land application proposal utilizing their WNRWF and Inland Bays Regional Wastewater Facility (IBRWF). This proposal requires further study and clarification before it can be evaluated and compared to the ocean outfall alternative. Thus, at this time, only the ocean outfall proposal is being presented in this report.

1.3 PURPOSE OF REPORT

The only two viable options for the disposal of effluent from the RBWWTP are land application and ocean outfall. The ultimate goal of this study and report is to develop the capital, operation & maintenance, project and user charge estimates on the basis of the same design criteria and

with a greater degree of confidence to allow the City to make an informed decision regarding their future direction.

The purpose of this report is to present the results of the cost analysis for the ocean outfall alternative. At a later date, if the proposals for land application progress to the point where they can be realistically considered, then the report will be amended to include this additional data.

2. OCEAN OUTFALL ALTERNATIVE

2.1 APPROACH

The Effluent Disposal Study completed in August 2005 estimated the construction cost of an ocean outfall to serve the City of Rehoboth Beach to be $ 29,130,000 in 2005 dollars (Table 7.11 Effluent Disposal Study). The estimate was based on a conceptual plan and input from several large marine contractors. The goal of this study was to develop cost estimates with as much confidence as possible given the state of the conceptual design. It was not possible to obtain a design-build estimate such as was pursued for the land application because of the cost and time required to issue that type of proposal. A significant investment in time and money would be required in order to develop the various permits for the ocean outfall to the point where a legitimate design-bid proposal could be solicited.

In order to update and refine the construction cost estimate, a number of major marine construction firms were contacted including:

- Ben C. Gerwick, Inc.
- WorleyParsons
- Oceaneering
- Ryba Marine Construction
- Weeks Marine
- Reed & Reed
- Commerce Construction
- In-Depth Marine Construction
- Atlantic Marine Constructors

Two firms agreed to work with the City to provide a realistic cost estimate based on their experience and knowledge of marine outfall construction. The two firms included:

Weeks Marine – Weeks Marine was founded in 1919 and is headquartered in Cranford, New Jersey. They are number 110 in the Engineering News Record Top 400 list of contractors and they specialize in dredging and marine construction. They are familiar with the Delaware coast having completed the beach replenishment work in Bethany Beach. The estimate was completed by Mr. Leo Iking who has extensive experience with the design and construction of ocean outfalls.

WorleyParsons – WorleyParsons is an international engineering and construction firm founded in 1971 with expertise in marine and offshore construction. The estimate was completed by Mr. Anthony Perri who has over 20 years experience and Mr. Harvey Walker who has designed numerous ocean outfalls and submarine pipelines.

A package of information describing the conceptual design (included in Appendix B) was submitted to each firm. Comments and suggested revisions to the design were invited. A summary of the conceptual design and comments received are presented in Section 2.2.

The capital cost estimate provided by each contractor is included in Appendix B. Section 2.3.1 presents the results of the capital cost estimates developed by the construction firms as well as the Stearns & Wheler cost estimated updated to 2009 dollars.

2.2 BASIS OF DESIGN

The basis of the cost estimate was the conceptual design as presented in the Rehoboth Beach Wastewater Treatment Plant Effluent Disposal Study (August 2005). The design basis is summarized as follows:

1. Outfall extends 6,000 LF east from the shore and terminates with a diffuser pipe which forms a wye in plan view and runs approximately 650 LF northeast and 650 LF southeast from the end of the outfall. The water depth at the diffuser location is approximately 30 feet.

2. The outfall and diffuser are 24-inch HDPE pipes.

3. Diffuser has 3-inch diffuser ports located 25-feet on center along the length of the 24-inch pipe. Each port has a 3-inch HDPE pipe extending upward from the buried diffuser pipe to the sea floor and ending with Red Valve Series 36-D diffuser check valves made of Neoprene.

4. The outfall and diffuser pipe will be buried such that the crown of the pipe is approximately 5 feet below the sea floor. The pipe will have a 12-inch bedding (1-1/2 inch stone) and backfilled to 1-foot above the crown of the pipe (6-inch stone). From the backfill to the sea floor there will be ballast rock (12-inch stone) with several feet of armor rock (24 to 30 inch stone) placed on top (see typical cross-section).

5. The outfall and diffuser pipe will be ballasted with concrete collars located 20-feet on center. There will also be helical screws located 20-feet on center. The helical screws will be placed on either side of the concrete collars.

6. Installation assumes that the trench will be dredged and the outfall floated out from the beach for installation. It is assumed that the HDPE outfall and diffuser pipe can be fusion welded on the beach at the location of the outfall.

7. It is assumed that construction through the surf zone will require sheeting (approximately 500 LF from the beach on either side of the pipe to a depth of 25 feet).

8. The requirements for dredging will be determined during the permitting process but it is assumed, as a worst-case scenario, that the dredged materials from excavation can not be side cast but rather will have to be temporarily placed in a barge.

9. Construction is limited to the months of October through May

A plan view of the force main and outfall are shown in Figure 2.2-1.

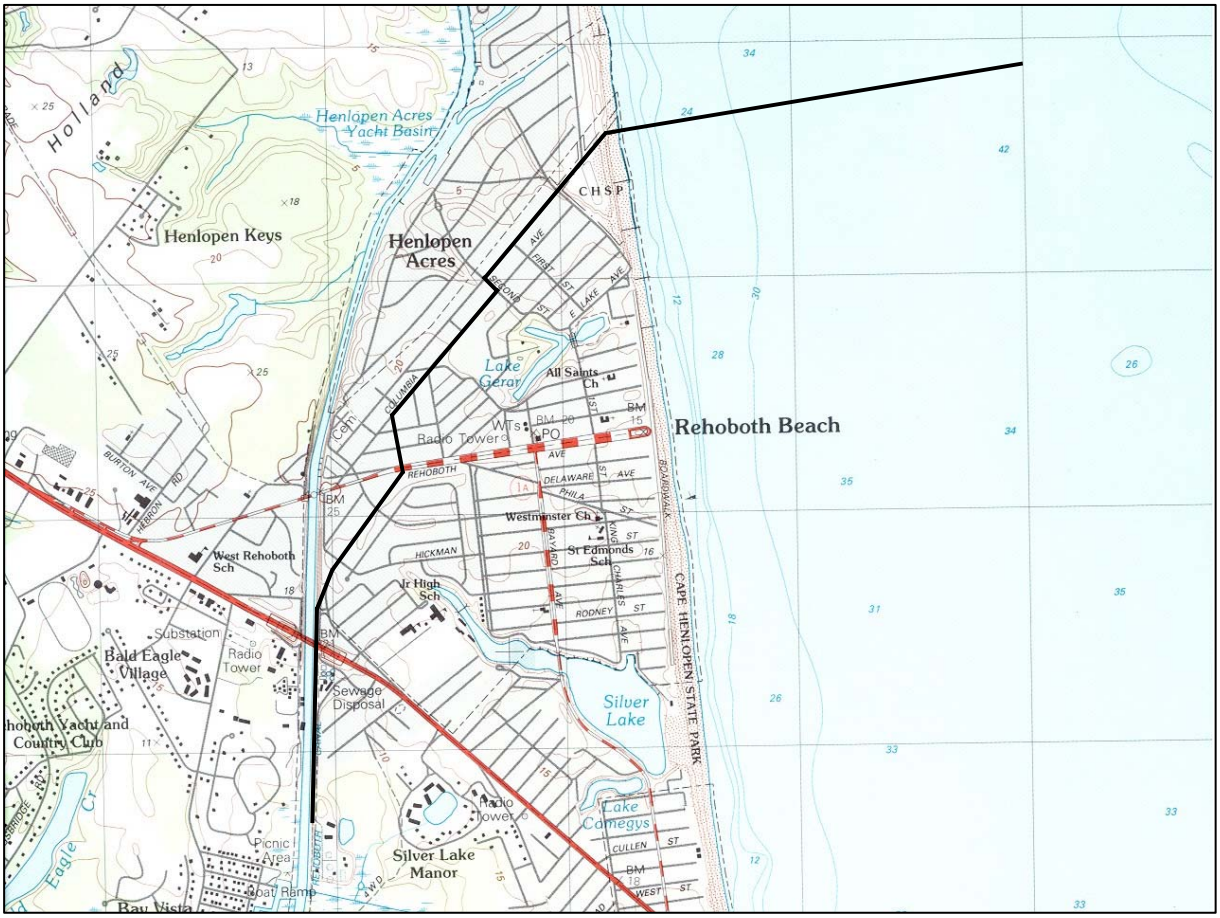

Figure 2.2-1: Proposed Alignment of Force Main and Ocean Outfall

2.3 CAPITAL COST

2.3.1 OCEAN OUTFALL

The capital cost estimate provided by each contractor is included in Appendix C. Table 2.3.1-1 presents the results of the capital cost estimates developed by the construction firms as well as the Stearns & Wheler cost estimated updated to 2009 dollars.

Table 2.3.1-1: Summary of Estimated Capital Costs – Ocean Outfall

COST COMPONENT	STEARNS & WHELER	WEEKS MARINE	WORLEYPARSONS
Subtotal	$19,900,000	$16,710,000	$12,724,000
Contingency	$6,000,000	Incl.	$3,817,000
Total	$25,900,000	$16,710,000	$16,541,000
Average	**$ 19,700,000**		

Explanation of Cost Estimates

Stearns & Wheler

This estimate was taken from the Rehoboth Beach Wastewater Treatment Plant Effluent Disposal Study completed by Stearns & Wheler in August 2005. The estimate was based on the design concept described in Section 2.2 of this report which includes HDPE pipe buried in an excavated trench. The total estimated construction cost ($22,100,000) was escalated to current dollars based on the ENR Construction Cost Index.

Weeks Marine

Weeks Marine based their cost estimate on the same basis of design which included HDPE pipe buried in an excavated trench. The individual line items that comprised their estimate each included a contingency. Thus the contingency was not broken out in Table 2.3.1-1 above.

WorleyParsons

WorleyParsons evaluated several alternatives for construction of the outfall including:

- Concrete encased steel pipe partially buried in an excavated trench
- HDPE pipe fully buried in an excavated trench
- HDPE pipe installed by Horizontal Directional Drilling (HDD)

The concrete encased steel pipe alternative, although less expensive, is not recommended because the installation offers less protection against disturbance on the ocean floor and potential damage. Also, it requires additional maintenance costs and concerns for corrosion protection. The HDPE pipe is corrosion resistant but somewhat more difficult to install because it is buoyant. Complete burial in an excavated trench is the recommended installation technique

since it provides protection against damage by disturbances on the sea bottom. Installation by Horizontal Directional Drilling (HDD) would minimize environmental disturbances during construction and may be selected as the construction method during final design. This decision would be based on additional geotechnical investigations during the permitting phase to determine if HDD is feasible.

2.3.2 PUMP STATION AND FORCE MAIN

The cost estimate for the pump station was based on the following design flows:

Design	**Flow (mgd)**
Average	3.4
Instantaneous Peak	10.2
Current	
Summer	2.2
Winter	1.1

The design concept included conversion of the existing reaeration tank at the RBWWTP to a wet well and installation of vertical inline turbine pumps above the wet well. All new construction and piping on the site of the wastewater treatment plant would be on piles. Three (3) vertical turbine pumps would be provided with variable speed drives. The force main would be 24-inch ductile iron pipe.

The alignment proposed for the force main is as follows:

- North from PS along edge of canal until reaching plant entrance road
- In ROW of plant access road, under Rt. 1 Bridge
- Continue on State Road to Rehoboth Ave.
- Cross Rehoboth Ave.
- ROW in Fifth St. to Columbia Ave.
- ROW in Columbia Ave. to 2nd St.
- ROW 2nd St. to Henlopen Ave.
- ROW Henlopen Ave. to the beach

- Through beach parking lot and dunes to the beach
- Connect to ocean outfall

However, it is understood that, if the ocean outfall alternative is selected, an alignment study would be completed to determine the best routing of the force main considering such issues as cost, permitting, potential interferences, traffic control and public concerns.

The estimated cost for construction of the pump station and force main to convey treated effluent from the RBWWTP to the ocean outfall is presented in Table 2.3.2-1. The detailed cost estimate and information regarding the pumps is included in Appendix D.

Table 2.3.2-1: Estimated Capital Cost – Pump Station and Force Main

COST COMPONENT	ESTIMATED CAPITAL COST
Pump Station	$340,000
Forcemain	$2,560,000
Subtotal	$2,900,000
General Conditions (5%)	$150,000
Contingency (30%)	$850,000
Total	**$3,900,000**

2.3.3 WWTP IMPROVEMENTS

The current RBWWTP was placed in service in 1987 and thus some of the equipment is nearing the end of its life cycle. Although normal maintenance has kept the plant in good operating condition, certain equipment items should be budgeted for replacement or repair since they represent significant capital expenditures. These expenditures have been divided into two categories; costs for repair that should be budgeted for and completed in the future and costs for upgrades that should be completed as soon as possible. These costs are further explained below.

2.3.3.1 BUDGETED ANNUAL OPERATIONS AND MAINTENANCE COSTS

These are costs associated with repairs of existing equipment at the RRWWTP that should be anticipated but which are not immediately critical to the continued operation of the plant. Table

2.3.3.1-1 presents a recommended list of such improvements with approximate costs for completing them. The recommended annual cost is based on the premise that the operating budget should establish an account to fund these improvements when and if required.

It should be noted that these costs have not been included in the calculation of the estimated user fees. This is because these costs have not been included in the calculation of other proposed effluent disposal alternatives and, thus it would be misleading to include them now.

Table 2.3.3.1-1: Additional Annual Costs Associated with the Wastewater Treatment Plant

ITEM	NO. UNITS	COST EACH	TOTAL COST	PROJECT COST (1)	EXPLANATION
Draft Tube Aerators	4	$150,000	$600,000	$960,000	
Microsrceens	2				Will be replaced by future effluent sand filter
Blowers					
Main Process	3	$25,000	$75,000	$120,000	
Aerobic Digester	3	$15,000	$45,000	$72,000	
Final Clarifier Drive	2	$50,000	$100,000	$160,000	
Pumping Equipment:					
Process	20	$20,000	$400,000	$640,000	
Collection System	7	$25,000	$175,000	$280,000	
Chemical Feed -pumps	10	$8,000	$80,000	$128,000	
Chemical Feed -tanks	4	$25,000	$100,000	$160,000	
Grit System	LS		$800,000	$1,280,000	
Instrumentation & Controls	LS		$250,000	$400,000	
Concrete Repair:					
Headworks	LS		$50,000	$80,000	Currently showing signs of pitting
Oxidation Ditches	LS		$300,000	$480,000	Currently showing signs of pitting
Misc	LS		$300,000	$480,000	
Miscellaneous:			$1,000,000	$1,600,000	Based on 50k per year
Total			$4,275,000	$6,840,000	Assume costs are incurred midway through 20 year life cycle
Annual Cost			$213,750	$342,000	Annual cost over 20 year life cycle (2005 dollars)
Annual Cost				$396,700	Escalated to 2009 dollars based on ENR cost index
Adopt				**$400,000**	

Note:
1. Basis of Project Costs: Installation - 25%; General Conditions – 5%: Electrical – 15%; Admin/Legal – 5%; Engineering – 10%; Total – 60%

2.3.3.2 INITIAL CAPITAL PROJECTS

Several equipment items at the RBWWTP are in more urgent need of repair or replacement. These include the effluent filters and the main MCC equipment. The existing effluent filter is a micro-screen which, although functional, is at the end of its useful life. Newer technologies are available which are more efficient and effective. Thus it is proposed to replace the micro-screen with a continuous backwash sand filter. The estimated construction cost is shown in Table 2.3.3.2-1.

Table 2.3.3.2-1: Estimated Capital Cost - Effluent Filters

COST COMPONENT	ESTIMATED CAPITAL COST
Effluent Filters	$2,520,000
General Conditions (5%)	$110,000
Contingency (30%)	$790,000
Total	**$3,420,000**

The main MCC equipment, which is required for power distribution and controls, is critical to the functioning of the plant. The existing system requires considerable maintenance. As a minimum, the switch gear should be retrofit by using the services of the MCC manufacturer. The approximate cost of this wok is $300,000.

Therefore the total estimated capital costs, to be included in the proposed upgrade to the RBWWTP, is approximately $3,700,000.

2.4 OPERATION & MAINTENANCE COSTS

The annual cost to the City for operation and maintenance of the wastewater treatment plant, pumping facilities and ocean outfall is estimated based on the existing actual costs plus the estimated cost for operation and maintenance of the new facilities. The cost to operate and maintain the new effluent filter will be approximately the same as the existing micro-screen. The primary additional costs will be for the new pump station and for maintenance of the force main and outfall. Table 2.4-1 summarizes the assumptions made to determine the operation and

maintenance cost. The estimated O&M costs for the pumping station, force main and outfall, plus the existing actual operations and maintenance costs budgeted for the WWTP (2008 – 2009 budget), are presented in Table 2.4-2.

Table 2.4-1: Operations and Maintenance Cost Assumptions

PARAMETER	VALUE
Electrical Cost ($/KWH)	$0.10
Labor Cost per hour (includes overhead)	$25.00
Maintenance cost (as % of Capital Cost)	
Equipment	2 %
Force Main	1 %

Table 2.4-2: Estimated Annual O&M Costs

COST COMPONENT	ESTIMATED ANNUAL COST
Pump Station	
Power	$7,000
Maintenance	$10,000
Force Main	
Maintenance	$24,000
Outfall	
Annual inspection	$5,000
Insurance	$100,000
Subtotal	$146,000
Adopt	**$150,000**
Existing WWTP O&M	$1,740,000
Estimated Total	**$1,890,000**

2.5 PROJECT COSTS

Project costs include the capital cost for construction plus additional costs that include permitting, engineering services for design and construction, resident inspection, owner administrative and legal fees, costs associated with financing the project and other overhead items. These costs are estimated as a percentage of the estimated capital cost using the following conventional guidelines:

		Percent Capital Cost
Permitting	Study	3
	Field work	2
Engineering	Design (1)	8
	Construction	5
Resident Inspection		3
Administration		5
Legal		2
Financial		2
	Total	**30**

Note: (1) Average depending on complexity of project

The estimated project costs are shown in Table 2.5-1.

Table 2.5-1: Estimated Total Project Costs

COST COMPONENT	ESTIMATED COST
Ocean Outfall	$19,700,000
Pump Station / Force Main	$3,900,000
WWTP Improvements	$3,700,000
Subtotal	**$27,300,000**
Permitting	$1,400,000
Engineering – Design	$2,000,000
Engineering – Construction	$1,400,000
Admin / Legal / Fiscal	$2,500,000
Total Estimated Project Cost	**$34,600,000**

2.6 ESTIMATED USER FEES

2.6.1 DESCRIPTION OF RATE STRUCTURE

The revenue from the collection and treatment of wastewater is comprised of four (4) components. The components are defined below:

- Metered Sewer Wastewater: The metered sewer wastewater is comprised of connections to the wastewater treatment plant that are within city boundaries and are greater than 1-inch connections, connections outside the City boundary, and connections that are 1-inch

and less. The 1-inch and less connections are billed on a quarterly basis and all others are billed on a monthly basis. The metered sewer bills are determined based on the water usage to each connection. The water usage is converted to a sewer rate.

- North Shores Revenue: There are currently 289 units in this service area that generate revenue for the City of Rehoboth Beach. The units are billed on a quarterly basis. The rates are determined by the cost of providing service plus a 50% surcharge added to the calculated cost.

- Dewey Beach and Henlopen Acres: The Dewey Beach and Henlopen Acres sanitary sewer districts are billed on a quarterly basis based on the actual metered flow discharged into the City's treatment plant. The metered flow is taken as a percentage of the total flow treated by the plant and multiplied by the City's total O&M costs. A 15% surcharge is added to the cost.

2.6.2 CURRENT USER RATES

An estimate of the current annual user charge, for a typical resident or Equivalent Dwelling Unit (EDU) in the Rehoboth Beach service area, is developed in this section based on the following data and assumptions:

- The average residential service connections are represented by the service connections that are 1-inch and less.
- The wastewater is distributed evenly between all service connections that are 1-inch and less.
- The total number of service connections that are 1-inch and less is 2,161.
- The average annual water usage for a residential customer is approximately 150 gal/day. This is based on a calculation of the total residential water consumption per year divided by the number of residential connections as shown in Table 2.6.2-1 below.

- The following rate structure:

Service charge	$12.09 per quarter
Usage charge	4.12 per 1,000 gal.
Surcharge	1.93 per 1,000 gal. (2nd and 3rd quarters)

Table 2.6.2-1: Typical Annual Residential Water Usage [1]

MONTH	UNITS	AVERAGE QUARTERLY WATER USAGE: 1-INCH OR LESS CONNECTIONS
Quarter 1 (Jan – Mar)	gal	17,560,000
Quarter 2 (Apr – Jun)	gal	27,450,000
Quarter 3 (Jul – Sep)	gal	53,820,000
Quarter 4 (Oct – Dec)	gal	18,610,000
Total Water Usage - Annual	gal/yr	**117,440,000**
Total Water Usage - Daily	gal/day	**321,753**
No. of Connections		**2,161**
Average Daily Use per EDU[2]	gal/day	**150**

Notes:
1. Based on 2003 data (a review of recent data verifies this data is still valid).
2. EDU – Equivalent Dwelling Unit.

Based on the estimated daily water usage and the actual rate structure, the typical annual user charge for a residential customer within the City of Rehoboth Beach limits is calculated as follows:

	Typical Annual Charge
Service charge	48.36
Usage charge	224.95
Surcharge	52.69
Total	**$326.00**

This can also be verified by an analysis of the average annual sewer charges based on the actual billings for 2008. Table 2.6.2-2 presents a summary of the annual costs for all 1-inch water accounts. The most expensive accounts are restaurants and businesses. The smallest accounts are most likely unoccupied residential units. The average rate is shown for the case where the top 50 and bottom 50 accounts were eliminated. This appears to be a reasonable estimate of the typical residential charge given the resulting range of costs from minimum to maximum.

Table 2.6.2-2: Distribution of Annual Costs ($)

ANNUAL COSTS ($)	HIGHEST	LOWEST	AVERAGE
All Accounts	6,102	48	369
Less Top & Bottom 50	1,344	57	325

Therefore, the estimate of the typical existing annual residential user charge is $325 per year.

2.6.3 IMPACT OF OCEAN OUTFALL PROJECT ON USER CHARGES

It is assumed that the project will be financed through the Delaware Water Pollution control Revolving Loan Fund (WPCRLF). The interest rate on the loan is based on 90% of the national bond yield. At the time of this report, the rate would be approximately 4.4% (0.90 x 4.88%) although there are some adjustments made based on financial hardships. All costs are presented in 2009 dollars. Based on the loan parameters presented in Table 2.6.3-1 and the assumption of no grant funding, the Principal (P) and Interest (I) payments to fund a project cost of $34,700,000 are as follows:

P = $1,830,000 per year

I = $ 810,000 per year

Table 2.6.3-1: Cost Analysis Parameters

PARAMETER	VALUE
Period for Present Worth Analysis	20 years
Annual Interest Rate	4.4%
Conversion Factor for Present Worth to Annual Cost(1)	0.0762

Note:
1. Calculated conversion value: $(Rate*(1+Rate)^{20})/((1+Rate)^{20}-1)$.

The estimated total annual cost for the ocean outfall, including the existing cost to operate the wastewater treatment plant and collections system, are presented in Table 2.6.3-2.

Table 2.6.3-2: Annual Cost for Ocean Outfall

SOURCE	VALUE
Existing O&M Costs[1]	$1,740,000
Additional O&M Costs (Ocean Outfall)	$150,000
Annual Interest[2]	$810,000
Annual Principal[2]	$1,830,000
Total Annual Cost	**$4,530,000**

Notes:
1. From Rehoboth Beach 2008 – 2009 budget.
2. Annual P and I payments averaged over life of loan

Thus, a total of $ 4,530,000 of revenue must be generated per year by the user charges to the areas served by the RBWWTP. These costs are shared according to various service agreements, by the City of Rehoboth Beach, Dewey Beach, Henlopen Acres and North Shores. The costs for the wastewater treatment plant and the collection system are divided based on flows although only Rehoboth Beach and North Shores contribute to the collection system costs. Table 2.6.3-3 provides a break down of the percentage share of these costs.

Table 2.6.3-3: Percentage Share of Operating Costs

SERVICE AREA	PLANT OPERATIONS	COLLECTION SYSTEM
Rehoboth Beach	56.32 %	92.49 %
Dewey Beach	35.33 %	0
Henlopen Acres	3.78 %	0
North Shores	4.57 %	7.51 %

The estimated increase in the annual user charge for the City of Rehoboth Beach is calculated in Table 2.6.3-4, based on the percentage share of costs shown in Table 2.6.3-3 and the annual total costs or revenue that must be generated as shown in Table 2.6.3-4.

Table 2.6.3-4: Estimated Rehoboth Beach User Charge

COST ITEM	TOTAL COST	REHOBOTH BEACH SHARE
Plant Operations	$1,590,000	$895,488
Collection System	$150,000	$138,735
Existing Costs	**$1,740,000**	**$1,034,223**
Additional O&M	$150,000	$84,480
Principal	$1,830,000	$1,034,223
Interest	$810,000	$456,192
New Costs	**$2,790,000**	**$1,574,895**
Total Estimated Future Cost	**$4,530,000**	**$2,609,118**
Current Revenue		$1,240,000
Percent Increase		110%
Exist. Average User Charge		$325
Proposed User Charge		**$680**

Thus, it is estimated that the typical annual user charge for wastewater will increase by a factor of 2.1 (110 %) to approximately $680 per year.

The DNREC guideline for establishing a maximum "reasonable" user charge is 1.5% of the median household income (MHI). The MHI is inflated to the year that the project is actually supposed to start. DNREC provided the projected MHI of $64,016 for Rehoboth Beach for 2008. The impact on Rehoboth Beach users was determined based on year 2009 dollars; therefore, the MHI was escalated to year 2009 dollars at 3% per year. The projected MHI in 2009 is $65,940. The maximum "reasonable" user charge based on the DNREC guidelines would be $989. An increase of 205% above the current user charge would be required in order to reach an average user charge of $989.

Appendix A
Land Application RFP

STEARNS & WHELER LLC
Environmental Engineers & Scientists

City of Rehoboth Beach, Delaware

REQUEST FOR PROPOSAL

August 5, 2008

Construction and/or Services Agreement
for the
Disposal of Wastewater
from the
City of Rehoboth Beach Wastewater Treatment Plant
via
Land Application

Request for Proposal
Rehoboth Beach, Delaware

City of Rehoboth Beach
City Manager's Office
229 Rehoboth Avenue
Rehoboth Beach, DE 19971

Sealed responses to Request for Proposal (RFP) for City of Rehoboth Beach for "Construction and/or Services Agreement for Wastewater Facility" as described in the proposal package, for the City of Rehoboth Beach will be accepted from qualified Respondents until **1:30 p.m., September 24, 2008** at the City Manager's Office, 229 Rehoboth Avenue, Rehoboth Beach, DE 19971. The proposal shall provide required information for construction, operation and/or ownership of transmission and disposal facilities for wastewater, as specified within the RFP. A **Mandatory Pre-proposal** meeting will take place on **August 19, 2008 at 9:00 a.m.** at the Rehoboth Beach Municipal Building, 299 Rehoboth Avenue, Rehoboth Beach, DE 19971. All Respondents submitting proposals shall attend the Pre-proposal meeting or their proposals may be considered non-responsive. Additional specifications and/or instructions to Respondents may also be obtained by calling the Rehoboth Beach City Manager's Office, 229 Rehoboth Avenue, Rehoboth Beach, DE 19971 (302-227-6181) Attn: Greg Ferrese.

Electronically submitted or late proposals will not be accepted. All Respondents shall acquire original proposal packages from the City Manager's Office in order to submit any proposal or their proposal may be considered non-responsive.

The Board of City Commissioners of Rehoboth Beach

By: Greg Ferrese
City Manager
City of Rehoboth Beach

1. Introduction

The City of Rehoboth Beach (City) owns and operates a wastewater treatment plant with a design capacity of 3.4 mgd and which currently discharges treated effluent, in compliance with its NPDES discharge permit, to the Lewes-Rehoboth Canal. The City is required, under the terms of a state mandated consent order, to eliminate this discharge and utilize an alternate method of disposal for treated effluent. The City is therefore soliciting proposals from responsible service providers to receive and dispose of the City's wastewater (either raw or treated effluent) via land application. The City, at it's sole discretion, will either proceed with executing an agreement with the successful bidder or determine that this agreement is not in the best interests of the City and therefore pursue an alternate means of complying with the consent order. The proposals will be evaluated on the basis of environmental considerations, permit compliance, costs and other issues as identified in this RFP.

2. Background

The City of Rehoboth Beach Wastewater Treatment Plant (WWTP) receives wastewater from the City and surrounding areas of Henlopen Acres and Dewey Beach and discharges the treated effluent to the Lewes-Rehoboth Canal. The original WWTP was completed in 1987 and was designed to provide a secondary level of treatment. Nutrient removal was not a requirement of the discharge permit.

In 1993 DNREC requested that the City implement Biological Nutrient Removal (BNR) at the Rehoboth Beach WWTP. This was consistent with the "Comprehensive Conservation and Management Plan (CCMP) for Delaware's Inland Bays". This plan established goals for nutrient reductions throughout the Rehoboth Bays watershed. A final cap on nutrients was established based on the 1989 baseline load. The final cap was established as a 30% reduction in nitrogen and a 70% reduction in phosphorus to be monitored on a rolling annual average. Interim goals of a 15% and 30% reduction in nitrogen and phosphorus discharge were also established. Therefore, the plant was upgraded in two phases, in 1994 and 1997, to reduce the nitrogen and phosphorus discharge as required by the consent order.

In 1996, portions of the Indian River, and the Rehoboth Bay were listed as water quality impaired and thus required the development of a Total Maximum Daily Load (TMDL). The TMDL was adopted in November, 1998, and required that "all point source discharges which are currently discharging into the Indian River, Indian River Bay, and Rehoboth Bay and their tributaries shall be eliminated systematically". Thus the City of Rehoboth Beach had to find an alternate method to discharge its treated wastewater effluent.

In August 2005, the terms of the consent order, which addressed the TMDL, were finalized and a revised discharge permit for the WWTP was issued. The consent order established a firm date of December 31, 2014 for the discharge to be eliminated and the new discharge method to be fully operational.

A study was completed in August 2005 which evaluated the following alternatives for the disposal of treated effluent:

- Land application
- Rapid infiltration beds
- Ground water injection
- Ocean outfall

Land application was eliminated from further consideration since, after an extensive land search taking over 2 years, sufficient property to be used for the spray sites, could not be located within a reasonable distance from the wastewater treatment plant. Rapid Infiltration Beds (RIBs) were eliminated because of potential serious problems with ground water mounding and because they would introduce nitrogen to the ground water which would then eventually flow to the Inland Bays. Any introduction of nitrogen to the Inland Bays would violate the intent of the consent order. Ground water injection was eliminated because of regulatory issues, cost and the high level of risk associated with these technologies. The ocean outfall was identified as the most cost-effective and technically feasible alternative and was recommended.

A series of public meetings and workshops were held in 2007 to explain the results of the study and to solicit feedback. During this time, it became apparent that it may be possible to proceed with land application by contracting with one of several service providers that had access to or plans to build a land application treatment and disposal facility.

3. Purpose

The purpose of this RFP is to solicit firm commitments from responsible service providers to receive, transport and dispose of the City of Rehoboth Beach wastewater via land application, at an annual cost and in accordance with terms established by contract between the Service Provider and the City. The method of land application shall be spray irrigation on agricultural fields. Disposal by rapid infiltration beds is specifically prohibited.

The response to this RFP will be used by the City to evaluate its future direction to comply with the consent order in a manner which is both environmentally and fiscally sound. Responses will be evaluated along with other options available to the City for the disposal of its wastewater effluent.

4. Definitions

RBWWTP	Rehoboth Beach Wastewater Treatment Plant
LAWTF	Land Application Wastewater Treatment Facility
DNREC	Delaware Department of Natural Resources and Environmental Control
Service Provider	A corporation or other business entity responding to the RFP which has the capacity and expertise to provide the services detailed in the RFP (also "Respondent" or "Offerer")
Agreement	Contract to be executed between the City of Rehoboth Beach and the successful Service Provider if it is determined to be in the best interests of the City to proceed

5. Service Requirements

5.1 Alternatives

The service provider may respond to either of two alternatives or they may respond to both alternatives at their discretion. The two alternatives are:

Alternative A: Disposal of Treated Effluent
Alternative B: Treatment and Disposal of Raw Wastewater

A detailed description of the two alternatives as well as the design flows and wastewater characteristics follows.

5.2 Capacity

The Project shall be designed to receive and dispose of all flows generated in the Rehoboth Beach service area. The design capacity of the existing RBWWTP is 3.4 mgd on an average daily basis. However, the flow fluctuates considerably due to seasonal and diurnal variations and also due to weather related conditions. The service provider should assume that there will be no flow equalization at the RBWWTP and that the flow pumped to the service provider will be equal to the influent flow to the RBWWTP. Statistical information on the existing treatment plant flows and the projected growth in flows is provided in Appendix No. 1.

5.3 Alternative A: Treated Effluent

Alternative A includes all capital and O&M costs associated with conveying treated effluent via a force main from the RBWWTP to the LAWTF and for storing and disposing of the treated effluent by land application. The force main would be designed, built, operated and maintained by the Service Provider. The City of Rehoboth Beach would construct and operate the pumping station at the site of the existing RBWWTP. The City would install and maintain a flow meter in the new effluent pump station. The discharge from the new effluent pump station will be constructed to a point approximately 10 feet outside the fence line at the entrance to the RBWWTP. Flow equalization will not be provided. The pumping system will be designed to pump all flows as they are received and treated through the existing wastewater treatment plant.

The Service Provider should note that the pumping station will be designed to pump the required flow against a specified head. The required head will vary depending on the location of the land application site and the distance of the site from the RBWWTP. Thus, if additional pumping head is required, the Service Provider should plan on installing an intermediate pumping station. This would be designed, built and operated by the Service Provider. This is described further in Section 6.7.1.1 of the RFP.

The treated wastewater from the RBWWTP is in compliance with its NPDES permit. The current permit is included in Appendix No. 2 and summarized in Table A1.

Table A1: Summary of NPDES Permit Requirements

Parameter	Units	Daily Average	Daily Maximum
Flow	mgd	3.4	-
BOD	mg/L	19	29
TSS	mg/L	15	23
pH	standard units	6.0 – 9.0	

The RBWWTP currently removes nitrogen and phosphorus. Nitrogen is removed biologically to a level of 6 to 9 mg/L TN. Phosphorus is removed by chemical precipitation using Ferric Chloride to a level of approximately 0.5 mg/L. The nutrient limits are based on an annual Waste Load Allocation in terms of pounds of nitrogen and phosphorus that can be discharged each year, on a rolling average, and not on a concentration limit. However, these limits are only applicable to the surface water discharge which will be eliminated once the treated effluent is sent to a land application facility.

Statistical information regarding the performance of the existing RBWWTP with respect to nitrogen and phosphorus, for the year 2007, is provided in Appendix No. 3. The service provider should not assume that the current performance is an indication of the future level of treatment performance for nutrient removal. As flows increase, the efficiency of the RBWWTP may decrease with respect to nitrogen and phosphorus removal. Also, the City may elect to discontinue the use of chemical addition for phosphorus removal since it would no longer be a permit requirement. Therefore, the Service Provider should assume that the wastewater would be treated to a level in compliance with the DNREC requirements to allow limited public access as described in the Section 303(2)b of the document "Guidance and Regulations Governing the Land Treatment of Wastes" which imposes the following restrictions:

- BOD5 30 mg/L
- TSS 30 mg/L
- Fecal Coliform 200 colonies / 100 mL

5.4 Alternative B: Raw Wastewater

Alternative B includes all capital and O&M costs associated with conveying raw wastewater via a force main from the RBWWTP to the LAWTF, treating the wastewater to the standards required for land application and disposing of the effluent by land application. The force main would be designed, built, operated and maintained by the Service Provider. The City of Rehoboth Beach would modify the existing raw wastewater pumping station at the site of the existing RBWWTP. The City would maintain a flow meter in the pump station. The discharge from the new effluent pump station will be constructed to a point approximately 10 feet outside the fence line at the entrance to the RBWWTP. The wastewater will be pumped directly to the Service Provider (discharged to the force main) without flow equalization and without preliminary treatment.

The Service Provider should note that the pumping station will be designed to pump the required flow against a specified head. The required head will vary depending on the location of the land application site and the distance of the site from the RBWWTP. Thus, if additional pumping head is required, the Service Provider should plan on installing an intermediate pumping station. This would be designed, built and operated by the Service Provider. This is described further in Section 6.7.1.1 of the RFP.

In general, the wastewater is a typical municipal wastewater comprised of flows from domestic and commercial facilities. The influent BOD and TSS concentrations are typically less than 200 mg/L.

6. RFP Requirements

6.1 General

Respondents shall provide the following information and in the format prescribed below. The submittal shall clearly indicate which alternative is being offered. If a respondent is submitting on both alternatives, then the information for each shall be provided in separate submittal packages.

The respondent shall provide one original and eight (8) copies of the proposal.

RESPONSES MUST BE RECEIVED NO LATER THAN
1:30 pm on Wednesday, September 24, 2008
At the Office of the City Manager
229 Rehoboth Avenue
Rehoboth Beach, DE 19971

6.2 Cover Letter

Provide letter signed by agent authorized to commit the Respondent to provide the required services and clearly state the Alternative that the proposal is in response to (Alternative A or Alternative B). Also describe the legal organization of the Respondent. If the Respondent is not a single entity, then describe the details of the partnership, joint venture or other organization as may be offered. The letter shall state that the Respondent meets all requirements of the RFP or, if it is does not, specifically identify all exceptions taken.

6.3 Table of Contents

6.4 Executive Summary

Provide a maximum of three (3) pages of single spaced information describing the ability of the Respondent to meet the requirements of the RFP.

6.5 Qualifications

6.5.1 Experience

Submit the Certificate of Offeror's Qualifications (Appendix No. 4) and demonstrate ability to successfully provide the required services through prior experience with similar projects. Provide a minimum of five (5) examples of previous projects and contact information for individuals familiar with the project. Only projects that are in operation shall be provided. Projects of comparable size (greater than 1.5 mgd average daily flow) are preferred.

6.5.2 Project Team

Provide organizational chart and narrative indicating the roles and responsibilities of the individuals who will be assigned to the project including responsibilities for permitting, engineering, construction and operation. The respondent shall demonstrate capabilities for all work required to complete the project, either through in-house or consultant personnel.

6.6 Schedule

Provide list of milestones and timeline for completing the work from acceptance of proposal by the City through startup and operation of the new Land Application System. Include critical dates for submittals, permit reviews and approvals, construction and startup testing.

6.7 Cost

6.7.1 Basis of Project Costs

6.7.1.1 Pumping Station

The City will own, operate and maintain a pump station at the RBWWTP to pump wastewater (treated or raw) into the force main provided and maintained by the Service Provider. It is recognized that, as the distance to the land application site increases, the dynamic head to pump the wastewater also increases. A booster pump may therefore be required in order to stay within reasonable guidelines for the design of a wastewater pumping station. For the purposes of this proposal, it should be assumed that the pump station at the RBWWTP will be designed to pump the required flow at a maximum Total Dynamic Head of 120 feet. The design maximum month capacity of the pump station will be 3.4 mgd with an instantaneous peak flow of 10.2 mgd.

If the design of the force main from the RBWWTP to the LAWTF requires greater head pumping capacity than specified above, the Respondent shall include, as part of their cost, the design, construction, operation and maintenance of an intermediate pump station.

6.7.1.2 Force Main

The force main, where it crosses the Lewes-Rehoboth Canal, shall be directional drilled. Suspending the force main from an existing bridge structure shall not be permitted.

The force main and all appurtenances shall be designed to Sussex County standards.

6.7.1.3 Inspection Services During Construction

The Service Provider will be required to provide full-time inspection during construction of any facilities for pumping, transmitting, treating or disposing of the wastewater.

6.7.2 Annual Service Fee

Provide an Annual Service Fee (ASF) that is inclusive of all fixed and variable costs associated with fully providing the facilities and services required to comply with the requirements of this Agreement. The ASF shall be calculated in accordance with the following formula:

$$\mathbf{ASF = FC + (VC \times EF)}$$

Where; **FC** = Fixed Costs
VC = Variable Costs
EF = Escalation Factor

As further defined below:

Fixed Costs (FC) shall include all costs associated with the capital improvements, debt service, depreciation, project administration, legal, permitting, engineering, operations and maintenance requirements that are fixed and not dependent on the flow received, treated or disposed of by the LAWTF. The Service Provider shall note that the Agreement will be based on the estimated capital cost included in the proposal and not on the final actual cost for construction of the required facilities.

Variable Costs (VC) shall include all costs associated with the operation and maintenance of the required facilities that are directly proportional to the amount of flow received, treated and disposed of by the LAWTF. This shall include, for example, the cost of pumping, aeration, chemicals, labor and other items that are related to the quantity of flow.

Escalation Factor (EF) is a factor that shall be determined by and clearly identified by the Service Provider in their proposal. The EF is the maximum annual percent increase in the VC that will be permitted by the Agreement.

Respondents shall note that the Agreement will limit the actual percent increase in the VC to the following, which ever is less:

- Actual costs subject to an annual audit. Following the annual audit, any legitimate cost adjustments from the previous year will be reconciled by adjusting the next year's billings.
- Escalation Factor (EF) contained in the proposal
- Consumer Price Index (CPI) local to the Sussex County Delaware area

The ASF shall be provided for the first year of service anticipated by the Agreement which shall be clearly stated in the proposal. Variable costs shall be based on the flow projections presented in Appendix No. 1. All proposals will be compared on the basis of the equivalent Year 2010 dollars using an inflation factor of 3% to adjust the ASF to the Year 2010.

6.7.3 Present Worth Analysis

The cost proposals will be evaluated on the basis of the Annual Service Fee and a calculation of the 20 year present worth of the fixed and variable costs including an annual increase in the ASF based on the Escalation Factor proposed by the Service Provider. The present worth of the costs shall be determined based on the following parameters.

Start Date	January 1, 2011
End Date	December 31, 2035
Annual Flows	see Appendix No. 1
Annual Interest Rate	6 %
Annual Inflation Rate	3 %

6.7.4 Service Area

Describe future plans to accept additional service areas into the treatment facility and the impact that may have on the annual service fee.

6.7.5 Documentation of Costs

Provide detailed calculation of the following costs:

- Capital
- Annual operations and maintenance
- Engineering
- Project administrative, legal and fiscal

Documentation of the cost calculations shall include a break-out of the quantities, unit costs for materials, equipment and labor and assumptions regarding overhead, profit and

general conditions. The level of detail indicated by the form provided in Appendix No. 5 (Summary of Capital Costs) shall be provided.

6.8 Project Approach

1. Provide description of the facilities and unit processes proposed to transport, treat and dispose of the wastewater via land application. Any proposed phasing of the construction and operation of the proposed facilities must be coordinated with the schedule discussed previously.

2. For each unit process (force main, pumping system, spray fields, etc) provide detailed design criteria anticipated for the constructed facility.

3. Provide maps showing the proposed alignment of pipes and the location of the land application facilities. Also provide a site plan of the land application facilities including the storage ponds, treatment systems (if required), pumping facilities and spray fields.

4. Identify any changes to the operation of the RBWWTP or to the physical facilities of the RBWWTP that may be required by the Respondent in order for the Respondent's proposal to be viable and complete. It is understood that the award of any proposal is contingent on approval of the identified modifications by the City and by DNREC (or any other agency with jurisdiction) and that the modifications would be strictly at the City's expense.

6.9 Legal

1. Provide evidence of legal standing regarding ownership or lease of the required land.

2. Provide documentation of the permit status of the proposed site for land application.

3. The site proposed for the land application wastewater treatment facility must be properly zoned to allow this use.

4. Provide statement of willingness to enter into an agreement to provide the required services under the terms and conditions presented in this RFP

6.7 Security

If this project were to proceed to an agreement, the successful Service Provider shall provide a Performance Bond in an amount equal to $3.5 million as security for the faithful performance of the Service Provider's obligations under the proposed agreement. This bond shall remain in effect until one year after the start of service. The Service Provider shall provide a Statement of Surety's Intent (Appendix No. 6) with this bid.

6.8 Environmental Considerations

6.11.1 Land Application Site

The location of the proposed land application site(s) shall not be within the areas designated as "Environmentally Sensitive Developing Areas" in the Sussex County Comprehensive Land Use Plan.

6.11.2 Environmental Impacts

The City of Rehoboth Beach wishes to minimize the potential environmental impacts of the project and therefore will consider the sustainability of each alternative in their evaluation. Therefore, the Respondent shall provide the following information regarding the estimated annual energy usage of their proposed alternative.

Estimated Annual Consumption of:

- Electricity
- Natural Gas
- Fuel Oil
- Gasoline

6.12 Attachments

As a minimum provide:

- Proof of Insurance
- Equal Opportunity Employment Affidavit
- Any additional information which the Respondent deems important in the evaluation of their proposal

7. Acknowledgements

1. The Respondent acknowledges, by offering a proposal, that the Project, if awarded by the City, must be completed and in operation by December 31, 2014.

2. The submission of a Proposal will constitute an incontrovertible representation by Service Provider that Service Provider has complied with every requirement of this RFP, that without exception the Proposal is premised upon performing and furnishing all facilities and services required for the faithful performance of the Service Provider's obligations under the proposed Agreement, that Service Provider has given the City written notice of all conflicts, errors, ambiguities, and discrepancies that Service Provider has discovered in the RFP and the written resolutions thereof by the City are acceptable to Service Provider, and that the

RFP is generally sufficient to indicate and convey understanding of all terms and conditions for entering into a binding Agreement.

3. The respondent is aware that the following agencies (as a minimum) have jurisdiction over the design, construction and operation of any proposed facilities for the Project and that the respondent is responsible for obtaining all permit approvals:

   - Delaware Department of Natural Resources and Environmental Control
   - Delaware Department of Transportation
   - United States Army Corp of Engineers
   - Sussex County

4. The City reserves the right to reject any and all proposals at its sole discretion, and Respondent acknowledges that contracting with a private Service Provider is one of several options the City will be evaluating for the disposal of its wastewater effluent.

8. Schedule

Advertise RFP	August 5, 2008
Mandatory Pre-proposal Meeting	August 19, 2008
Written Requests for Clarifications	September 5, 2008
Receive RFPs	September 24, 2008

9. Compliance with RFP

All proposals submitted shall be in strict compliance with the RFP and failure to comply with all provisions in the RFP may result in disqualification or rejection of the proposal.

10. RFP Revisions due to Ambiguity, Conflict, Discrepancy, Omission or Errors

Any ambiguity, conflict, discrepancy, omission or errors discovered in the RFP must be reported immediately to the Rehoboth City Manager's Office, 229 Rehoboth Avenue, Rehoboth Beach, DE 19971 (302-227-6181) Attn: Greg Ferrese, in writing and a request made for modifications or clarifications. All changes to the RFP will be made in writing by addendum and all parties who have received the RFP will receive the addendum. Each Respondent is responsible for clarifying any ambiguity, conflict, discrepancy, omission or errors in the RFP prior to submission of the proposal or it shall be deemed waived.

11. Implied Requirements

Any product or service that is not specifically addressed in the RFP, but which are necessary to provide functional capabilities proposed by the Respondent, must be included in the proposal.

12. Proposal and Presentation Cost

City of Rehoboth Beach or its agencies are not liable in any way for any costs incurred by the Respondents in the preparation of their proposals in response to the RFP or for the presentation of their proposals and/or participation in any discussions or negotiations.

13. Rejection of Proposals

City of Rehoboth Beach or its agencies reserves the right to accept in part or in whole any or all proposals submitted or to waive any technicality or minor irregularity in a proposal. Additionally, the City shall reject the proposal of any Respondent determined to be non-responsive in accordance with the guidelines and requirements set within this RFP. Unreasonable failure of a Respondent to promptly supply the City with information with respect to responsibility may be grounds for a determination of non-responsibility. All RFP's are contingent upon budgetary constraints and a determination by the City to use a different means to dispose of its wastewater.

14. Exceptions to Format

The RFP describes the requirements and response format in sufficient detail to secure comparable proposals, recognizing that various proponent approaches may vary widely. Any proposal that differs from the described format may be considered non-responsive and rejected.

15. Request for Clarification

Any request for clarification on the RFP must be in writing and accomplished prior to the receipt of the Respondent's proposal.

16. Validity of Proposals

All proposals shall be valid for one hundred eighty (180) days from the date of the RFP opening and become the property of the City. If negotiations result in modifications to the RFP, the one hundred eighty (180) days will commence from the date of the receipt of the final proposal. This period may be extended by mutual written agreement between the Respondent and City of Rehoboth Beach.

17. Evaluation of Proposal and Award

CITY HAS SOLE DISCRETION ON EVALUATION AND AWARD

A. The City reserves the right to reject any and all proposals.

B. The construction and/or services agreement shall be executed or rejected within one hundred eighty (180) days from the date of opening the proposals.

C. If the City elects to contract with a service provider and the Respondent to whom the award is made fails to execute the construction agreement and/or services agreement in the specified time, the award shall be annulled and the contracts awarded to the second qualified Respondent, at the sole discretion of the City. The City may reject the entire proposal as their interests may require.

Procedure to Qualify Proposals

1. Preliminary Review
2. Initial Technical and Financial Evaluation
3. Oral Presentation
4. Secondary Evaluation – Technical and Qualitative Review
5. Referral for Inclusion
6. Final Determination

Preliminary Review

Proposals shall be initially reviewed for general compliance with the submission requirements of the RFP. Failure to comply with any of the submission requirements may result in the proposal being classified as "not reasonably acceptable for review" or "Unqualified". Those proposals that meet all mandatory requirements will be deemed "reasonably acceptable to be selected for review" or "Qualified" for the review process.

Minor irregularities in proposals that are identified by the evaluation committee to be immaterial or inconsequential in nature may be waived whenever it is determined to be in the best interest of the City of Rehoboth Beach. All responsible efforts will be made by the City of Rehoboth Beach to avoid prejudice to any Respondent.

Initial Technical and Financial Evaluation

The Evaluation Committee will review those Qualified proposals for technical and financial features. All Qualified proposals will have the opportunity for an Oral Review, which will involve Respondent presentation before the Evaluation Committee and an opportunity for questions and answers.

The Evaluation Committee shall consist of the following members:

- Mayor
- City Manager
- Director – City Sewer Department
- One (1) member of the Water and Sewer Committee
- City Engineer
- Solicitor – City of Rehoboth
- One (1) City Commissioner
- One (1) representative of Sussex County

The Evaluation Committee will have an oral presentation and discussion with each Respondent whose Qualified proposals have been classified as reasonably acceptable from the preliminary technical and financial review to be selected for review.

Oral Presentation

The purpose of the discussions and oral presentations are as follows:

1. To permit City of Rehoboth Beach to meet the Respondents' key personnel.
2. To permit Respondents to discuss selected aspects of this proposal.
3. To provide an opportunity to clarify the scope of services for the Project.

Within three (3) working days following oral presentations, each Respondent will be required to provide an Executive Summary/Overview of their firm's oral presentation inclusive of highlighting the discussion at the presentation.

Upon completion of the oral presentations, the City of Rehoboth Beach will finalize the evaluation of each proposal. A best and final proposal may be solicited by the City at this time.

Secondary Evaluation – Technical and Qualitative Review

Qualified Proposals will move into the Secondary Evaluation process after the Oral Presentation, Criteria for Secondary Evaluation of Respondents will include the following:

- Understanding of the Project
- Development Team Qualifications
- Excellence of Project Design and Specifications
- Benefits to the City in terms of project scope , schedule, ability to fulfill obligations and contract terms
- Annual Service Fee
  The ASF of the respondent shall be compared on the basis of year 2010 dollars suing an inflation factor of 3% to adjust the ASF to year 2010. A calculation of the total 20 year cost of the ASF including both the Fixed Component and the Variable Component shall be made based on the flow projections provided in the Appendix.

Referral for Inclusion

Based on the Initial, Oral and Secondary Evaluations of the proposals, the Evaluation Committee will make a recommendation on which proposal(s) is most advantageous to the City and should be included for further consideration with the other options available to the City.

Final Determination

The City will, after evaluating all identified options, make a determination of which alternative for wastewater disposal is in the City's best interest. If the decision is made to contract with a service provider, the City will choose one party with which to negotiate a construction and/or

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services agreement based on the proposal that is considered to be the most advantageous to the City, considering technical, financial, scheduling factors as set forth in the RFP.

Method of Award

A. The City reserves the right to reject any and all proposals.

B. The construction and/or services agreement shall be executed or rejected within one hundred eighty (180) days from the date of opening the proposals.

C. If the City elects to contract with a service provider and the Respondent to whom the award is made fails to execute the construction agreement and/or services agreement in the specified time, the award shall be annulled and the contracts awarded to the second selected Respondent. The City may reject the entire proposal as their interest may require.

Discussions

A. Discussions shall be held only to clarify individual RFP submissions. Any questions or clarifications on any proposal must occur with three (3) or more members of the Evaluation Committee. Minutes of such discussion shall be placed in the record. There will be no ex-partie discussions. At no time shall any part of a proposal of one Respondent be discussed or identified in any manner, with any other Respondent. No member of the Evaluation Committee shall have any role in any of the proposals before the committee, nor any pecuniary benefit from any of the Respondents, or any proposals.

B. During discussions a Respondent may modify their proposal to coincide with any clarification of the proposal. At no time will a proposal be allowed to be withdrawn without approval of the proper City authorities.

C. If any part of the RFP document is changed to strengthen the RFP or its process, written documentation of the change shall be made by the City and issued by addenda. Each Respondent shall have the opportunity, within a finite time period, to modify their proposal accordingly.

D. Any questions raised or clarifications requested at either the pre-proposal meeting or the oral presentations will be responded to in writing by the City.

Negotiations

It is the policy to procure from responsible sources at fair prices the goods and services required by the City of Rehoboth Beach. During the RFP process negotiation may be required to resolve uncertainties relating to procurement, including the price for goods and services prior to the execution of the construction and/or services agreement. The objective of negotiation is the complete agreement of the parties on all basic issues of the Proposal.

18. Term of Contract

The term of the construction and/or services agreement shall be from the date of "Notice to Proceed" through the end of the year 2035. It is understood that an alternate term of contract may be selected through final negotiation.

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19. Personal Liability of Public Officials

In carrying out any of the provision of this Contract or in exercising any power of authority granted to him thereby, there shall be no personal liability upon the City or any of its authorized agents, who acts in a responsible manner on these matters as the bonafide representative of the City.

20. Affirmative Action Policy

In accordance with Rehoboth Beach's Affirmative Action policy against discrimination, no person shall, on the grounds of race, color, creed, religion, sex, age, marital status, national origin, handicap or disability, be excluded from full employment rights in, participation in, be denied the benefits of, or be otherwise subjected to discrimination. During the performance of the work and services, hereunder, the Contractor, for themselves, their assignees, and successors in interest agrees to comply with all federal, state and local nondiscrimination regulations.

21. Insurance Requirements:

WORKER'S COMPENSATION AND EMPLOYER'S LIABILITY INSURANCE

a. The Service Provider shall take out and maintain during the life of the Construction and/or Services Agreement the Statutory Worker's Compensation and Employer's Liability Insurance for all of its employees to be engaged in work on the project under the Contract.

b. In case any portion of the project is sublet, the Service Provider shall require all of its subcontractors and team members to take out and maintain during the entire life of the Construction and/or Services Agreement, the Statutory Worker's Compensation and Employer's Liability Insurance for all of their employees to be engaged in work in the project under the contract.

c. The Service Provider and any subcontractor shall not begin work until the Service Provider has first filed with the City, satisfactory evidence that insurance of the above nature is in full force and effect, (receipt of Certificate of Insurance naming the City of Rehoboth Beach as an additional insured).

BODILY INJURY, LIABILITY AND PROPERTY DAMAGE LIABILITY INSURANCE

The Service Provider shall take out and maintain during the life of the Construction and/or the Services Agreement, Bodily Injury Liability and Property Damage Liability Insurance to protect him and any subcontractor performing work covered by the Contract from claims for damages for personal injury, including accidental death, as well as claims for property damage, which may arise from operations under the Contract, whether such operations be by himself for by any subcontractor or by anyone directly or indirectly employed by either of them, and the amount of such insurance shall not be less than amounts shown in the following chart:

General Liability:	$2,000,000 Annual Aggregate $1,000,000 Each Occurrence $1,000,000 Products and Completed Operations $1,000,000 Personal Injury and Advertising
Automobile Liability:	$1,000,000 Combined Single Limit
Worker's Compensation	Statutory
Umbrella Catastrophic Liability	$5,000,000 Each Occurrence

(Upon an award of contract, the Service Provider shall provide a copy of a Certificate of Insurance with the City of Rehoboth Beach named as an Additional Insured to liability coverage on the certificate, for the duration of the contract).

All contractors performing services for the City of Rehoboth Beach are required to provide notification of the Certificate of Insurance cancellation 30 – 60 days prior to the cancellation. The Service Provide shall provide a "Certificate of Insurance" naming the City of Rehoboth Beach as an "Additional Insured" and showing the levels of Worker's Compensation and all Liability Coverage.

With the submission of this proposal, the Respondent thereto certifies that the information supplied is, to the best of your knowledge, accurate and correct.

_____
(Name of Respondent)

By: _____

Title: _____

Respondent Certification

The above statements are certified to be true and accurate and we have the equipment, labor, supervision and financial capacity to perform this Contract.

Dated at _____ this _____ day of _____ 2008.

By: _____

_____
(Title of Person Signing)

_____
(Name of Organization)

State of _____

City of _____, ss.

_____ being duly sworn, states he is _____
(Office)
of _____ and that the answers of the foregoing questions and all statements therein contained are true and correct.

Sworn to before me this _____ day of _____ 2008.

_____
Notary Public

_____
(My Commission Expires:

(NOTARY SEAL)

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Appendices

1. **Current and Future Flows**
2. **Current NPDES Permit**
3. **WWTP Effluent Summary (2007)**
4. **Certificate of Offeror's Qualifications**
5. **Summary of Capital Costs**
6. **Statement of Surety's Intent**

Appendix No. 1
Current and Future Flows

The following information regarding flow is provided:

- Statistical analysis of flows for the year 2007
- Plot of daily average flows for the year 2007
- Plot of projected future flows based on actual flows for the period of 1988 – 2007

Statistical Analysis of Year 2007 Influent Flows

ANNUAL	
Average	1.08
Min	0.04
Max	2.52

SUMMER	
Average	1.649
Min	0.737
Max	2.516

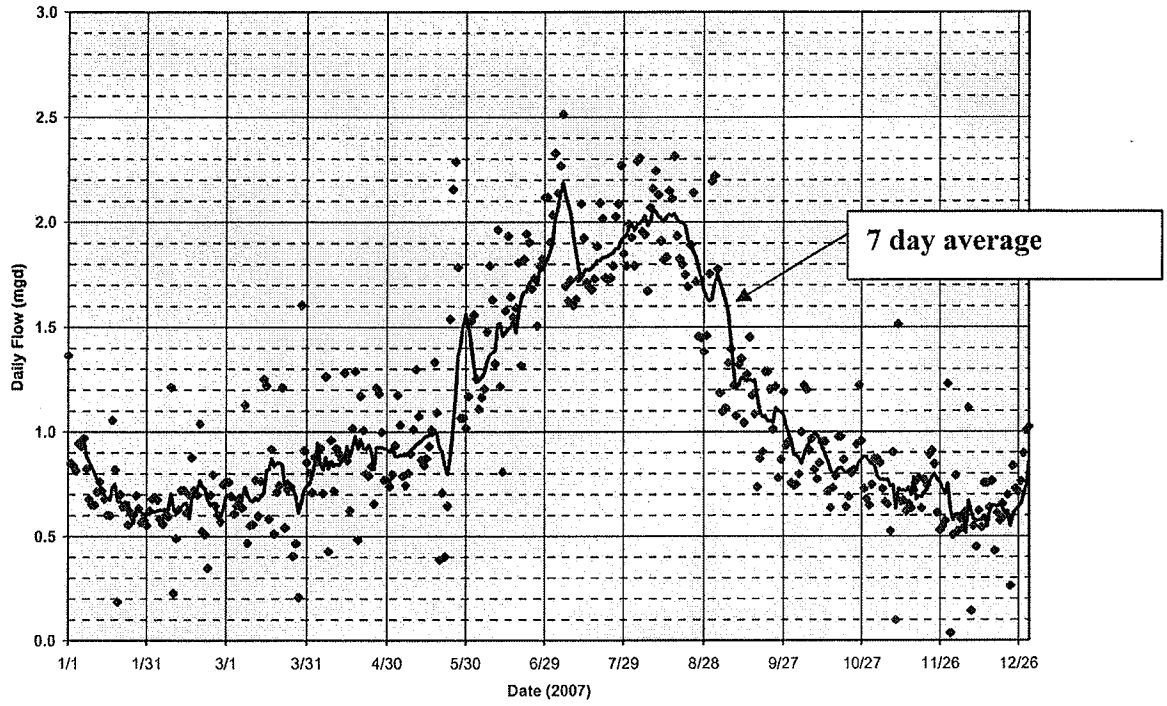
WINTER	
Average	0.786
Min	0.037
Max	2.289

Peaking Factors

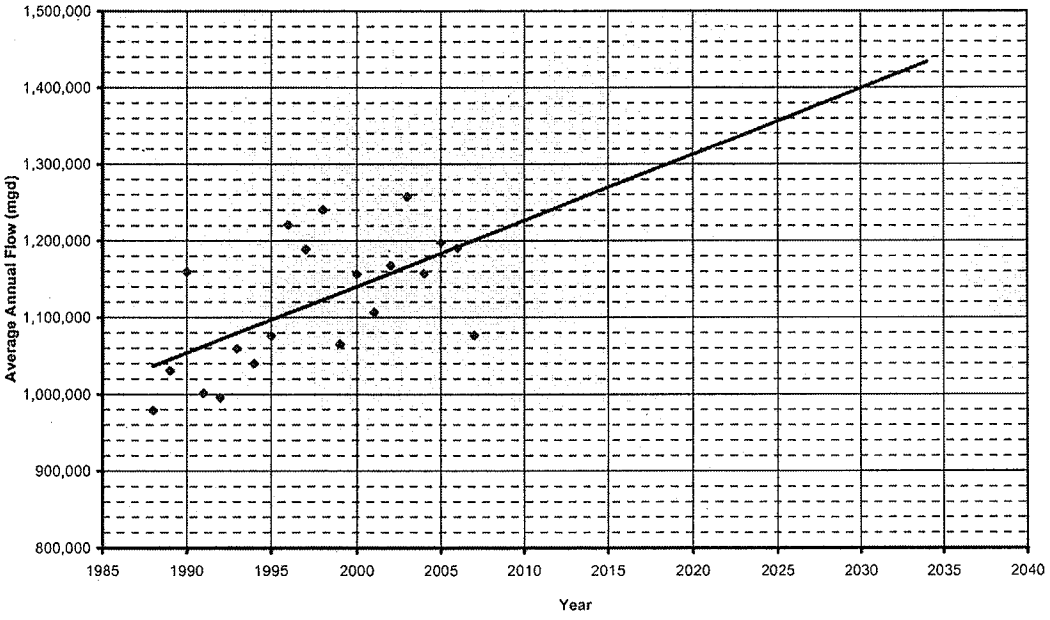
Summer/Winter Average	2.10
Summer/Annual Average	1.53
Winter/Annual Average	0.73

		Influent Flow (mgd)		
		Monthly Ave	**Daily Max**	**Daily Min**
Summer	June	1.566	2.118	0.808
	July	1.909	2.516	1.605
	Aug	1.900	2.316	1.385
	Sep	1.219	2.223	0.737
		1.649	2.516	0.737
Winter	Jan	0.724	1.360	0.187
	Feb	0.655	1.214	0.228
	Mar	0.746	1.607	0.209
	Apr	0.892	1.289	0.427
	May	1.035	2.289	0.388
	Oct	0.856	1.224	0.638
	Nov	0.742	1.515	0.100
	Dec	0.637	1.116	0.037
		0.786	2.289	0.037

Year 2007 Daily Influent Flow (mgd)



Projected Future Annual Average Flows



Appendix No. 2
Current NPDES Permit

STATE OF DELAWARE
DEPARTMENT OF NATURAL RESOURCES &
ENVIRONMENTAL CONTROL
DIVISION OF WATER RESOURCES
89 KINGS HIGHWAY
DOVER, DELAWARE 19901

SURFACE WATER DISCHARGES SECTION

TELEPHONE: (302) 739-9946
FACSIMILE: (302) 739-8369

September 21, 2005

Mr. Gregory Ferrese
City Manager
City of Rehoboth Beach
229 Rehoboth Avenue
P.O. Box C
Rehoboth Beach, DE 19971

RE: Permit Reissuance
NPDES Permit No. DE 0020028
City of Rehoboth Beach STP

Dear Mr. Ferrese:

The referenced NPDES permit has been signed. Copies of the signed permit and Fact Sheet are attached. Copies of the revised Discharge Monitoring Report (DMR) will be forwarded separately. The permit effective date is October 1, 2005, and the expiration date is September 30, 2010.

If you have any questions or comments, please call me at (302)739-9946.

Sincerely,

Anthony E. Hummel, PE, CHMM
Environmental Engineer
Discharges Permits Branch

Enclosures

AUTHORIZATION TO DISCHARGE UNDER THE

NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM

AND THE LAWS OF THE

STATE OF DELAWARE

In compliance with the provisions of the Federal Water Pollution Control Act, as amended by the Clean Water Act of 1977 (33 U.S.C. 1251 et seq.) (hereinafter referred to as "the Act"), and pursuant to the provisions of 7 Del. C., 6003

City of Rehoboth Beach
229 Rehoboth Avenue
P.O. Box C
Rehoboth Beach, Delaware 19971

is authorized to discharge from the facility (Point Source 001) located at

State Road Extended
Sussex County, Delaware

to receiving waters named

Rehoboth segment of the Lewes and Rehoboth Canal

The effluent limitations, monitoring requirements and other permit conditions are set forth in Part I, II and III hereof.

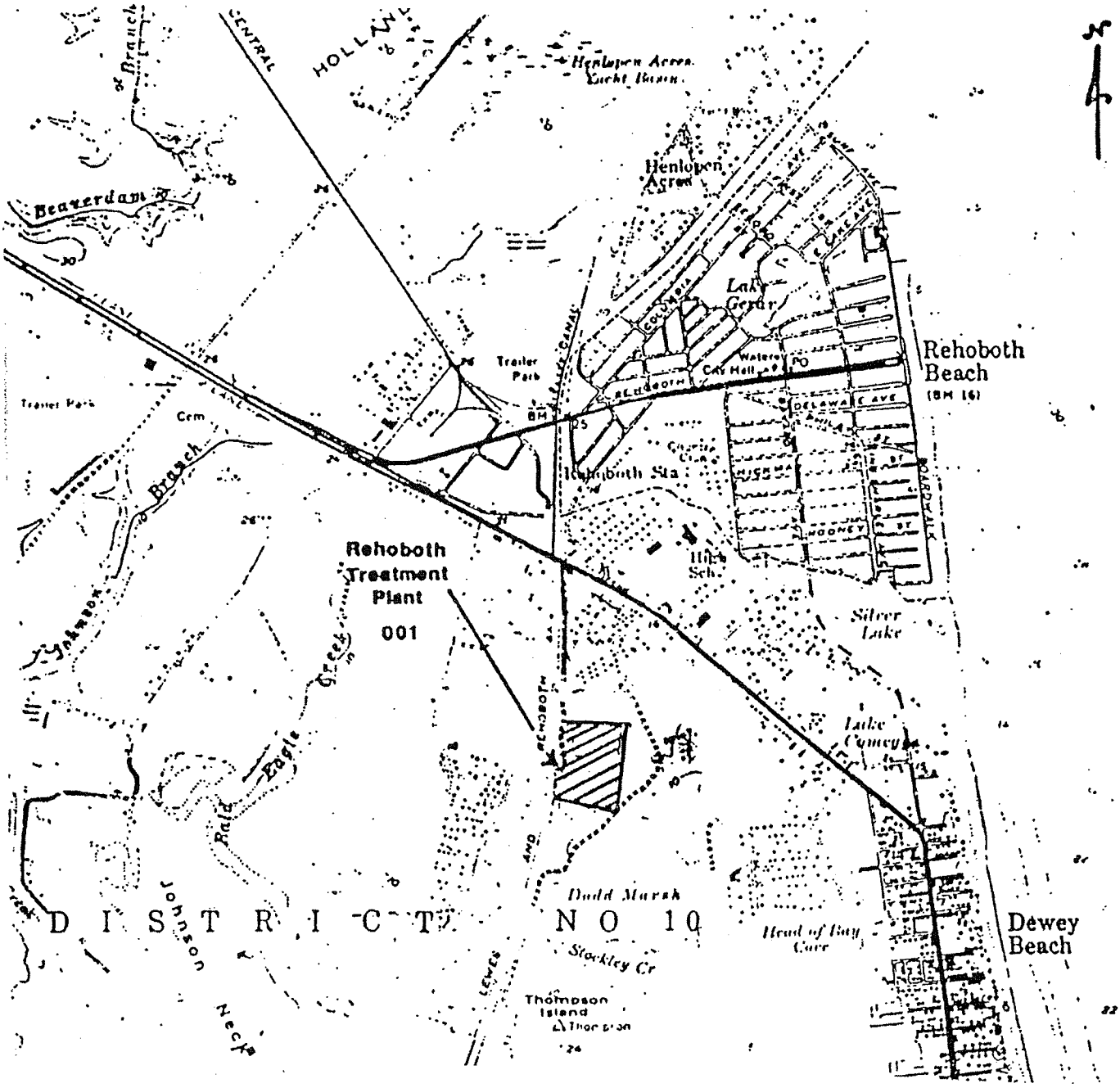
R. Peder Hansen, P.E.
Surface Water Discharges Section
Division of Water Resources
Department of Natural Resources and Environmental Control

September 21, 2005
Date Signed

A. General Description of Discharges and Facilities

1. **Site Location Map**

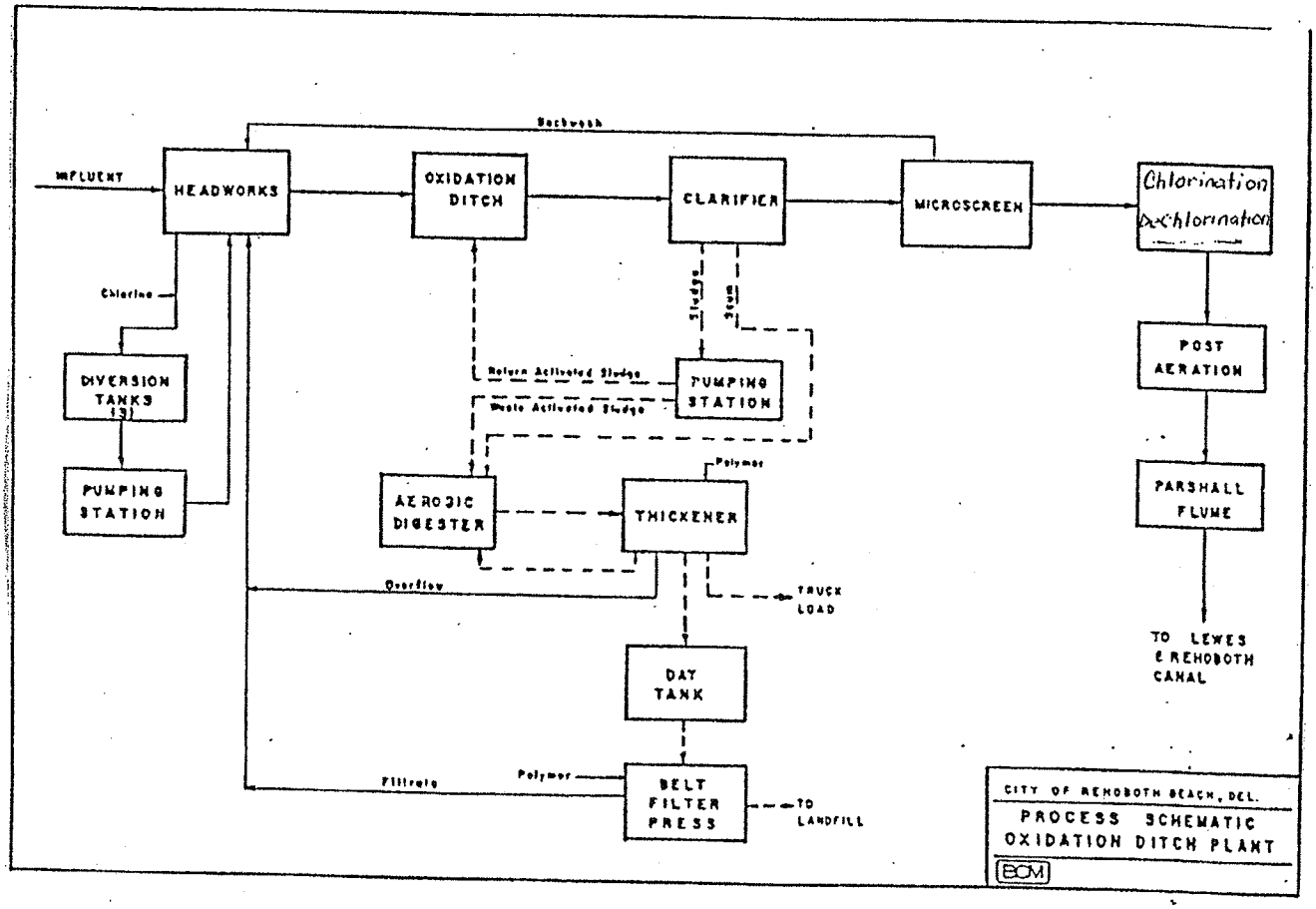
Outfall 001 - Effluent from the wastewater treatment facilities. The discharge is conveyed to the Rehoboth segment of the Lewes-Rehoboth Canal.



A. General Description of Discharges and Facilities (continued)

2. Process Diagram

Wastewater treatment is provided by bar screens, a grit collector, emergency off-line diversion tanks, two total barrier oxidation ditches, chemical addition for phosphorus removal, two secondary clarifiers, two microscreens, chlorination and de-chlorination tanks, and post aeration. Waste sludge is aerobically digested, thickened, and land applied as a liquid or dewatered by a belt press and taken to a sanitary landfill.



B. Effluent Limitations And Monitoring Requirements

1. Outfall 001 -- EFFLUENT LIMITATIONS AND MONITORING REQUIREMENTS

During the period beginning effective date and lasting through expiration date, the permittee is authorized to discharge from point source 001[1] the quantity and quality of effluent specified below:

Parameter	Effluent Limitations						Monitoring Requirements[2]	
	Load			Concentration			Measurement Frequency	Sample Type
	Daily Average	Daily Maximum	Units	Daily Average	Daily Maximum	Units		
Flow[3]	3.4	--	mgd				Continuous	Record/ Totalize
pH	The pH shall be between 6.0 S.U. and 9.0 S.U at all times					S.U.	Daily	Grab
Total Residual Chlorine	None Detectable[4]					mg/L		
Dissolve Oxygen	The dissolved oxygen concentration shall not be less than 5.0 mg/L at any time					mg/L		
Enterococcus				10[5]		Col./ 100mL	Three times per week	Composite
BOD5	539	822	lbs/day	19	29	mg/L		
Total Suspended Solids (TSS)	425	652	lbs/day	15	23	mg/L		
Total Nitrogen	See Part III, A., Special Condition No. 10							
Total Phosphorus								
Biomonitoring	See Part III, A., Special Condition No. 7						Once per year	
The discharge shall be free from floating solids, sludge deposits, debris, oil and scum.								

Samples taken in compliance with the monitoring requirements specified above shall be taken at the following location: From the overflow box of the post aeration chambers.

1 See discharge description on page 2 of 22 of this permit.
2 Report "nondetected" testing results on the discharge monitoring report (DMR) as "<" and the applicable test MDL. For example, if BOD5 is "nondetected" using a test method with an MDL of 2.4 mg/L, report "< 2.4 mg/L" on the DMR.
3 Report both average daily and maximum daily flows on the discharge monitoring report (DMR).
4 See Part III. A., Special Condition No. 11.
5 The average enterococcus limit is based on a geometric mean.

C. SCHEDULE OF COMPLIANCE

1. The permittee shall comply with the requirements herein as soon as possible, but in no event later than the dates set forth in the following schedule:

   See Part III. A., Special Condition No. 10.

2. No later than 14 calendar days following a date identified in the above schedule of compliance, the permittee shall submit either a report of progress or, in the case of specific actions being required by identified dates, a written notice of compliance or noncompliance. In the latter case, the notice shall include the cause of noncompliance, any remedial actions taken, and the probability of meeting the next scheduled requirement.

D. Monitoring and Reporting

1. Representative Sampling

   Samples and measurements taken as required herein shall be representative of the volume and nature of the monitored discharge.

2. Reporting

   Monitoring results obtained during the previous one (1) month shall be summarized for each month and reported on a Discharge Monitoring Report Form ("DMR", EPA Form No. 3320-1), postmarked no later than the 28th day of the month following the completed reporting period. Electronically-generated DMR forms may be used, if approved by the Department in writing. Signed copies of these, and all other reports required herein, shall be submitted to the Department at the following address:

   STATE OF DELAWARE DEPT. OF NATURAL RESOURCES AND ENVIRONMENTAL CONTROL, DIVISION OF WATER RESOURCES, SURFACE WATER DISCHARGES SECTION, R & R BUILDING, 89 KINGS HIGHWAY, DOVER, DELAWARE 19901
   TELEPHONE: (302) 739-5731 FACSIMILE: (302) 739-8369

3. Definitions

   a. "Average daily loading" means the total discharge by weight during a calendar month divided by the number of days in the month that the production or commercial facility was operating. Where less than daily sampling is required, the daily average discharge shall be determined by the summation of all the measured daily discharges by weight divided by the number of days during the calendar month when the measurements were made.

   b. "Average monthly discharge" or "daily average discharge" is the arithmetic mean of all daily discharges during a calendar month, calculated as the sum of all daily discharges sampled and/or measured during the month divided by the number of daily discharges sampled or measured during such month.

   c. "Average monthly effluent limitation" or "daily average effluent limitation" means the highest allowable average of daily discharges over a calendar month.

   d. "Best management practices" or "BMP's" means schedules of activities, prohibitions of practices, maintenance procedures and other management practices or measures to prevent or reduce the discharge of pollutants. BMP's include but are not limited to: structural and nonstructural controls; treatment requirements; operating procedures and practices or leaks,

sludge or waste disposal, or drainage from raw material storage. BMPs can be applied before, during and after pollution generating activities to reduce or eliminate the introduction of pollutants into receiving waters.

e. "Biosolids" refers to the biomass or biological sludge generated or produced by biological wastewater treatment processes.

f. "Bypass" means the intentional diversion of wastes from any portion of a treatment facility.

g. "Composite sample" means a combination of individual samples obtained at specified intervals over a given time period, generally 24 hours.

In collecting a composite sample of a discharge other than a discharge of storm water or storm runoff (a non-storm water discharge), either: a) the volume of each individual sample is proportional to the discharge flow rate or b) the sampling interval is proportional to the discharge flow rate and the volume of each individual sample is constant. For a continuous non-storm water discharge, a minimum of 24 individual grab samples shall be collected and combined to constitute a 24 hour composite sample. For intermittent non-storm water discharges 4 hours or more in duration, the number of individual grab samples collected and combined to constitute a composite sample shall at a minimum be equal to the duration of the discharge in hours but not less than 12. For intermittent non-storm water discharges of less than 4 hours, the minimum number of individual grab samples collected and combined to constitute a composite sample shall be equal to the duration of the discharge in hours times 3 but not less than 3 samples.

h. "Daily discharge" means the total discharge measured during a calendar day or any 24-hour period that reasonably represents the calendar day for sampling purposes. For pollutants with limitations expressed in units of mass, the daily discharge is calculated as the total mass of a pollutant discharged over a calendar day or the equivalent 24-hour period. For pollutants with limitations expressed in other units of measurement, the daily discharge is calculated as the average measurement of the pollutant over a calendar day or the equivalent 24-hour period.

i. "Daily maximum effluent limitation" is the highest total mass of a pollutant allowed to be discharged during a calendar day or, in the case of a pollutant limited in terms other than mass, the highest average concentration or other measurement of the pollutant specified during the calendar day, or any 24-hour period that reasonably represents the calendar day for sampling purposes.

j. "Daily maximum temperature" is the highest arithmetic mean of the temperature observed for any two (2) consecutive hours during a 24-hour day, or during the operating day if flows are of shorter duration.

k. "Direct Responsible Charge" or "DRC" means on-location accountability for, and on-location performance of, active daily operation (including Technical Supervision, Administrative Supervision, or Maintenance Supervision) for a Wastewater Facility, an operating shift of a system or a facility, or a major segment of a system or facility.

l. "Estimate" is that based on a technical evaluation of the sources contributing to the discharge including, but not limited to, pump capabilities, water meters and batch discharge volumes.

m. "Grab sample" is an individual sample collected in less than 15 minutes.

n. "I/S" (immersion stabilization) means the immersion of a calibrated device in the effluent stream until the reading is stabilized.

o. "Maximum instantaneous concentration" or "MIC" is the highest allowable measured concentration of a pollutant, obtained by analyzing a grab sample of the discharge.

p. "Measured flow" is any method of liquid volume measurement the accuracy of which has been previously demonstrated in engineering practice, or for which a relationship to absolute volume has been obtained.

q. "Method Detection Limit" or "MDL" means the lowest concentration of a substance which can be measured with 99 percent confidence that the analyte concentration is greater than zero and is determined from analysis of a sample in a given matrix containing the analyte.

r. "Minimum analytical level" or "MAL" means the lowest concentration of a substance that can be quantified within specified limits of interlaboratory precision and accuracy under routine laboratory operating conditions in the matrix of concern. When there is insufficient interlaboratory study data, the "MAL" may be determined through the use of a multiplier of 5 to 10 times the method detection level or "MDL".

s. "Monthly average temperature" is the arithmetic mean of temperature measurements made on an hourly basis, or the mean value plot of the record of a continuous automated temperature recording instrument, either during a calendar month, or during the operating month if flows are of shorter duration.

t. "Non-contact cooling water" is that which is contained within a leak-free system, i.e. has no contact with any gas, liquid or solid other than the container used for transport.

u. "Nuisance condition" is any condition that, as a result of pollutant addition to a surface water, causes unreasonable interference with the designated uses of the waters or the uses of the adjoining land areas.

v. "Operator" means any person employed or appointed by any owner, and who is designated by such owner to be the person controlling the operations of the treatment works, including direct actions, decisions or evaluations which affect the quality of the discharge, and whose duties include testing or evaluation to control treatment works operations.

w. "Pollution prevention" means any practice which results in a lesser quantity of emissions released or discharged prior to out-of-process recycling, treatment or control, as measured on a per-unit-of-production basis.

x. "Severe property damage" means substantial physical damage to property, damage to the treatment facilities which would cause them to become inoperable, or substantial and permanent loss of natural resources which can reasonably be expected to occur in the absence of a bypass. Severe property damage does not mean economic loss caused by delays in production.

y. "Sewage" means the water carried human or animal wastes from septic tanks, water closets, residences, buildings, industrial establishments or other places together with such groundwater infiltration, subsurface water, storm inflow, admixture of industrial wastes, or other wastes as may be present.

z. "Sewage sludge" means any solid, semi-solid or liquid residue removed during the treatment of municipal wastewater or domestic sewage, including but not limited to, solids removed during primary, secondary or advanced wastewater treatment, scum, septage, portable toilet pumpings and sewage sludge products.

aa. "Sludge" means the accumulated semi-liquid suspension, settled solids, or dried residue of these solids removed by any surface water or groundwater treatment facility or any liquid waste treatment facility or works, whether or not such solids have undergone treatment.

bb. "Upset" means an exceptional incident in which there is unintentional and temporary noncompliance with technology-based permit effluent limitations because of factors beyond the reasonable control of the permittee. The basis for specific effluent limitations can be found in this permit's fact sheet. An upset does not include noncompliance to the extent caused by operational error, improperly designed treatment facilities, inadequate treatment facilities, lack of preventive maintenance, or careless or improper operation.

cc. "Whole effluent toxicity" means the aggregate toxic effect of an effluent or discharge measured directly by a toxicity test.

4. Test Procedures

Test procedures for the analysis of pollutants shall conform to the applicable test procedures identified in 40 C.F.R., Part 136, unless otherwise specified in this permit.

5. Quality Assurance Practices

The permittee is required to show the validity of all data by requiring its laboratory to adhere to the following minimum quality assurance practices:

a. Duplicate[1] and spiked[2] samples must be run for each constituent in the permit on 5% of the samples, or at least on one sample per month, whichever is greater. If the analysis frequency is less than one sample per month, duplicate and/or spiked samples must be run for each analysis.

b. For spiked samples, a known amount of each constituent is to be added to the discharge sample. The amount of constituent added should be approximately the same amount present in the unspiked sample, or must be approximately that stated as maximum or average in the discharge permit.

c. The data obtained in a and b shall be summarized in an annual report in terms of precision, percent recovery, and the number of duplicate and spiked samples run, date and laboratory log number of samples run, and name of analyst. The report shall cover the calendar year, January 1 through December 31, and shall be submitted to the Department, postmarked no later than the February 15 following the fourth quarter of reporting.

d. Precision shall be calculated by the formula, standard deviation $s = (\sum d^2/k)^{1/2}$, where d is the difference between duplicate results, and k is the number of duplicate pairs used in the calculations.

e. Percent recovery shall be reported on the basis of the formula $R = 100\ (F-I)/A$, where F is the analytical result of the spiked sample, I is the result before spiking of the sample, and A is the amount of constituent added to the sample.

f. The percent recovery, R, in e above shall be summarized yearly in terms of mean recovery and standard deviation from the mean. The formula, $s = (\sum(x-\mathbf{x})^2/(n-1))^{1/2}$, where s is the

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[1] Duplicate samples are not required for the following parameters: color, temperature, and turbidity.

[2] Spiked samples are not required for the following parameters: acidity, alkalinity, bacteriological, benzidine, chlorine, color, dissolved oxygen, hardness, pH, oil & grease, radiological, residues, temperature, turbidity, BOD_5, and total suspended solids. Procedures for spiking samples are available through the Regional Quality Assurance Coordinator.

standard deviation around the mean $\underline{x}$, x is an individual recovery value, and n is the number of data points, shall be applied.

g. The permittee or its contract laboratory is required to annually analyze an external quality control reference sample for each pollutant. These are available through the EPA regional quality assurance coordinator, or other EPA-approved supplier. Results shall be included in the Annual Report, required in paragraph c above.

h. The permittee and/or its contract laboratory is required to maintain an up-to-date and continuous record of the method used, of any deviations from the method or options employed in the reference method, of reagent standardization, of equipment calibration and of the data obtained in a, b and f above.

i. If a contract laboratory is utilized, the permittee shall report the name and address of the laboratory and the parameters analyzed together with the monitoring data required.

6. Records

a. For each measurement or sample taken pursuant to the requirements of this permit, the permittee shall record the following information:

(1) The date, exact place and time of sampling or measurements;

(2) The person(s) who performed the sampling or measurements;

(3) The date(s) analyses were performed;

(4) The individual(s) who performed each analysis;

(5) The analytical techniques or methods used;

(6) The results of each analysis; and

(7) The quality assurance information as stated above.

b. An operator log must be kept on site at all times. This log should include time spent at the treatment facility on any date, and the nature of operation and maintenance performed.

7. Additional Monitoring by Permittee

If the permittee monitors any pollutant at the location(s) designated herein more frequently than required by this permit, using approved analytical methods as specified above, the results of such monitoring shall be included in the calculation and reporting of the values required in the Discharge Monitoring Report Form (EPA No. 3320-1). Such increased frequency shall also be indicated.

8. Records Retention

All records and information resulting from the monitoring activities required by this permit including hard copies of any electronically generated Discharge Monitoring Reports, all records of analyses performed, records of calibration and maintenance of instrumentation, and recording from continuous monitoring instrumentation shall be retained for three (3) years. This period of retention shall be extended automatically during the course of any unresolved litigation regarding the regulated activity or regarding control standards applicable to the permittee, or as requested by the Department

A. MANAGEMENT REQUIREMENTS

1. Duty to Comply

   a. The permittee must comply with all the conditions of this permit. All discharges authorized herein shall be consistent with the terms and conditions of this permit.

   b. The discharge of any pollutant more frequently than, or at a level in excess of that identified and authorized herein shall constitute a violation of the terms and conditions of this permit. The violation of any effluent limitation or of any other condition specified in this permit is a violation of 7 Del. C., Chapter 60, and the Act and is grounds for enforcement as provided in 7 Del. C. §§6005, 6013, and 6018, for permit termination or loss of authorization to discharge pursuant to this permit, for permit revocation and reissuance, or permit modification, or denial of a permit renewal application. The Department may seek voluntary compliance by way of warning, notice or other educational means, pursuant to 7 Del. C. §6019, or any other means authorized by law. However, the Law does not require that such voluntary means be used before proceeding by way of compulsory enforcement.

   c. Any person violating Sections 301,302, 306, 307, 318, or 405 of the Clean Water Act or any permit condition or limitation implementing such sections in a permit issued under Section 402 of the Act is subject to civil, administrative, and/or criminal penalties as set forth in 40 CFR 122.41(a)(2).

2. Notification

   a. Notification of Planned Changes

      The permittee shall notify the Department in writing of any anticipated expansion or alteration of this permitted facility, any production increases, process modifications, or other changes which could result in new, different or increased discharges of pollutants. Notice is required only when such alteration, addition or change:

      (1) may justify the application of permit conditions that are different from those specified in this permit, or

      (2) may justify the application of permit conditions that are absent from this permit, or

      (3) meets any one of the following criteria:

         (a) The alteration or addition to this permitted facility may meet one of the criteria for determining whether a facility is a new source, as defined in Section 2 of the Department's Regulations Governing the Control of Water Pollution, as amended June 11, 2002; or

         (b) As a result of the alteration or addition, the nature of the discharge is or could be substantially different from that represented in the application originally submitted for the discharge(s) authorized herein, upon which this permit is based; or

         (c) The alteration or addition results in a significant change in the permittee's sludge use or disposal practices, including any uses or disposal sites not identified in application for this permit or during this permit's issuance process; or

         (d) The planned change in permitted facility or activity may result in noncompliance with the requirements of this permit.

Upon notification of a planned change, the Department may require the submission of a new application. The permittee is encouraged to notify the Department and submit any application well in advance of the scheduled date for the anticipated alteration or addition to allow sufficient time to process any modifications of this permit necessitated by the change and to avoid any resultant project delays.

b. Notification of Noncompliance

The permittee shall report all instances of noncompliance with this permit to the Department as outlined herein:

(1) If, for any reason, the permittee does not comply with or will be unable to comply with any daily maximum effluent limitation or maximum instantaneous concentration specified in this permit, the permittee shall report such incident within 24 hours and provide the Department with the following information, in writing, within five (5) days of becoming aware of such conditions:

(a) A description of the discharge and cause of noncompliance;

(b) The period of noncompliance, including exact dates and times and if the noncompliance has not been corrected, the anticipated time when the discharge will return to compliance; and

(c) Actions taken or to be taken to reduce, eliminate, and prevent recurrence of the noncomplying discharge.

(2) If, for any reason, the permittee does not comply with any daily average or average monthly effluent limitation or standard specified in this permit, the permittee shall provide the information outlined above in paragraphs b.(1)(a) through b.(1)(c) with the discharge monitoring report (DMR) submitted in accordance with Part I.D.2. of this permit.

(3) In the case of any upset or unanticipated bypass that exceeds any permitted effluent or discharge limitation, the permittee shall notify the Department within 24 hours. If this notification is provided orally, a written report shall be submitted within 5 days.

(4) In the case of any discharge subject to any toxic pollutant effluent standard under Section 307(a) of the Act, the permittee shall notify the Department within 24 hours from the time the permittee becomes aware of a noncomplying discharge. Notification shall include the information outlined above in paragraphs b.(1)(a) through b.(1)(c). If this information is provided orally, a written submission covering these points shall be provided within five days of the time the permittee becomes aware of the circumstances covered by this paragraph.

(5) In the case of any other discharges which could constitute a threat to human health, welfare, or the environment, the information required above in paragraphs b.(1)(a) through b.(1)(c) shall be provided as quickly as possible upon discovery and after activating the appropriate emergency site plan, unless circumstances exist which make such a notification impossible. A delay in notification shall not be considered a violation of this permit when the act of reporting may delay the mitigation of the discharge and/or the protection of public health and the environment. A written submission covering these points must be provided within five days of the time the permittee becomes aware of the circumstances covered by this paragraph.

(6) The permittee shall report all instances of noncompliance not otherwise reported under the preceding paragraphs at the time the discharge monitoring report (DMR) is submitted. The report shall contain the information outlined above in paragraphs b.(1)(a) through b.(1)(c).

(7) The Department may waive the written report as required herein on a case-by-case basis, if an oral report was provided within 24 hours.

d. Reporting Discharge(s) of Pollutants Pursuant to 7 Del. C. §6028

Any person who causes or contributes to the discharge of a pollutant into waters of the State or the United States either in excess of any conditions specified in this permit or in absence of a specific permit condition shall report such an incident to the Department as required under 7 Del. C. §6028.

3. Facilities Operation

The permittee shall at all times maintain in good working order and operate as efficiently as possible all collection and treatment facilities and systems (and related appurtenances) installed or used by the permittee for water pollution control and abatement to achieve compliance with the terms and conditions of this permit. Proper operation and maintenance includes but is not limited to, effective performance (based upon the facilities' design), adequate funding, effective management, adequate operator staffing and training, and adequate laboratory and process controls including appropriate quality assurance procedures. This provision requires the operation of back-up or auxiliary facilities or similar systems, when necessary, to achieve compliance with the terms and conditions of this permit.

4. Adverse Impact

The permittee shall take all reasonable steps to minimize any adverse impact to State waters resulting from noncompliance with this permit, including such accelerated or additional monitoring as necessary to determine the nature and extent of the noncomplying discharge.

5. Failure

The permittee, in order to maintain compliance with this permit, shall control production and all discharges as necessary upon reduction, loss, or failure of the treatment facility until the treatment facility is restored or an alternative method of treatment is provided. The need to halt or reduce the permitted activity in order to maintain compliance with this permit shall not be a defense for a permittee in any enforcement action.

6. Alternative Power Source

In order to ensure compliance with the terms and conditions of this permit, the Department may require that the permittee provide an alternative power supply which is sufficient to operate the permittee's wastewater collection, conveyance and treatment facilities.

7. Removed Substances

Any solids, sludges, filter backwash, or other pollutants removed in the collection, conveyance or treatment of wastewater shall be disposed of in such manner as to prevent any pollutant from such materials from entering surface waters or groundwaters.

8. Bypass

a. The Secretary may prohibit the intentional diversion or bypass of waste streams from any portion of the facility regulated herein in consideration of the adverse effect of the proposed bypass or where the proposed bypass does not meet the conditions set forth below in Part II.A.8.b.

b. The intentional diversion or bypass of waste streams from any portion of the facility regulated herein is prohibited unless:

(1) The bypass is necessary to perform essential maintenance and auxiliary equipment, a redundant or back-up system or an alternate mode of operation is utilized to maintain treatment performance; or

(2) The following four conditions are met:

(a) Bypass is unavoidable to prevent loss of human life, personal injury or severe property damage;

(b) There are no feasible alternatives to bypass, such as the use of auxiliary treatment facilities, retention of untreated wastes, plant shutdown or maintenance during normal periods of equipment down-time. This condition is not satisfied if adequate back-up equipment should have been installed in the exercise of reasonable engineering judgment to prevent the bypass;

(c) The permittee notifies the Department of the bypass or of the need to bypass as outlined below in paragraph 8.c below; and

(d) The permittee is utilizing or will utilize all available alternative operating procedures or interim control measures to reduce the impact of the bypass on State waters.

c. Notice

(1) If the permittee knows in advance of the need for a bypass, the permittee shall notify the Secretary, in writing, at least ten days before the date of the bypass, if possible.

(2) In the event of an unanticipated or unintentional bypass, the permittee shall notify the Department within twenty-four hours of discovery. Notice may be provided orally, but shall be followed up with submission of a written report that provides the information outlined in paragraphs (1)(a) through (1)(c) of Part II.A.2.b. within five (5) days.

(3) The public shall be notified and given an opportunity to comment on bypass incidents of significant duration, to the extent feasible.

9. Upset

a. An upset shall constitute an affirmative defense to an action brought for noncompliance with any technology-based permit effluent limitations established herein, if the requirements of Part II.A.9.b. (below) are met.

b. To establish an affirmative defense for an upset, the permittee shall demonstrate, through properly signed and authenticated, contemporaneous operating logs, or by other relevant evidence that:

(1) An upset occurred and that the permittee can identify the specific cause(s) of the upset;

(2) The permitted facility was at the time being operated in a prudent and workman-like manner and in compliance with proper operation and maintenance procedures;

(3) The permittee submitted notice of the upset as required in Part II.A.2.(b)(3) (within 24 hours of becoming aware of the upset); and

(4) The permittee took all reasonable measures necessary to minimize any adverse impact to State waters.

c. Burden of proof. The permittee shall have the burden of proving an upset in any case where an upset is claimed as a defense.

B. RESPONSIBILITY

1. Right of Entry

The permittee shall allow the Secretary of the Department, the EPA Regional Administrator, or their authorized representatives, jointly and severally, upon the presentation of his or her credentials:

a. To enter upon the permittee's premises where the regulated facility, treatment works, or discharge(s) is located or the regulated activity is conducted or where any records required to be kept under the terms and conditions of this permit are located;

b. To have access to and copy, at reasonable times, any records required to be kept under the terms and conditions of this permit;

c. To inspect at reasonable times any monitoring equipment or monitoring method required in this permit;

d. To inspect at reasonable times any facilities, equipment, management or control practices, or operations regulated or required under this permit; and

e. To sample at reasonable times any discharge or substance at any location for the purpose of assuring compliance with this permit or otherwise determine whether a violation of the Law or these regulations exists, as provided in 7 Del. C. §6024;

2. Duty to Provide Information Requested by the Department

The permittee shall furnish to the Department, within a reasonable time, any information which the Department may request to determine compliance with this permit or to determine whether cause exists for modifying, revoking and reissuing, or terminating this permit. The permittee shall also furnish, upon request, copies of records required to be kept by this permit.

3. Duty to Provide Information Found to be Missing or Inaccurate

When the permittee discovers that it failed to submit any relevant facts in a permit application or that it submitted any incorrect information in any permit application or in any report to the Department, it shall promptly submit such facts or information.

4. Availability of Reports

Except for any data and information that is deemed to be confidential and claimed as such when submitted, and that is entitled to protection as trade secrets under State law, all reports prepared in accordance with the terms and conditions of this permit shall be available for public inspection at the Department's offices. This permit, the permit application and any information submitted to support the application (other than information entitled to protection as trade secrets pursuant to State law) and any effluent or discharge monitoring data shall not be deemed confidential and any claims of confidentiality will be denied. Knowingly making any false statement in any such report may result in the imposition of criminal penalties as provided under 7. Del.C., §6013.

5. Signatory Requirements

   All applications, reports, or information submitted to the Department shall be signed and certified as outlined in Section 6.11 of the Department's Regulations Governing the Control of Water Pollution, as amended May 14, 2003.

6. Permit Transfer

   a. This permit is not transferable to any person, except after notice to and with the concurrence of the Secretary.

   b. In the event of a change in ownership or control of the facilities from which the authorized discharge(s) emanate(s), this permit may be transferred if the permittee:

      (1) Notifies the Department, in writing, of the proposed transfer, in advance; and

      (2) Submits to the Department a written agreement signed by all parties to the transfer, containing a specific date for transfer of permit responsibility, coverage and liability to the new permittee. The written agreement shall expressly acknowledge the current permittee is responsible and liable for compliance with the terms and conditions of this permit up to the date of transfer and the new permittee is responsible and liable for compliance from that date on; and

      (3) The Department within thirty (30) days of receipt of the notification of the proposed transfer does not notify the current permittee and the new permittee of its intent to modify, to revoke and reissue or to terminate this permit and require that a new application be submitted.

   c. The permittee is encouraged to provide as much advance notice as possible of any proposed transfer, to allow sufficient time for the Department to modify this permit to identify the new permittee and to incorporate such other requirements as may be necessary under the Law or the Act.

7. Modification, Termination, or Revocation and Reissuance

   This permit may be modified, terminated or revoked and reissued in whole or in part, during its term, for cause as provided in Section 6, Part V of the Department's Regulations Governing the Control of Water Pollution, as amended June 11, 2002. The filing of a request for permit modification, or revocation and reissuance, or termination, or a notification of any planned changes or anticipated noncompliance does not stay any permit condition.

8. Reapplication for a Permit

   a. The permittee must apply for and obtain a new permit if the permittee wishes to continue the activity regulated by this permit beyond its expiration date;

   b. At least 180 days before the expiration date of this permit, the permittee shall submit a new application or notify the Department of the permittee's intent to cease discharging by the expiration date;

   c. In the event that a timely and sufficient reapplication has been submitted and the Department is unable, through no fault of the permittee, to issue a new permit before the expiration date of this permit, the terms and conditions of this permit are continued and remain fully effective and enforceable;

9. Compliance With Effluent Standards for Toxic Pollutants

   The permittee shall comply with effluent standards or prohibitions established under section 307(a) of the Act for toxic pollutants within the time provided in the regulations that establish such standards or prohibitions, even if this permit has not yet been modified to incorporate the requirement.

10. Construction Authorization

    This permit does not approve or authorize the construction, installation or modification of any wastewater/liquid waste collection, transmission or treatment facilities, system, or any other pollution control equipment or device necessary to achieve or to maintain compliance with the terms and conditions of this permit. Separate authorization for the construction, installation or modification of such pollution control facilities must be obtained from the Secretary.

    This permit does not authorize or approve the construction of any onshore or offshore physical structures or facilities or the undertaking of any work in navigable waters.

11. Property Rights

    This permit does not convey any property rights of any sort, or any exclusive privileges.

12. State Laws

    Nothing in this permit shall be construed to preclude the institution of any legal action or relieve the permittee from any responsibilities, liabilities, or penalties to which the permittee is or may be subject under 7 Del. C., Chapter 60, or any other State law or regulation.

13. Severability

    The provisions of this permit are severable. If any provision of this permit is held invalid, the remainder of this permit shall not be affected. If the application of any provision of this permit to any circumstance is held invalid, its application to other circumstances shall not be affected.

A. Special Conditions

1. This permit supersedes the State Permit No. WPCC 3084C/74 and NPDES Permit No. DE 0020028, issued on August 16, 1994, effective date September 1, 1994.

2. The permittee, a publicly owned treatment works (hereinafter referred to as POTW), shall:

   a. Provide adequate notice to the Department and the EPA of the following:

      i. Any new discharge of pollutants to the POTW from any source which would be subject to sections 301 (requires effluent limitations for point sources) and 306 (designation of the primary industrial categories) of the Act if the source is directly discharged to waters of the United States; and

      ii. Any substantial change in the volume or character of pollutants being introduced into the POTW at the time of issuance of the permit.

   b. Identify, in terms of character and volume of pollutants, any significant indirect dischargers into the POTW subject to pretreatment standards under section 307 (b) of the ACT and 40 CFR, Part 403.

   c. Establish a local pretreatment program, when required by the Department or EPA. The Department or EPA will require program development in accordance with 40 CFR, Part 403 and applicable State laws and regulations when the permittee receives non-domestic waste which may interfere with, pass through, or otherwise be incompatible with the operation of the treatment works, including sludge use or disposal; or to assure compliance with pretreatment standards to the extent practicable under section 307 (b) of the Clean Water Act. The local program shall be incorporated into the permit as described in 40 CFR, Part 403.

   d. Require any indirect discharger to such POTW to comply with the reporting requirements of section 204(b), 307, and 308 of the Act, including any requirements established under 40 CFR, Part 403.

3. The Department or agencies under its supervision may perform or direct the performance of analyses or biosurveys on the receiving waters in the immediate vicinity of the permittee's discharge or further downstream, after the issuance of this permit. Such analyses or biosurveys may include evaluating impingement, entrainment, and thermal impacts the permittee's facility poses on its intake and receiving waters. If the results of these analyses or biosurveys suggest that the permittee's discharge is causing, or has the potential to cause, diminished attainment of designated protected uses (as defined by the State of Delaware's "Water Quality Standards for Streams") then this permit may be reopened and modified after notice and opportunity for a public hearing. At that time, additional effluent limitations, monitoring requirements and/or special conditions may be included in the permit. If it is determined that additional equipment is needed to meet the revised permit conditions, the permittee shall install the necessary equipment.

4. The permittee shall comply with all existing Federal and State laws and regulations that apply to its sludge use or disposal practice(s) including, but not limited to, Federal Regulations 40 CFR Part 258, Section 28 "Liquids Restrictions" and the Department's Guidance and Regulations Governing the Land Treatment of Wastes, August 1988. If the Department determines that additional requirements or permit conditions are needed to insure compliance with the referenced regulations, or if the Federal Government promulgates new regulations under Section 405(d) of the Act governing, (a) the treatment or disposal of sewage sludge, (b) sewage sludge

management practices, or (c) concentrations of pollutants in sewage sludge, this permit may be reopened, and after notice and opportunity for public hearing, modified accordingly during its term.

5. Prior to any planned change in the permittee's sludge use or disposal practice(s), the permittee shall notify the Department in accordance with the requirements of Part II.A.2.a. (Notification of Planned Changes) of this permit. A change in the permittee's sludge use or disposal practice(s) shall be considered cause for this permit to be modified, or revoked and reissued, under Part II.B.7. (Modification, Termination, or Revocation and Reissuance) of this permit.

6. The permittee shall maintain monthly sludge inventory data. This data shall include at a minimum (a) quantity of sludge generated, (b) quantity of sludge stored on site, and (c) quantity of sludge transported off site. Transportation records shall include the date, quantity, carrier used, and the final destination for each shipment. The inventory data shall be maintained at the facility and be made available to the Department in accordance with Part I.D.8 (Records Retention) of this permit, excepting that records shall be retained for five (5) years.

7. The permittee shall conduct chronic biomonitoring tests once per **year** on effluent in accordance with the following requirements. Dependent on the results of the initial tests, outlined in 7.a., the permittee may be required to perform additional testing as outlined in 7.b. below. Dependent on the results of the additional testing, the permittee may be required to perform a Toxicity Reduction Evaluation as outlined in 7.c. below.

   These tests shall be performed using a 100% representative composite effluent sample collected prior to chlorination. All testing shall be performed in accordance with the procedures outlined in "Short-term Methods for Estimating the Chronic Toxicity of Effluents and Receiving Waters to Marine and Estuarine Organisms", Third Edition, October 2002, U.S. E.P.A, Office of Water (4303T), EPA-821-R-02-014. At a minimum these tests shall include the following:

   a. The permittee shall conduct EPA test methods 1004.0 Cyprinodon variegatus Larval Survival and Growth Test, and 1007.0 Mysidopsis bahi Survival, Growth and Fecundity Test. Alternative EPA test method approved species may be used, if approved by the Department in writing. Each test shall be initiated no later than 36 hours after the collection of the representative composite effluent sample.

      Within 30 days of the completion of these tests, the results shall be reported to the Department. This report shall follow the general format and include the information listed in Section 10, pages 40 – 51, of EPA-821-R-02-014.

   b. If the NOEC (No Observable Effect Concentration) is less than 100% effluent, the permittee shall perform two (2) confirmation tests on the more sensitive species in 7.a. Both confirmation tests shall be completed within 60 days of the completion date of the testing described in 7.a.

      Within 30 days of the completion of each test, the results shall be reported to the Department in accordance with the general format and information requirements referenced in 7.a.

   c. If either of the additional tests result in a NOEC less than 100% effluent, the permittee shall submit a plan for reducing the effluent toxicity to the Department. This plan shall be submitted within 60 days of the completion date of the testing described in 7.b. This plan shall outline a schedule, as well as identify the test methods to be used for performing a Toxicity Reduction Evaluation.

   For a purpose of these tests, a representative composite sample is a 24-hour composite sample

as defined in Part I.D.3.g. If the instantaneous flow rate does not vary by more than +/- 15 percent of the average flow rate, a time-interval composite will be an acceptable representative sample. Otherwise, a flow-weighted composite sample must be used. All composite samples shall be representative of 24 hours of typical operations.

The Department shall be notified in writing at least thirty (30) days in advance of the day when a bioassay test is planned to commence. The permittee shall split the composite samples used to perform a bioassay test with the Department upon request. All documentation pertaining to these tests shall be maintained at the facility as required in Part I.D. (Monitoring and Reporting) of this permit and shall be made available for inspection, upon request.

8. If annual biomonitoring results indicate a NOEC < 100% effluent, and one or both of the confirmation tests described in Special Condition No. 7.b. indicate a NOEC < 100%, the permittee shall notify the Department and initiate quarterly biomonitoring frequency. The permittee may resume annual biomonitoring after successfully completing four (4) consecutive quarters of valid biomonitoring with written approval from the Department.

9. The wastewater treatment facility constructed in accordance with State Permit WPCC 3210/84, for which the final effluent limits for Outfall 001 contained herein are issued, is a Class IV facility. The permittee shall retain the services of a Delaware certified wastewater treatment plant operator for the operation and maintenance of the facility. The operator shall, at a minimum, be licensed at the level necessary to comply with the "State of Delaware Regulations for Licensing Operators of Wastewater Facilities, as revised."

10. For the first 24 months following the permit effective date, the permittee shall continue to meet the previous annual effluent limits for nutrients at Outfall 001. Specifically, the twelve-month moving cumulative discharge load for total nitrogen shall not exceed 32,427 lb, and the twelve-month moving cumulative discharge load for total phosphorus shall not exceed 7,077 lb. The twelve-month cumulative discharge load for each constituent shall be computed by adding monthly discharge loads for the most current twelve months of operation.

    No later than 25 months following the permit effective date, the permittee agrees to meet interim nutrient permit levels, which are a 25% reduction from the above levels by trading and/or technical refinements at the Rehoboth WWTP. Specifically, the twelve-month moving cumulative discharge load for total nitrogen shall be reduced to a level not to exceed 24,300 lb, and the twelve-month moving cumulative discharge load for total phosphorus shall be reduced to a level not to exceed 5,308 lb.

    This permit provides for a systematic reduction of Nitrogen and Phosphorus discharges to the Inland Bays. Since it is unlikely that the permittee will be able to eliminate the nutrient discharge as required by the Inland Bays TMDL during the term of this permit, the permittee has entered into a Consent Order (No. 98C-12-023-THG) with the Department to allow for a schedule to meet the TMDL requirements past the term of this permit.

11. The permittee shall demonstrate compliance with the "none detectable" total residual chlorine limit using the following 40 CFR 136.3 approved inorganic test procedures: Iodometric Method I; DPD Ferrous Titrimetric Method; DPD Colorimetric Method; or an equivalent method currently approved in 40 CFR 136. These methods also correspond to Standard Methods (18th Edition) test procedures 4500-Cl B, 4500-Cl F, and 4500-Cl G, respectively.

    Unless otherwise notified in writing by the Department, the permittee shall use the most sensitive method of these test procedures appropriate for the sample matrix. Residual chlorine concentrations less than or equal to the minimum detection level for the selected test procedure shall be considered in compliance with the "none detectable" residual chlorine limit.

12. The TMDL for the Inland Bays requires the systematic elimination of point source nutrient discharges. The Department interprets systematic elimination to require "the elimination of waste loading into the affected water body by point sources on a firm, fixed schedule as approved by the Department. This elimination must occur within five years of the expiration of the facilities current NPDES permit unless a longer period of time is provided for in a State or Federally enforceable Consent Order, Decree, or Administrative Order."

13. The permittee shall develop, implement, and maintain a Storm Water Plan (SWP) to minimize the discharge of contaminated storm water from its facility. The SWP shall be implemented and maintained to be in accordance with the requirements of the Delaware Regulations Governing the Control of Water Pollution(RGCWP), Section 9, "The General Permit Program", Subsection 1, "Regulations Governing Storm Water Discharges Associated with Industrial Activity:, Part 1, "Provisions Governing All Storm Water Discharges". In particular, the SWP shall address practices including good housekeeping, inspections under wet and dry weather, sediment and erosion control, facility security, and managing runoff.

STATE OF DELAWARE
DEPARTMENT OF NATURAL RESOURCES &
ENVIRONMENTAL CONTROL
DIVISION OF WATER RESOURCES
89 KINGS HIGHWAY
DOVER, DELAWARE 19901

Surface Water Discharges Section

Telephone: (302) 739-9946
Fax: (302) 739-8369

FACT SHEET - October 1, 2005

City of Rehoboth Beach
229 Rehoboth Avenue
P.O. Box C
Rehoboth Beach, Delaware 19971

NPDES Permit No. DE 0020028
State Permit No. WPCC 3084D/74

The City of Rehoboth Beach has applied for reissuance of their National Pollutant Discharge Elimination System (NPDES) permit to discharge treated wastewater to the Rehoboth segment of the Lewes-Rehoboth Canal.

Facility Location

This facility is located on State Road Extended, Sussex County, Delaware as shown in the attached permit.

Activity Description

The facility is a municipal wastewater treatment facility that receives wastewater from Rehoboth Beach and neighboring areas including North Shores, Henlopen Acres, and the Dewey Beach Sanitary District. No significant industrial wastes are discharged to this facility.

Statutory and Regulatory Basis

The Delaware Department of Natural Resources and Environmental Control (DNREC) proposes to reissue the City an NPDES permit to discharge wastewater subject to certain effluent limitations identified in the attached permit. Section 402 of the Federal Clean Water Act of 1977, as amended and 7 Del. C., Chapter 60 provide the authority for NPDES permit issuance. Regulations promulgated pursuant to these statutes are the regulatory basis for permit issuance.

Chronic biomonitoring will be required on an annual basis. Biomonitoring frequency will revert to quarterly if the facility fails an annual test.

The permittee shall continue to meet the existing annual effluent limits for nutrients at Outfall 001 for the first 24 months of the permit term. Specifically, the twelve-month moving cumulative discharge load for total nitrogen shall not exceed 32,427 lb, and the twelve-month moving cumulative discharge load for total phosphorus shall not exceed 7,077 lb. The twelve-month cumulative discharge load for each constituent shall be computed by adding monthly discharge loads for the most current twelve months of operation.

The permittee will take any and all necessary steps within its power to achieve compliance with the numeric discharge limits set forth in the NPDES permit, discharge zero pounds of nitrogen and phosphorus, as soon as practicable, consistent with the permittee's obligations pursuant to the Total Maximum Daily Load (TMDL) Program and in particular the TMDL for the Inland Bays. The TMDL for the Inland Bays requires systematic elimination of point source nutrient discharges.

Compliance Order

To ensure the City of Rehoboth Beach meets its obligations under their NPDES Permit regarding effluent limits and special conditions for nutrient pollutants to be consistent with the TMDL WLA's for nitrogen and phosphorus as required under 40 CFR § 122.44(d)(1)(vii)(B), DNREC has entered into a Consent Order (No. 98C-12-023-THG) with the City of Rehoboth Beach. The Consent Order requires the following:

1. Within two years of the issuance date of the NPDES permit, the City must meet interim permit limits which represent a 25% reduction from current permitted levels. These reductions can be attained by trading and/or technical refinements at the WWTP. Specifically, there will be a reduction to a maximum level of 24,300 lbs./yr. of nitrogen and 5,308 lbs./yr. of phosphorus.

2. The City will consider the feasibility of two different options for eliminating the remaining nitrogen and phosphorus discharges. These two options are elimination in fact and effective elimination. "Elimination in fact" refers to the removal of nutrients from the Rehoboth WWTP effluent through technical changes or upgrades or through some method of removing the discharge from the Lewes-Rehoboth Canal, such as the construction of an ocean outfall or the use of spray irrigation. "Effective elimination" refers to some form of nutrient trading by the reduction of nutrient loads within the inland bays watershed that may be credited toward the Rehoboth WWTP's nutrient limits.

3. Within two and one half years following the permit issuance date, the City must

complete an evaluation of the technical and economic feasibility of elimination in fact of the nitrogen and phosphorus discharges. The City will meet periodically with the Department during this period to discuss the status of their evaluation.

4. If the City determines that elimination in fact is technically and economically feasible, it shall be allowed one year from such determination to investigate and secure the source(s) of funding for the project.

5. Upon agreement of both parties, extension of time will be permitted for either the feasibility study or the funding investigation, or both if necessary.

6. Beginning two years after the permit issuance date, the Department intends to accelerate the effective elimination of discharges if it is determined by the Department that the City is not acting in good faith. The Department shall notify the City in writing of its intention to make such a determination. The City may appeal such a determination to the Environmental Appeals Board in accordance with 7 Del. C. Sec. 6008. The City will be allowed two years to effectively eliminate the discharges from the time of such determination.

7. If the City determines that elimination in fact of the nitrogen and phosphorus discharges to be technically and economically feasible and that adequate funding is available, it shall select an option and submit an Implementation Plan to the Department within six months of such determination.

8. Final implementation of any such plan will occur within four years after all the necessary permits are obtained.

9. If the City determines that elimination in fact of the nitrogen and phosphorus discharges is not economically feasible or that adequate funding is not available, it shall proceed to effectively eliminate the nitrogen and phosphorus discharges through some combination of technical upgrades at the WWTP and/or trading with non-point sources.

10. Nutrient reductions through technical upgrades at the WWTP will be credited at a ratio of 1 (i.e., 1 lb. credited for every 1 lb. removed).

11. Nutrient reductions through trading will be credited at a ratio of 0.5 (i.e., 1 lb. credited for every 2 lb. removed).

12. Nutrient reductions achieved through trading must be completed within two years from the determination made in paragraph 9, nutrient reductions achieved through technical upgrades at the WWTP must be completed within three years from the determination made in paragraph 9 above.

13. The final completion date of any elimination in fact project shall not be later than December 31, 2014, or ten years after the effective date of this NPDES permit, whichever occurs first. If, through no fault of the permittee, permitting for an elimination in fact project takes in excess of two years to obtain all necessary Federal, State, and Local permits, the deadlines provided for in this paragraph shall be adjusted accordingly.

Special Conditions

Special Condition No. 1 indicates that this permit supersedes NPDES Permit DE 0020028 and State Permit WPCC 3084C/74, issued on August 16, 1994, effective date September 1, 1994.

Special Condition No. 2 outlines the pretreatment program requirements applicable to this facility.

Special Condition No. 3 is a standard permit reopener clause. This Special Condition allows the Department to reopen and modify the permit if the discharge is causing water quality problems.

Special Condition Nos. 4, 5, and 6 require proper disposal of sludge in accordance with state and federal requirements.

Special Condition No. 7 outlines the requirements for chronic biomonitoring of the effluent discharge.

Special Condition No. 8 requires the facility to perform quarterly biomonitoring of the effluent if the effluent fails an annual biomonitoring test. The facility is then allowed to resume annual biomonitoring frequency after successful completion of four consecutive quarters of valid biomonitoring with written approval from the Department.

Special Condition No. 9 identifies the treatment facility's classification and requires that the services of an appropriately licensed wastewater treatment operator be maintained in accordance with Section 4 of the State of Delaware Regulations for Licensing Operators of Wastewater Facilities.

Special Condition No. 10 outlines the effluent limitations and monitoring requirements for total nitrogen and total phosphorus. This permit provides for a systematic reduction of Nitrogen and Phosphorus discharges to the Inland Bays. Since it is unlikely that the City of Rehoboth Beach will be able to eliminate the nutrient discharge during the term of this permit, they have entered into a Consent Order (No. 98C-12-023-THG) to allow for a schedule to meet the requirements of the Inland Bays TMDL past the term of this NPDES permit.

Special Condition No. 11 states requirements to meet the "none detectable" effluent limitation for total residual chlorine (TRC).

Special Condition No. 12 defines "systematic elimination" as the term pertains to the TMDL for the Inland Bays, this NPDES permit, and the associated Consent Order (No. 98C-12-0230THG).

Special Condition No. 13 requires the permittee to develop, implement, and maintain a Storm Water Plan (SWP).

Public Notice and Process for Reaching a Final Decision

The public notice of the Department's receipt of the application and of reaching the tentative determinations outlined herein will be published in the Wilmington News Journal on July 9, 2003. Interested persons are invited to submit their written views on the draft permit and the tentative determinations made with respect to this NPDES permit application. The Department will not hold a public hearing on this application unless the Department receives a meritorious request to do so or unless the notice of this proposal generates substantial public interest. A public hearing request shall be deemed meritorious if it exhibits a familiarity with the application and a reasoned statement of the permit's probable impact. The request for a public hearing shall be in writing and shall state the nature of the issues to be raised at the hearing. All comments received by the close of business on August 8, 2003 will be considered by the Department in preparing the final permit.

Department Contact for Additional Information

Tony Hummel, PE, CHMM
Environmental Engineer
Surface Water Discharges Section
Division of Water Resources
Department of Natural Resources and Environmental Control
89 Kings Highway
Dover, DE 19901
Ph: (302) 739-5731
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Appendix No. 3
WWTP Effluent Data (2007)
Nitrogen and Phosphorus

2007 Nutrient Removal Performance

Month	Flow mgd	Conc mg/L	Load lb/d	Conc mg/L	Load lb/d
Jan	0.72	10.3	61.8	0.43	2.6
Feb	0.66	10.6	58.3	0.6	3.3
Mar	0.75	6.3	39.4	0.64	4.0
Apr	0.89	4.2	31.2	0.43	3.2
May	1.03	6.8	58.4	0.16	1.4
Jun	1.57	3.3	43.2	0.4	5.2
Jul	1.91	3.4	54.2	0.4	6.4
Aug	1.9	3.9	61.8	0.6	9.5
Sep	1.22	2.4	24.4	0.49	5.0
Oct	0.86	3.4	24.4	0.21	1.5
Nov	0.74	6.7	41.3	0.22	1.4
Dec	0.64	8.8	47.0	0.1	0.5

Appendix No. 4

CERTIFICATE OF OFFEROR'S QUALIFICATIONS

1. Name of Contract: **Construction and/or Services Agreement for Disposal of Wastewater from the City of Rehoboth Beach Wastewater Treatment Plant via Land Application**

2. Name of Respondent: _____
3. Respondent's Federal Employee I.D. No.: _____
4. State of Delaware Construction Firm License No.: _____
5. State of Delaware Control No.: _____
6. Business Address: _____
   _____
7. When Organized: _____
8. Where Incorporated: _____
19. Foreign Business No.: _____
10. How many years has the bidder been engaged in this business under your present firm name? _____
11. Have you ever refused to sign a contract at your original RFP/Bid?
    Yes _____ No _____
12. Have you ever defaulted on a contract? Yes _____ No _____
    Remarks: _____
13. Will you, upon request, furnish any other pertinent information the City of Rehoboth Beach may require? Yes _____ No _____
15. Does your business maintain a regular place of business in the State of Delaware (Resident) _____ or would your business be considered a Non-Resident _____?

16. Has the Respondent or firm ever been disbarred, suspended or otherwise prohibited from doing work with the federal government? Yes _____ No _____
    (If yes, explain: _____)

With the submission of this certification, the Respondent thereto certifies that the information supplied is, to the best of your knowledge, accurate and correct.

_____
(Name of Respondent)

By: _____

Title: _____

Respondent Certification

The above statements are certified to be true and accurate and we have the equipment, labor, supervision and financial capacity to perform this Contract.

Dated at _____ this _____ day of _____ 2008.

By: _____

_____
(Title of Person Signing)

_____
(Name of Organization)

State of _____

City of _____, ss.

_____ being duly sworn, states he is _____
(Office)

of _____ and that the answers of the foregoing questions and all statements therein contained are true and correct.

Sworn to before me this _____ day of _____ 2008.

_____
Notary Public

_____
(My Commission Expires:

(NOTARY SEAL)

Appendix No. 5

Summary of Capital Costs

Estimate of Probable Construction Cost

Facility:

Description	Quantity		Material		Installation		Total
	No. Units	Units	Per Unit	Total	Per Unit	Total	Cost
Concrete							
Slab							
Wall							
Civil							
Excavation							
Backfill							
Hauling							
Bedding							
Dewatering							
Sediment and Erosion Control							
Piping							
Miscellaneous Metal							
Architecture							
Equipment							
Electrical / I&C							
Special							
Subtotal							
General Conditions							
Subtotal							
Overhead							
Profit							
Subtotal							
Contingency							
TOTAL							

Appendix No. 6

STATEMENT OF SURETY'S INTENT

To: _____City of Rehoboth Beach_____
(Owner)

We have reviewed the Proposal of_____
(Service Provider)

of_____.
(Address)

for ___**Construction and/or Services Agreement for Disposal of Wastewater from the City of Rehoboth Beach Wastewater Treatment Plant via Land Application**

Proposals for which will be received on _____(Opening Date)

and wish to advise that should this Proposal of the Service Provider be accepted and the Agreement be awarded to him, it is our present intention to become surety on the performance bond required by the Agreement.

Any arrangement for the bonds required by the Service Provider is a matter between the Service Provider and ourselves and we assume no liability to you or third parties if for any reason we do not execute the requisite bonds.

We are duly authorized to do business in the State of Delaware.

Attest:

_____ _____

_____
Surety's Authorized Signature(s)

Attach Power of Attorney

(Corporate seal if any. If no seal, write "No Seal" across this place and sign.)

Appendix B
Conceptual Design

STEARNS & WHELER LLC
Environmental Engineers & Scientists

City of Rehoboth Beach **September 2008**
Proposed Ocean Outfall Conceptual Design

Basis of Design

1. Outfall extends 6,000 LF east from the shore and terminates with a diffuser pipe which forms a wye in plan view and runs approximately 650 LF northeast and 650 LF southeast from the end of the outfall. The water depth at the diffuser location is approximately 30 feet.

2. The outfall and diffuser are 24-inch HDPE pipe.

3. Diffuser has 3-inch diffuser ports located 25-feet on center along the length of the 24-inch pipe. Each port has a 3-inch HDPE pipe extending from the buried diffuser pipe to the sea floor and ending with Red Valve Series 36-D diffuser check valves made of Neoprene.

4. The outfall and diffuser pipe will be buried such that the crown of the pipe is approximately 5 feet below the sea floor. The pipe will have a 12-inch bedding (1-1/2 inch stone) and backfilled to 1-foot above the crown of the pipe (6-inch stone). From the backfill to the sea floor there will be ballast rock (12-inch stone) with several feet of armor rock (24 to 30 inch stone) placed on top (see typical cross-section).

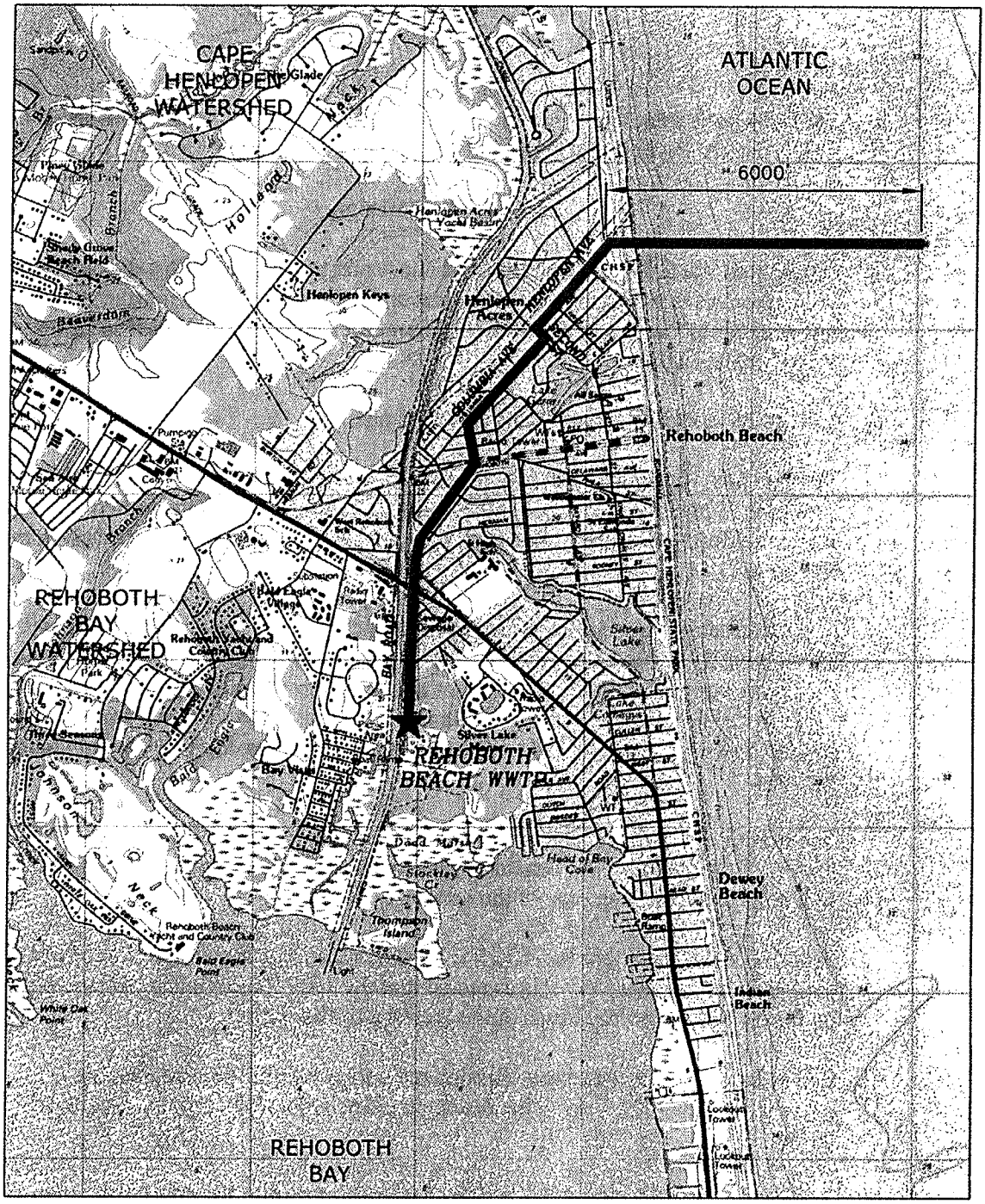
5. The outfall and diffuser pipe will be ballasted with concrete collars located 20-feet on center. There will also be helical screws located 20-feet on center. The helical screw will be placed on either side of the concrete collars.

6. Installation assumes that the trench will be dredged and the outfall floated out from the beach for installation. It is assumed that the HDPE outfall and diffuser pipe can be fusion welded on the beach at the location of the outfall.

7. It is assumed that construction through the surf zone will require sheeting (approximately 500 LF from the beach on either side of the pipe to a depth of 25 feet).

8. The requirements for dredging will be determined during the permitting process but it is assumed, as a worst-case scenario, that the dredged materials from excavation can not be side cast but rather will have to be temporarily placed in a barge.

9. Construction is limited to the months of October through May



SCALE: 1"=3000'-0"

KEY

PROPOSED 24" PIPELINE

Stearns & Wheler, LLC
Environmental Engineers and Scientists

REHOBOTH BEACH
EFFLUENT DISPOSAL STUDY

DATE:09/04 JOB No.:20212.10

FIGURE 7-11
PROPOSED REHOBOTH BEACH
OCEAN OUTFALL

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08/04 BOWIE LB
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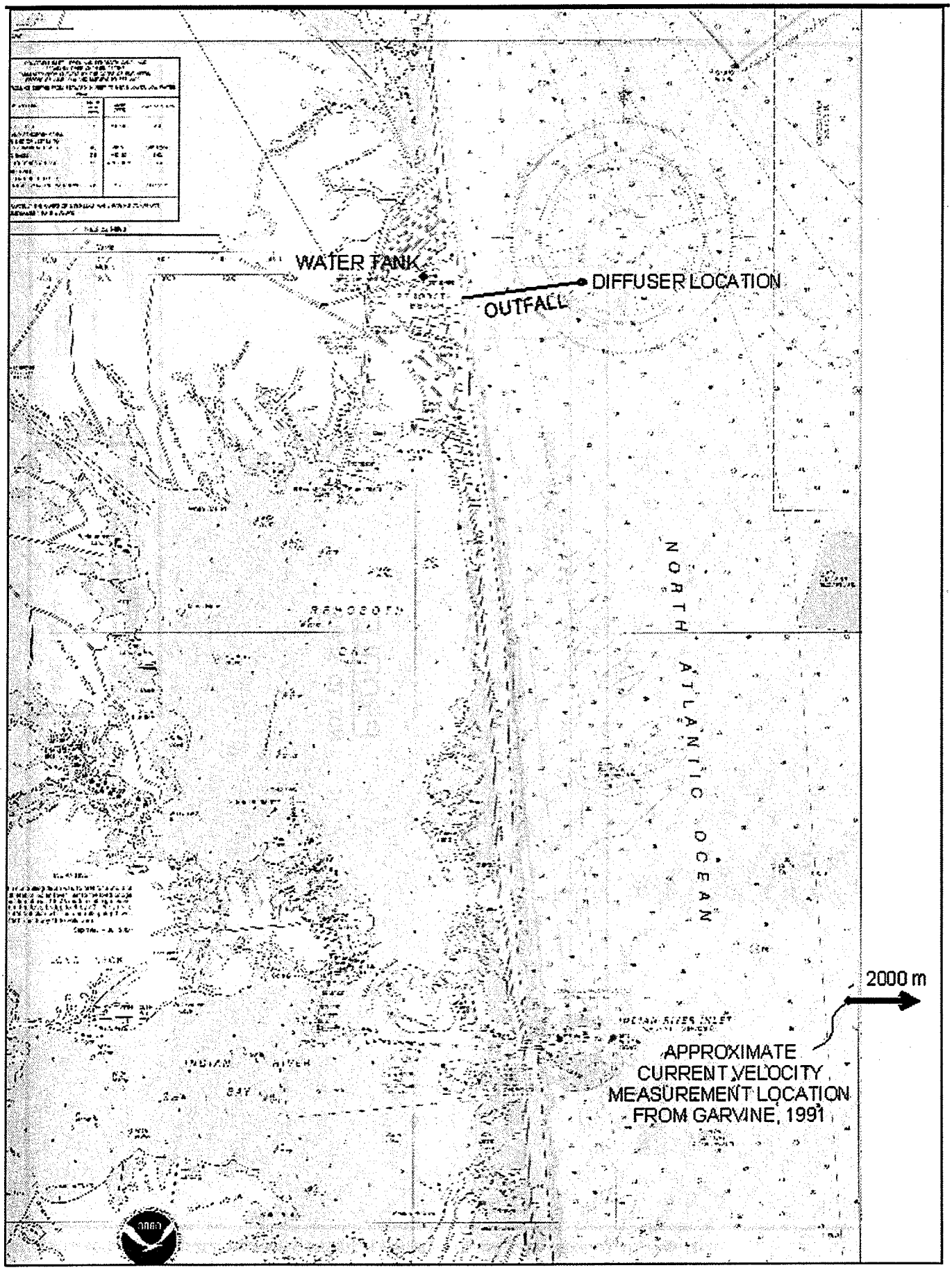
WATER TANK
DIFFUSER LOCATION
OUTFALL
NORTH ATLANTIC OCEAN
2000 m
APPROXIMATE CURRENT VELOCITY MEASUREMENT LOCATION FROM GARVINE, 1991

08/04 BOWIE LB
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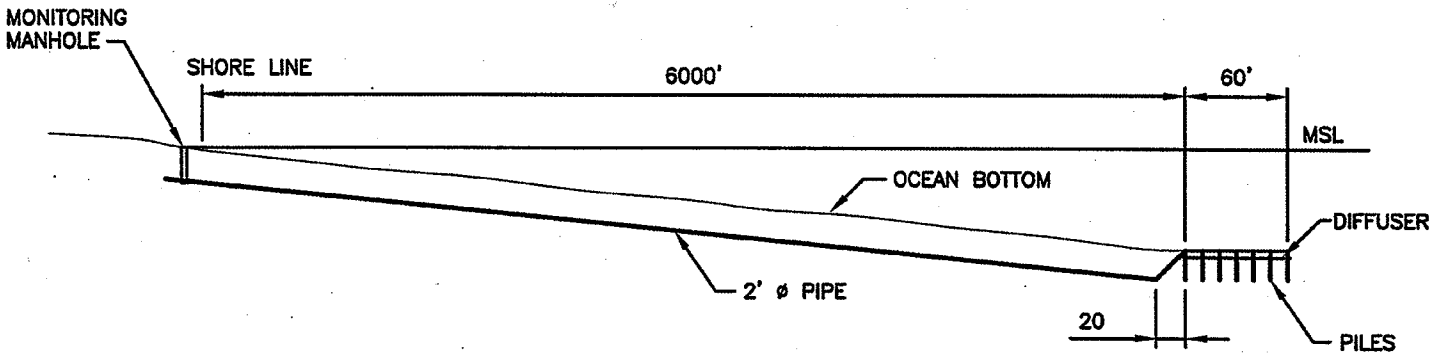

PROFILE

NOT TO SCALE

Stearns & Wheler, LLC
Environmental Engineers and Scientists

BOWIE, MD

DATE: 10/04 JOB No.:20212.10

REHOBOTH BEACH EFFLUENT DISPOSAL STUDY

FIGURE 7-12
OCEAN OUTFALL PROFILE

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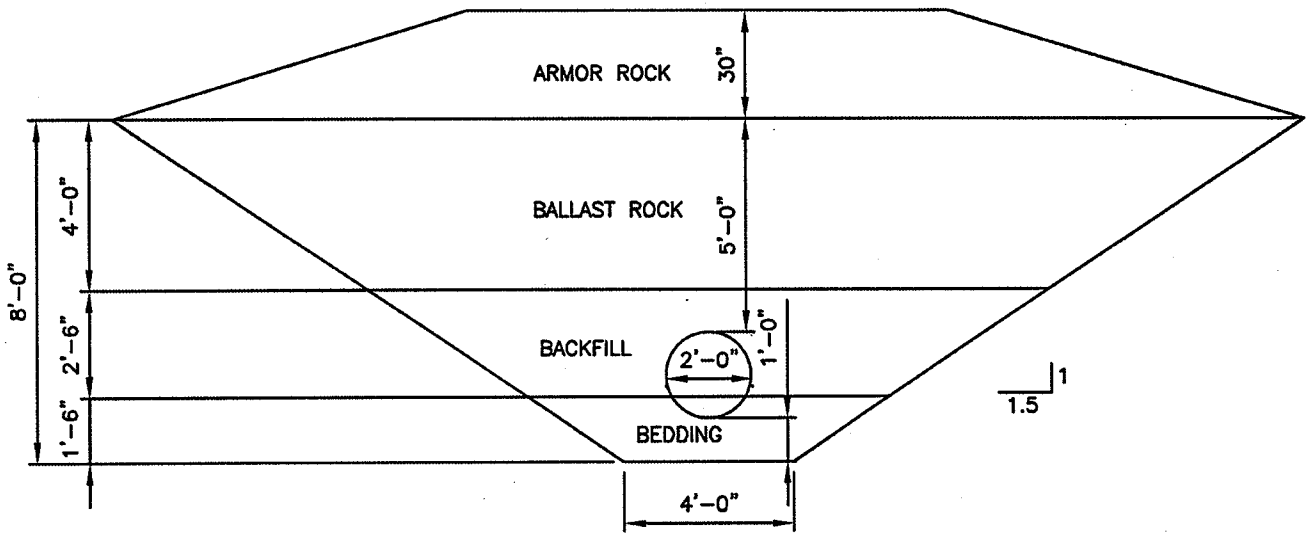
08/04 BOWIE LB
O:\20212 Rehoboth\Study\Figures\20212-AEERIALCROSS_SEC.DWG

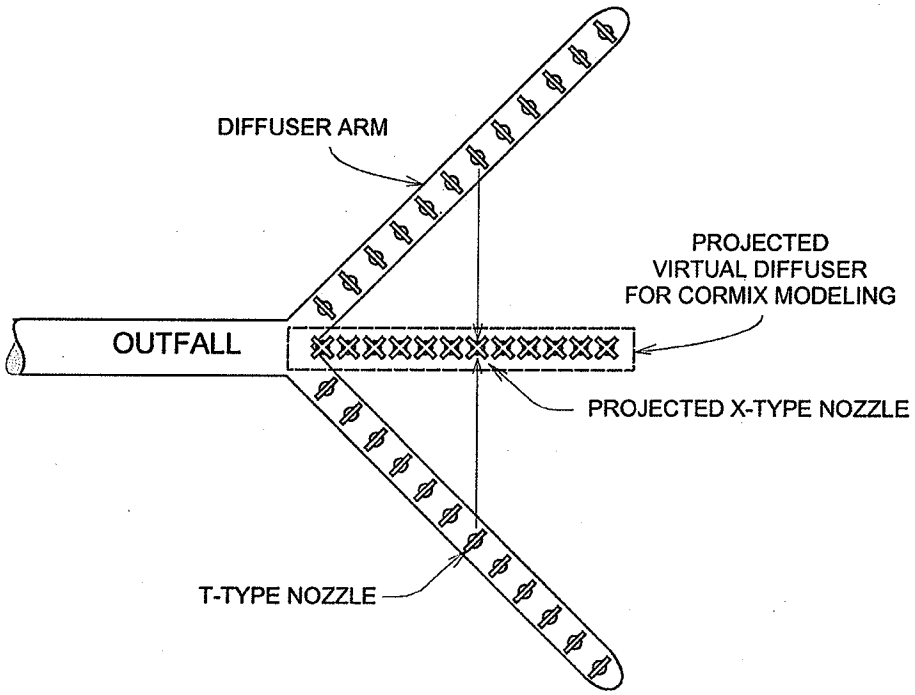


TYPICAL OCEAN OUTFALL CROSS SECTION

SCALE: NTS

Stearns & Wheler, LLC Environmental Engineers and Scientists BOWIE, MD DATE: 10/04 JOB No.:20212.10	REHOBOTH BEACH EFFLUENT DISPOSAL STUDY **FIGURE 7-10** **OCEAN OUTFALL CROSS SECTION**

O:\20212 Rehoboth\Study\Figures\20212-CROSS_SEC_Powerpoint.dwg, Layout1, 7/8/2005 1:10:31 PM, lb, 1:1



Schematic Design of Diffuser
Proposed Rehoboth Beach Ocean Outfall

Appendix C
Capital Cost Estimates

STEARNS & WHELER LLC
Environmental Engineers & Scientists

Stearns & Wheler, LLC

STEARNS & WHELER LLC
Environmental Engineers & Scientists

ENGINEER'S ESTIMATE OF PROBABLE CONSTRUCTION COST

Project:	Effluent Disposal Study						**Computed By:**			KLP
Location:	Delaware						**Checked By:**			RRC
Owner:	City of Rehoboth Beach/Sussex County						**Design Status of Estimate:**			PRELIM
Description:	**Rehoboth Beach Ocean Outfall**						**Project Number:**			20212
	Quantity		Material		Equipment		Labor			
Description	No. Units	Basis	Per Unit	Total	Per Unit	Total	Man Hours	$/Man Hour	Total	Total Cost
Site Work										
Sand Dune Restoration	1	LS	$50,000	$50,000						$50,000
OffShore Pipe										
Marine Survey	1	LS					48	$734	$40,000	$40,000
Testing	1	LS	$50,000	$50,000						$50,000
Mobilization/Demobilization	1	LS	$1,000,000	$1,000,000						$1,000,000
Sheeting	30,000	SF	$20.00	$600,000			0.400	$40	$480,000	$1,080,000
Dredging	75,600	CY					2066	$1,500	$3,099,600	$3,100,000
24" HDPE Outfall Pipe	6,000	LF	$53.00	$318,000	included w/overall		885	$1,500	$1,327,500	$1,646,000
18" HDPE Diffuser Pipe	184	LF	$28.00	$5,152	included w/overall		109	$1,500	$163,527	$169,000
Diffuser (Riser+2 Ck valves)	24	EA	$1,500	$36,000	included w/overall		73	$1,500	$109,018	$145,000
Piles	21	EA	$3,000	$63,000						$63,000
Bedding	2,880	CY	$18.00	$51,840			528	$1,500	$792,000	$844,000
Backfill	4,800	CY	$18.00	$86,400			528	$1,500	$792,000	$878,000
Ballast Stone	11,000	CY	$21.50	$236,500			0.003	$5,460	$192,192	$429,000
Helical Anchors	612	EA	$2,150.00	$1,315,800					Incl.	$1,316,000
Concrete Saddles	310	EA	$2,150.00	$666,500					Incl.	$667,000
On-Site Fill	56,920	CY					1000	$1,500	$1,500,000	$1,500,000
Trestle (Thru Surf Zone)	500	LF	$2,100.00	$1,050,000						$1,050,000
Pipe Thru Surf Zone	300	Hrs			$250	$75,000				$75,000
Sampling Manhole	1	EA	$6,000.00	$6,000						$6,000
Cost Escalation										
City Cost Index Adjustment										
General Conditions			**5%**	$276,800	**5%**	$3,800		**5%**	$424,800	
Subtotal				$5,812,000		$78,800			$8,920,600	**$14,811,000**
Taxes		**Tax-Exempt**		$0	**0%**	$0		**0%**	$0	
Overhead			**10%**	$581,200	**10%**	$7,900		**10%**	$892,100	
Profit			**5%**	$290,600	**5%**	$3,900		**5%**	$446,000	
Subtotal				$6,683,800		$90,600			$10,258,700	**$17,033,000**
Contingency			**30%**	$2,005,100	**30%**	$27,200		**30%**	$3,077,600	
TOTAL				$8,688,900		$117,800			$13,336,300	**$22,100,000**

Escalation to current dollars:

ENR August 2005	7420	
ENR January 2009	8620	
Ratio	1.17	**$25,900,000**

Weeks Marine

STEARNS & WHELER LLC
Environmental Engineers & Scientists

10/01/2008 13:58
08037BUDGET Rehoboth Outfall Budget
*** Ray van Antwerp

BID TOTALS

Biditem	Description	Status - Rnd	Quantity	Units	Unit Price	Bid Total
10000	Mob / Demob	U	1.000	LS	1,200,000.00	1,200,000.00
20000	Land Acticvities (HDPE Fab)	U	1.000	LS	2,200,000.00	2,200,000.00
25000	Trestle Section 500' Into Surf Zone	U	1.000	LS	4,500,000.00	4,500,000.00
40000	Trench Excavation - Dredging	U	1.000	LS	450,000.00	450,000.00
45000	Dredge Spoil Management	U	1.000	LS	1,300,000.00	1,300,000.00
50000	Pile Driving for Diffuser	U	1.000	LS	1,440,000.00	1,440,000.00
60000	Lay HDPE Pipe	U	1.000	LS	1,300,000.00	1,300,000.00
80000	Backfill Pipe	U	1.000	LS	4,220,000.00	4,220,000.00
90000	Test Pipe	U	1.000	LS	100,000.00	100,000.00
			Bid Total	==========>		$16,710,000.00

WorleyParsons

STEARNS & WHELER LLC
Environmental Engineers & Scientists

WorleyParsons

resources & energy

EcoNomics

STEARNS & WHEELER, LLC

Rehoboth Beach Ocean Outfall

Cost Estimate and Construction Methodology

401010-00438 – 401010-00438-RP-001

28 November 2008

Hydrocarbons
Level 12, 333 Collins Street
Melbourne VIC 3000
Australia
Telephone: +61 3 8676 3500
Facsimile: +61 3 8676 3505
www.worleyparsons.com
ABN 61 001 279 812

Disclaimer

PROJECT 401010-00438 - REHOBOTH BEACH OCEAN OUTFALL

REV	DESCRIPTION	ORIG	REVIEW	WORLEY-PARSONS APPROVAL	DATE	CLIENT APPROVAL	DATE
A	Issued for client review	A Perri	F Losty	N/A	28-Oct-08	N/A	
0	Final Report	A Perri	F Losty	N/A	28 Nov 08		N/A

CONTENTS

Appendices

APPENDIX 1 - COST ESTIMATE DETAILS

1. INTRODUCTION

WorleyParsons has been engaged by Stearns & Wheler, LLC to develop construction methodologies and prepare high level cost estimates for the construction of a 24" diameter ocean outfall for treated effluent off Rehoboth Beach in Delaware. A concept design has been carried out by Stearns & Wheeler LLC and this is reflected in the project description below.

1.1 Description of Outfall

The outfall is located at the Northern end of Rehoboth Beach; key characteristics of the outfall, as outlined in the concept design, are:

- Outfall to extend 6,000 feet (1830 m) from the shore line
- Outfall diameter 24"
- Outfall pipe and diffuser fabricated from HDPE pipe
- Water depth at the diffuser location is 30 feet (10 m) with a steady gradual slope from the beach

Figure 1-1 Arial View (Google earth) of Shore Crossing Location

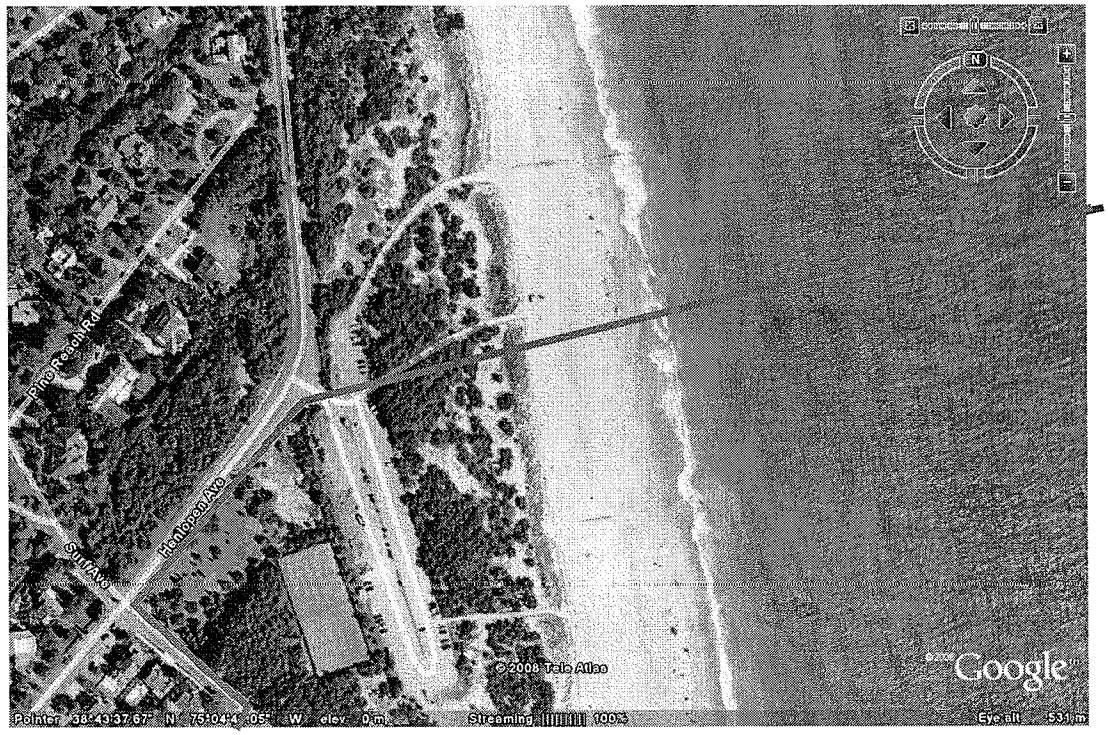
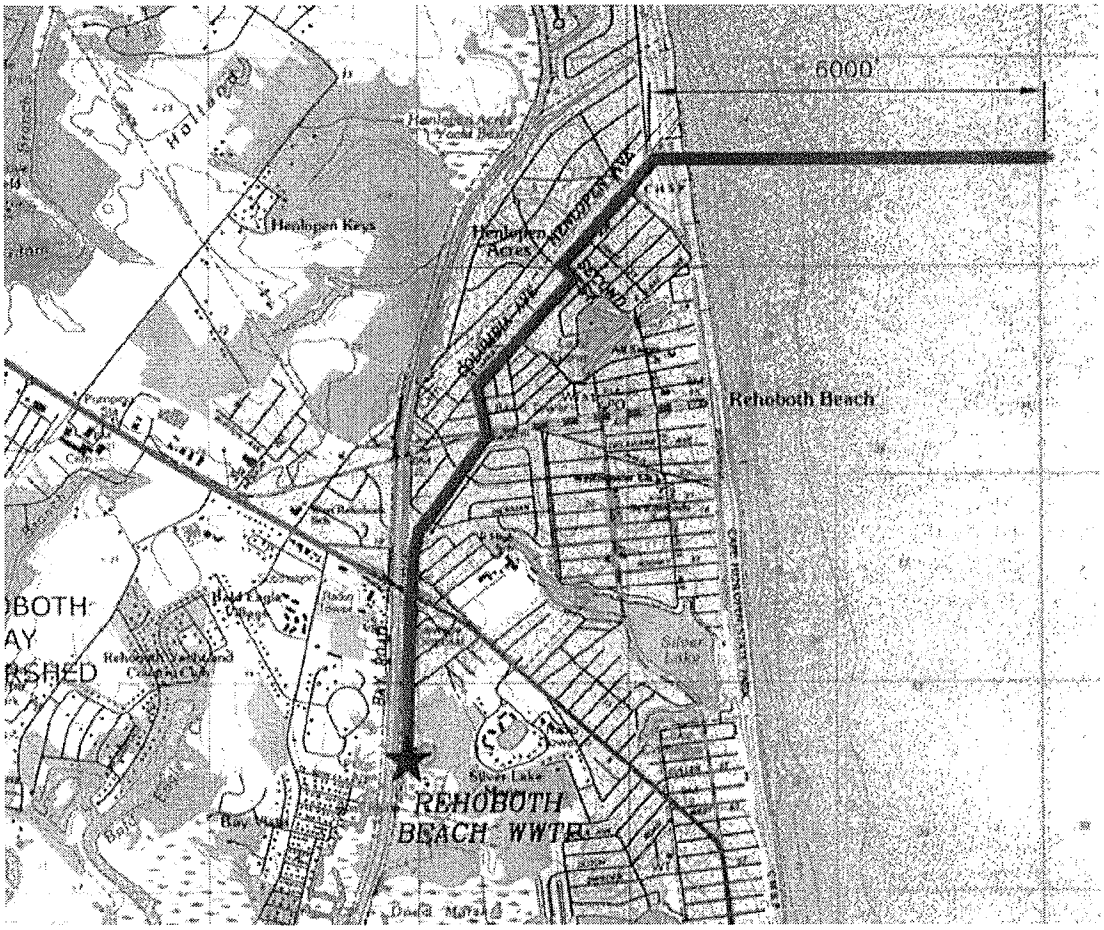


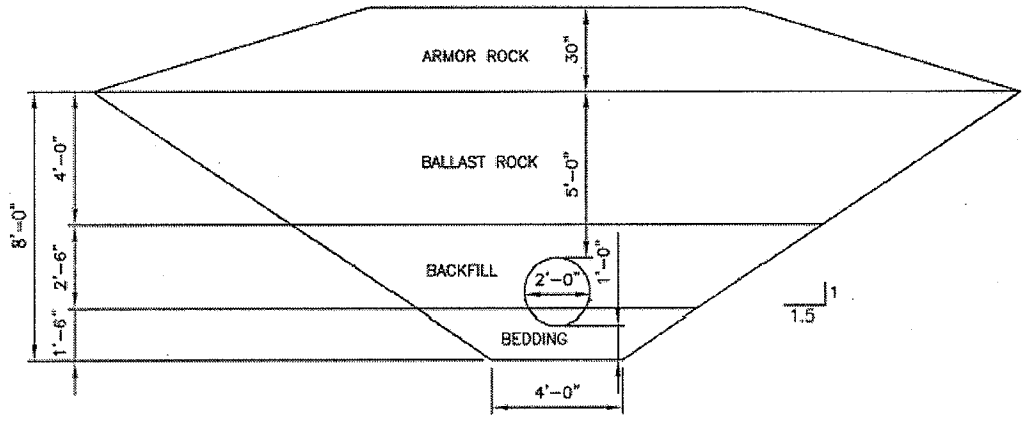
Figure 1-2 Plan of Proposed Pipeline and Outfall Route



As outlined in the concept design, the outfall pipe will be buried with the top of the pipe 5 feet (1.5 m) below the seabed level. The pipe will be laid in a trench on a bedding material with rock protection. The proposed bedding and burial materials shown in Figure 1-3 are:

- Bedding material 1' 6" deep of 1 ½" stone
- Backfill material 2' 6" deep of 6" stone
- Ballast rock 5' deep of 12" stone
- Armour rock 2' 6" deep of 2' to 3' stone

Figure 1-3 Proposed Outfall Pipe Burial and Protection



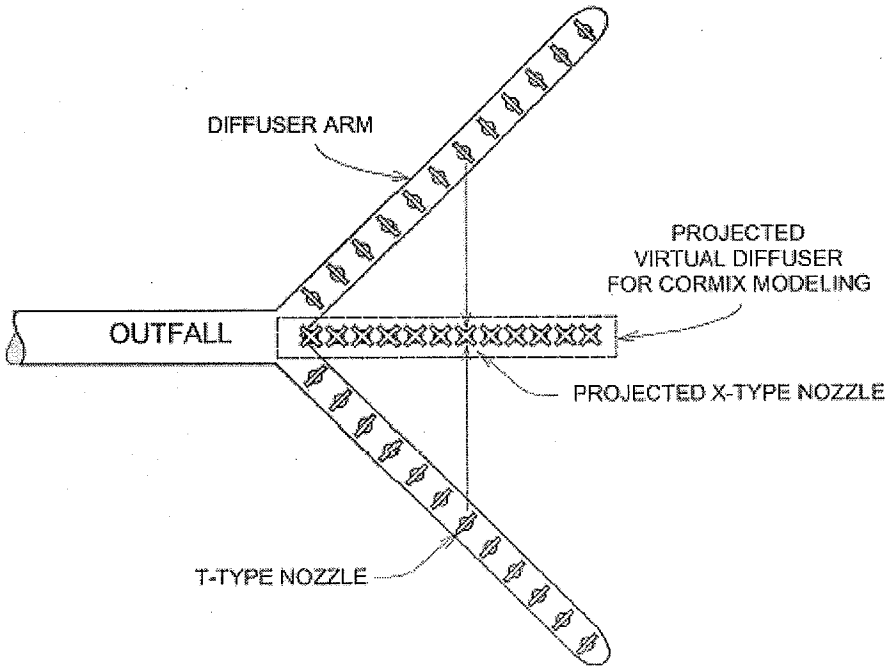
TYPICAL OCEAN OUTFALL
CROSS SECTION
SCALE: NTS

1.2 Description of Diffuser

According to the concept design, the diffuser will be a Y shape with two arms to disperse the effluent. The key characteristics of the diffuser are:

- Fabricated from 24" HDPE pipe
- Each arm is 650 feet (200m) long
- Nozzles located at 25 feet centres (7.6m) along the pipe; total of 52 diffusers
- Nozzles 3" HDPE risers extending to the sea floor
- Nozzles to have a 3" neoprene check valve (Red Valves 36-D)

Figure 1-4 Proposed Diffuser Arrangement



Schematic Design of Diffuser
Proposed Rehoboth Beach Ocean Outfall

2. SITE CONDITIONS

The installation period for the ocean outfall is planned for the period from October to May, which avoids the main tourist season over summer. An overview of the weather conditions and metocean data is given in the sections below.

2.1 Weather

The charts below show that the work will be happening during the colder months of the year with mean temperatures ranging from -3°C to +18°C over the period. For the majority of the period the average daily highs would be in the 8°C to 10°C range. Average rainfall is constant throughout the year with 3" to 4" average per month.

Average wind speeds are 10 to 15 knots through the construction period with peak winds during storms in the 40 to 50 knot range. As expected the plots show that the summer months have more benign conditions.

Work during the construction period could experience delays due to weather downtime. Regular storms would be the main contributor and would impact most on the offshore installation activities.

Figure 2-1 Rehoboth Beach Average and Extreme Temperature Chart

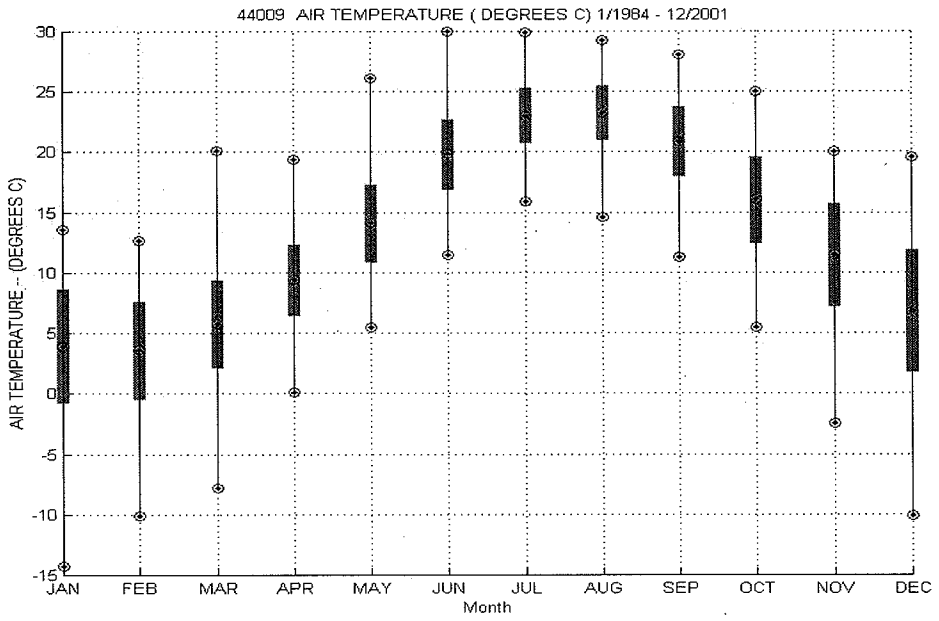


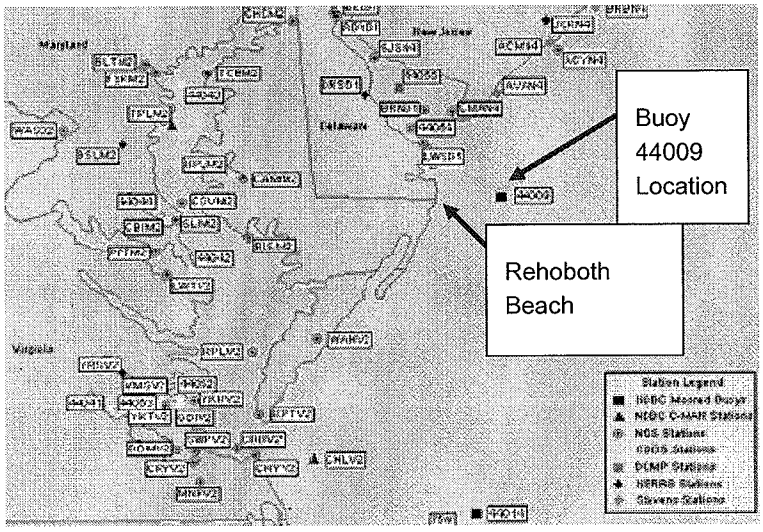
Figure 2-2 Rehoboth Beach Average Temperatures and Rainfall

Month	Average High	Average Low	Average Precipitation.
January	44.4° F / 6.8°C	26.0°F / -3.3°C	3.80 in.
Feburary	46.5°F / 8.0°C	27.1°F / -2.7°C	3.22 in.
March	55.4°F / 13°C	33.9°F / 1.0°C	4.21 in.
April	65.5°F / 18.6°C	42.1°F / 5.6°C	3.73 in.
May	75.4°F / 24.1°C	52.0°F / 11.1°C	3.76 in.
June	83.7°F / 28.7°C	61.3°F / 16.2°C	3.52 in.
July	87.5°F / 30.8°C	66.0°F / 18.8°C	4.53 in.
August	85.5°F / 29.7°C	64.4°F / 18°C	5.18 in.
September	79.9°F / 26.6°C	57.9°F / 14.3°C	3.72 in.
October	69.1°F / 20.6°C	46.7°F / 8.1°C	3.23 in.
November	58.5°F / 14.7°C	37.6°F / 3.1°C	3.39 in.
December	47.6°F / 8.6°C	29.1°F / -1.6°C	3.39 in.

2.2 Seastates

Seastate data is available for the Rehoboth Beach area from a NOAA environmental weather monitoring buoy (number 44009) located off Delaware Bay.

This data shows seastates with significant wave heights generally in the 1 to 2 m range and peak wave events in the 5 to 7 m range through the installation period. Winds through the cooler months are predominately from the North and West, with storms through winter from the East.



Maximum tide range for Rehoboth Beach is approximately 6 feet.

Figure 2-3 Rehoboth Beach Average Wind by Month

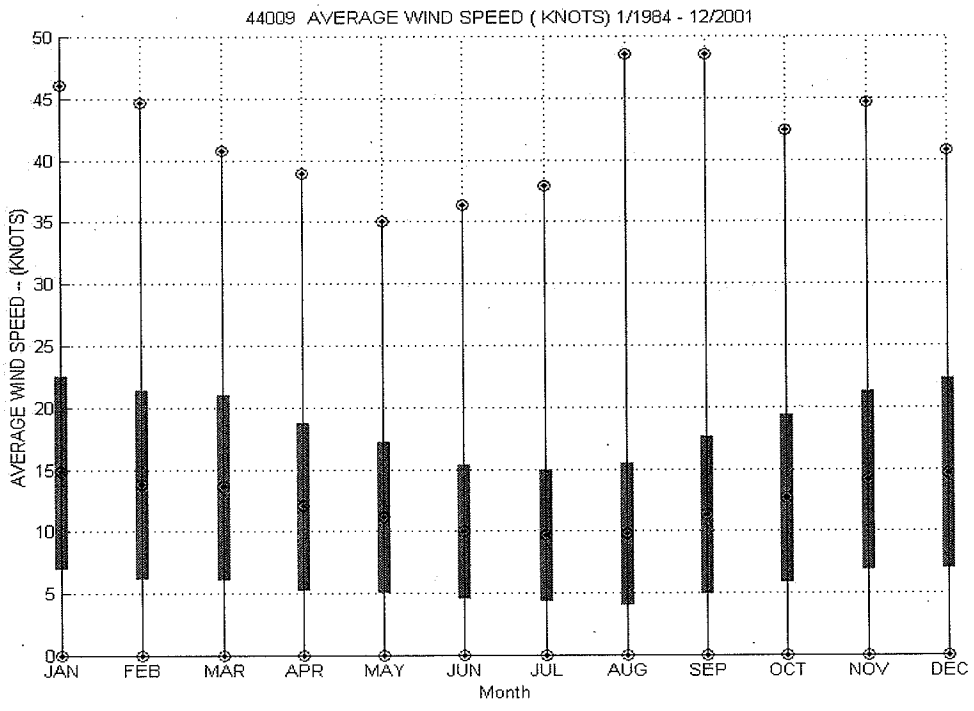
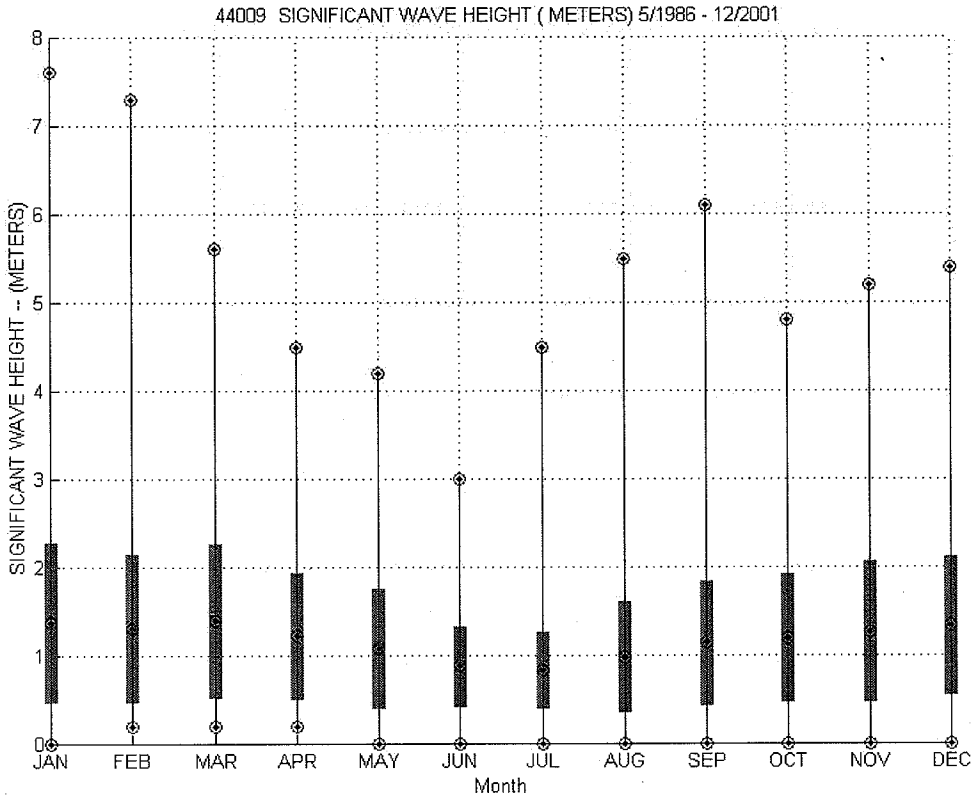


Figure 2-4 Rehoboth Beach Significant Wave Height by Month



2.3 Geology

The geology of the area as shown on the excerpts from the geological survey maps below; show there are marine sands (fine to very fine sands and sandy silt) in the offshore sections of the proposed route with overlying spit deposits (with layers of sand, gravel and silt).

These soils are easily excavated but will need support to maintain a trench in the near shore zone. WorleyParsons has experience with both open trench and directionally drilled shore crossings in similar soils conditions.

Figure 2-5 Rehoboth Beach Geological Survey

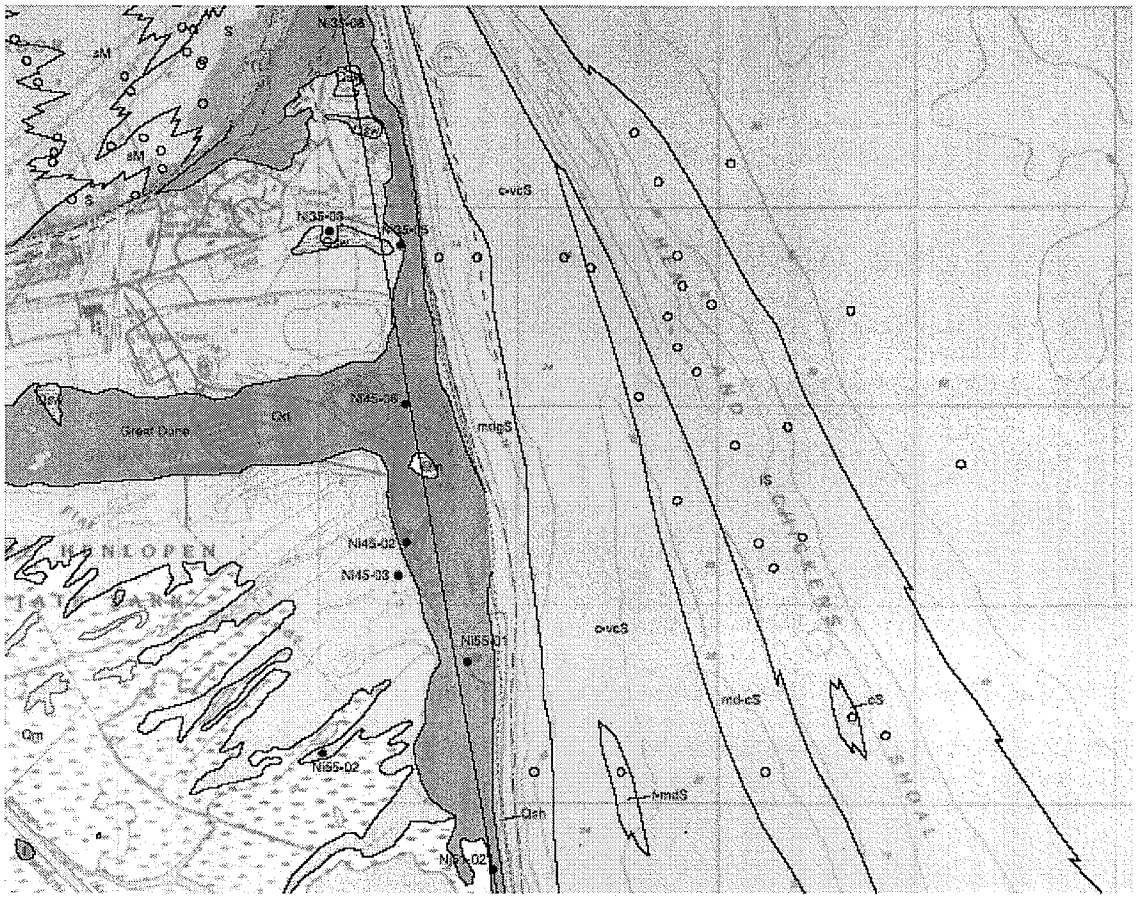
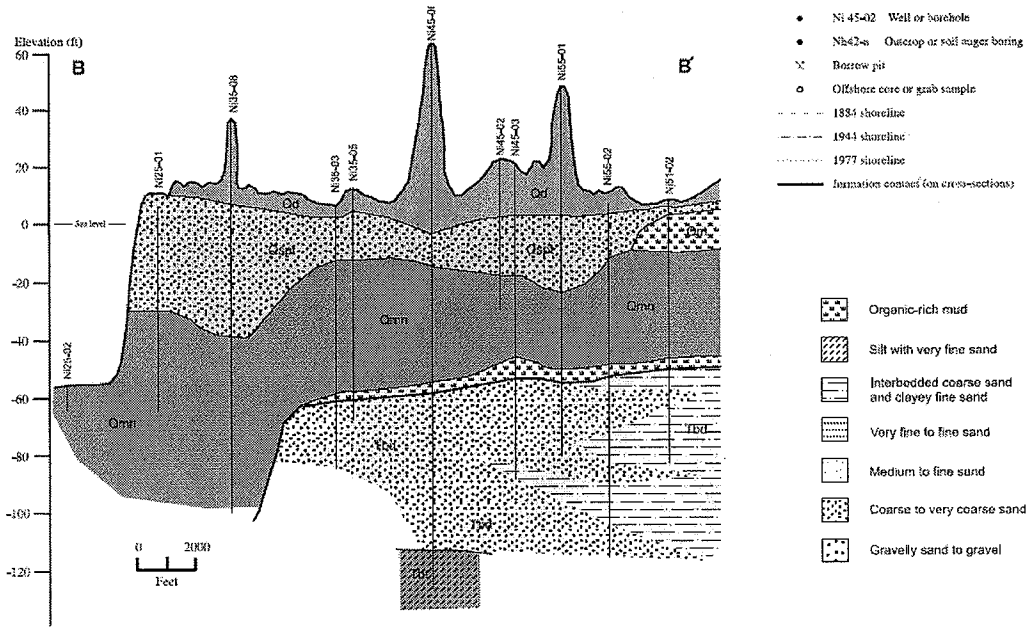


Figure 2-6 Rehoboth Beach Geological Profile



3. CONSTRUCTION METHODOLOGY

Alternative construction methodologies considered for the Rehoboth Beach Ocean Outfall are:

- Excavated and buried with HDPE pipe
- Excavated and partially buried with steel pipe
- Horizontal Directional drilled with HDPE pipe

All of these methods are widely used and are considered technically feasible for the Rehoboth Beach location.

A description of each of these methods and discussion of their advantages and disadvantages for the Rehoboth Beach location are included below.

3.1 Excavated and Buried HDPE Pipe

The excavated and buried HDPE pipe is the base case option described in the Concept Design. This pipeline would be constructed using the methodology outlined below.

Step	Action	Comment
1	Establish a construction area behind the beach at the shore crossing location. A minimum area of 80 m x 40 m (260' x 130') would be required	This site has to be large enough to stockpile the pipe, stores, machinery etc.
2	Establish pipe spooling area	Ideally a long spooling area approximately half the length of the outfall pipe would be available. This would enable the pipe to be made up in two lengths with only one connection required during the pipe pull out
3	Drive sheet piling to 25' penetration for 500 feet (150 m) from shore, pile rows approx 10 feet (3m) apart	This sheet piling will maintain the trench through the wave zone during construction
4	Excavate the trench to 8 feet depth between the sheet piles using land based excavators	See Figure 3.1 below
5	Dredge a trench from the end of the excavated section to the diffuser, also dredge for the two diffuser arms. The trench is to be nominally 8 feet (2.4 m) deep	A cutter suction dredge (see Figure 3.2 below) disposing to a cuttings barge would be used to remove seabed material. Disposal to be in an agreed area clear of the site

6	Lay bedding material in trench.	A grab bucket mounted on a cargo barge would be used for this work
7	Pull pipeline out from shore using a workboat or tug connected to a pulling head via a winch cable (see Figure 3.3 below)	The HDPE pipe is buoyant even when full of water. This will make it difficult to control; weights will therefore need to be added to minimise current effects.
8	Weld up sections as the pipe is being pulled out	Due to the restricted space apparently available at the proposed shore crossing, multiple welds will be required during the pipeline pull, with each weld estimated to take approximately 1.5 hours
9	When the pipe is in place continue back filling and armouring	To be done from cargo barge with grab bucket to lower the rock
10	Install pipe diffuser sections by floating out and sinking in place; bolt up flanges using divers from a work boat	All diving work is in shallow water (maximum 30 feet) so there will be minimal bottom time restrictions
11	Secure pipe ring weights to the diffuser sections	Stability would be provided by ring weights and rock material
12	Complete backfilling and armouring of diffusers	Cargo barge with grab bucket
13	Complete back filling and armouring of the near shore section	To be done using shore based excavators
14	Remove the sheet piles	
15	Make good the onshore construction area	

Figure 3-1 Excavator with Swamp Tracks for Working on Soft Ground or Water.

This would be used for excavating between sheet piles and placing rock in shallow section

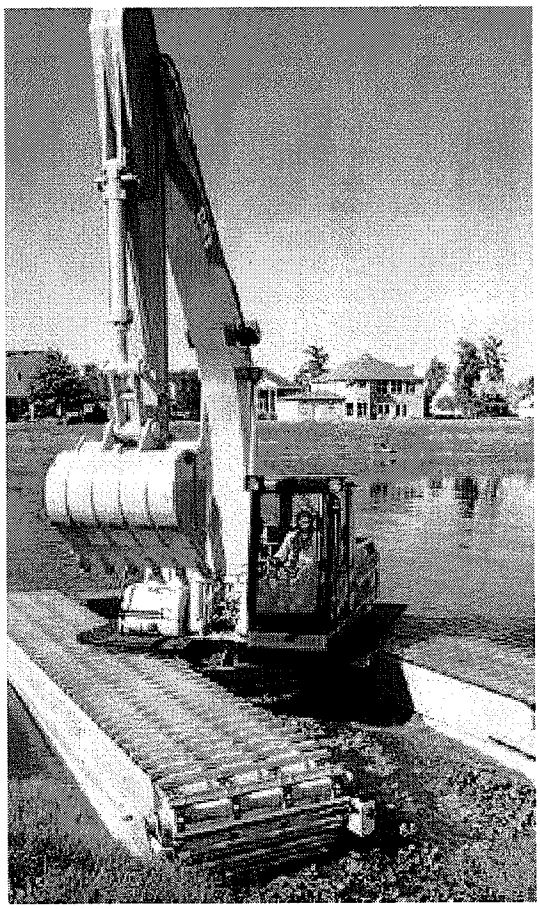


Figure 3-2 Cutter Suction Dredges

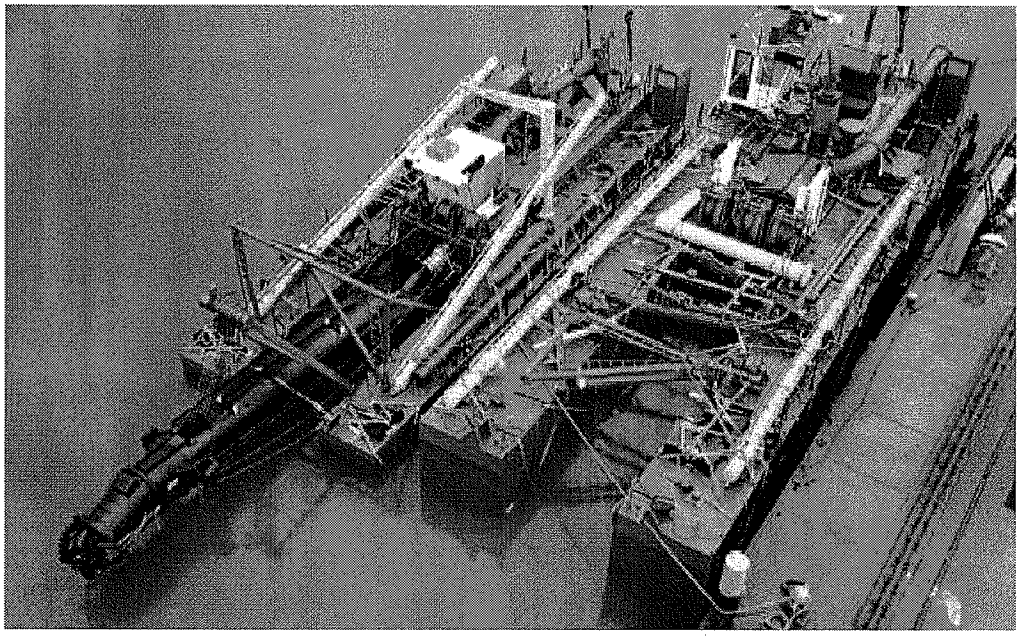
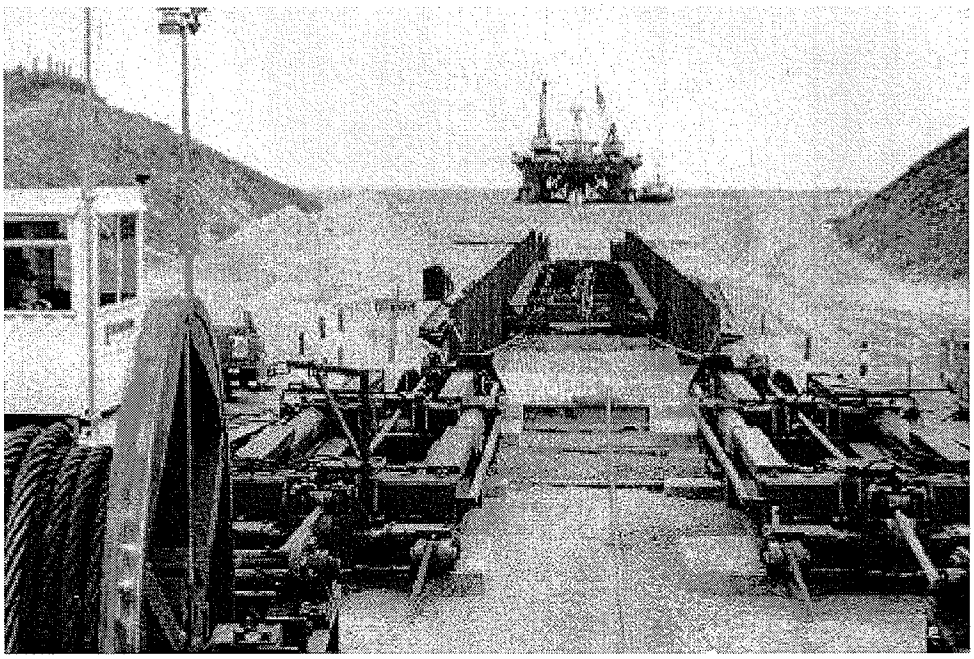


Figure 3-3 Sheet Piled Shore Crossing ready for Pipelay



3.2 Excavated and Partially Buried Steel Pipe

An alternative to using the HDPE pipe would be to use steel pipe with external concrete coating (nominally 2.5 inches) to provide on bottom stability. This would minimise the need for trenching and burial, as only the near shore section (500 feet) would be buried and armoured.

This methodology could result in significant cost savings although the pipe for most of its length would not be protected by burial and armouring. A risk assessment could be carried out based on shipping and fishing activities to evaluate if non-burial of the offshore pipe would be a concern.

An outline of the methodology required is as follows.

Step	Action	Comment
1	Establish a construction area behind the beach at the shore crossing location. A minimum area of 80 m x 40 m (260' x 130') would be required	This site has to be large enough to stockpile the pipe, stores, machinery etc.
2	Establish pipe spooling area	Ideally a long spooling area approximately half the length of the

		outfall pipe would be available. This would enable the pipe to be made up in two lengths with only one weld required during the pipe pull out
3	Drive sheet piling to 25' penetration for 500 feet (150 m) from shore, pile rows approx 10 feet (3m) apart	This sheet piling will maintain the trench through the wave zone during construction
4	Excavate the trench to 8 feet depth between the sheet piles using land based excavators	See Figure 3.1 above
5	Lay bedding material in trench.	To be done using shore based excavators
6	Pull pipeline out from shore using a workboat/tug connected to a pulling head via a winch cable	The steel pipe buoyancy can be controlled by partial flooding of the pipe. If the pipe pull has to be stopped due to weather or breakdowns the pipe can be quickly stabilised by flooding with water
7	Weld up sections as the pipe is being pulled out	Due to the restricted space apparently available at the proposed shore crossing, multiple welds will be required during the pipeline pull, each weld is estimated to take approximately 3 hours
8	When the pipe is in place flood the pipe to provide stability	Stability would be provided by ring weights and rock material
9	Install pipe diffuser sections by floating out and sinking in place; bolt up flanges using divers from a work boat	All diving work is shallow water (maximum 30 feet) so there will be minimal bottom time restrictions
10	Complete back filling and armouring of the near shore section (500 feet)	To be done using shore based excavators
11	Remove the sheet piles	
12	Make good the onshore construction area	

3.3 Horizontal Directional Drilled (HDD)

The Horizontal Directional Drilled (HDD) technique has been used extensively over the last 20 years for shore crossings in the oil and gas industry. The drilling rigs are high cost items but they greatly reduce the exposure to weather downtime and minimise environmental impacts. A typical HDD rig is shown in Figure 3-4 below.

A brief description of the installation procedure using a HDD installed HDPE pipe is as follows:

Step	Action	Comment
1	Establish a construction area behind the beach at the shore crossing location. A minimum area of 100 m x 50 m (300' x 150') would be required (see Figure 3-5 below)	This site has to be large enough to accommodate the rig, drill string, stockpile the pipe, stores, machinery etc.
2	Establish pipe spooling area	Ideally a long spooling area approximately half the length of the outfall pipe would be available. This would enable the pipe to be made up in two lengths with only one connection required during the pipe pull out
3	Drill pilot hole then back ream to 32" to allow 24" HDPE outfall pipe to be installed. HDD to be drilled to 6000' offshore	All of this work is done from within the construction site in the car park behind the beach behind the beach, an area approximately 200' by 200' would be required
4	Push the pipeline out from shore using the drill rig (see Figure 3-6 below).	Stability of the pipe is not an issue as the pipe is totally buried beneath the seabed
5	Weld up sections as the pipe is being pushed out	Due to the restricted space apparently available at the proposed shore crossing, multiple welds will be required during the pipeline pull;, each weld is estimated to take approximately 1.5 hours
6	Prepare trenches for diffuser sections	To be done using cargo barge and grab bucket
6	Install pipe diffuser sections by floating out and sinking in place; bolt up flanges using divers from a work boat	All diving work is shallow water (maximum 30 feet) so there will be minimal bottom time restrictions

7	Secure pipe ring weights to the diffuser sections	
8	Back filling and armouring of diffusers	To be done using cargo barge and grab bucket
9	Make good the onshore construction area	

Figure 3-4 HDD Rig and Drill Pipe set up for a Shore Crossing

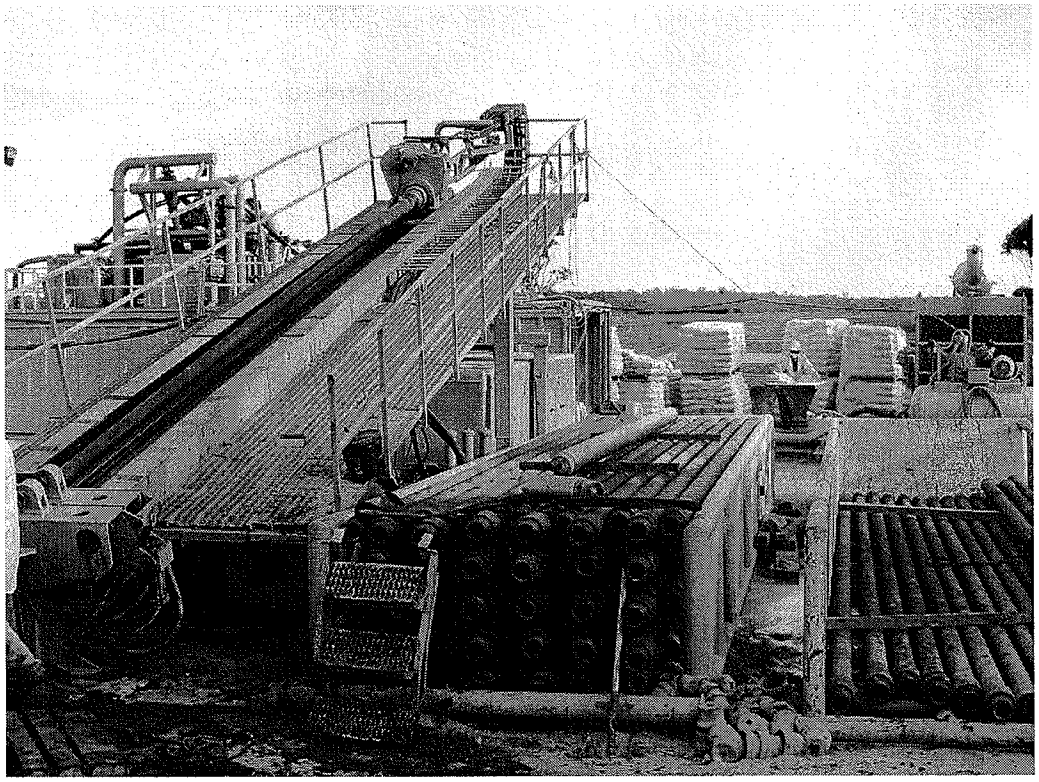


Figure 3-5 HDD Rig Site

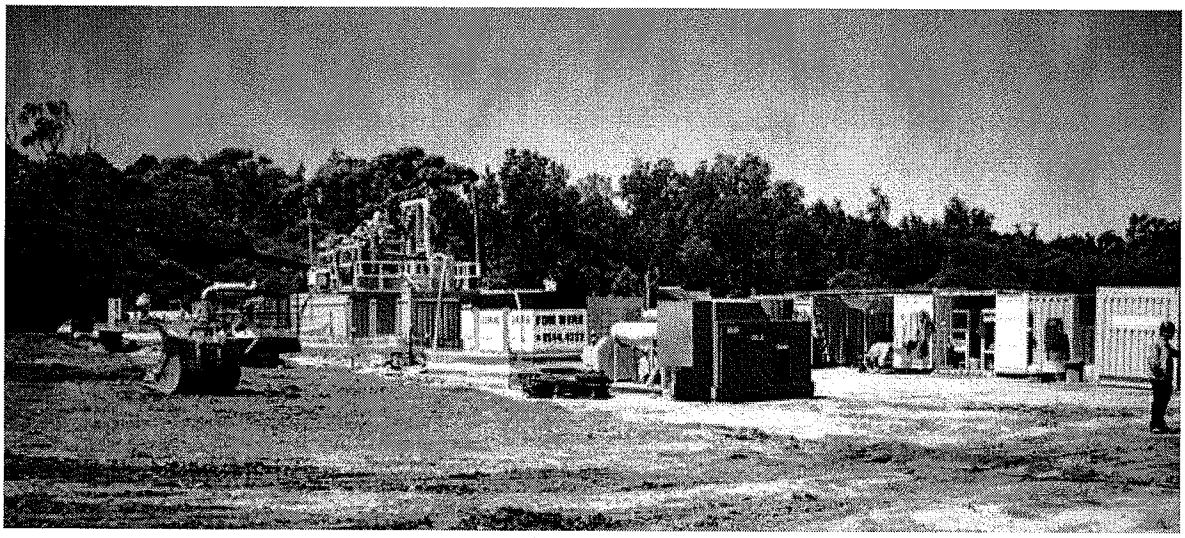
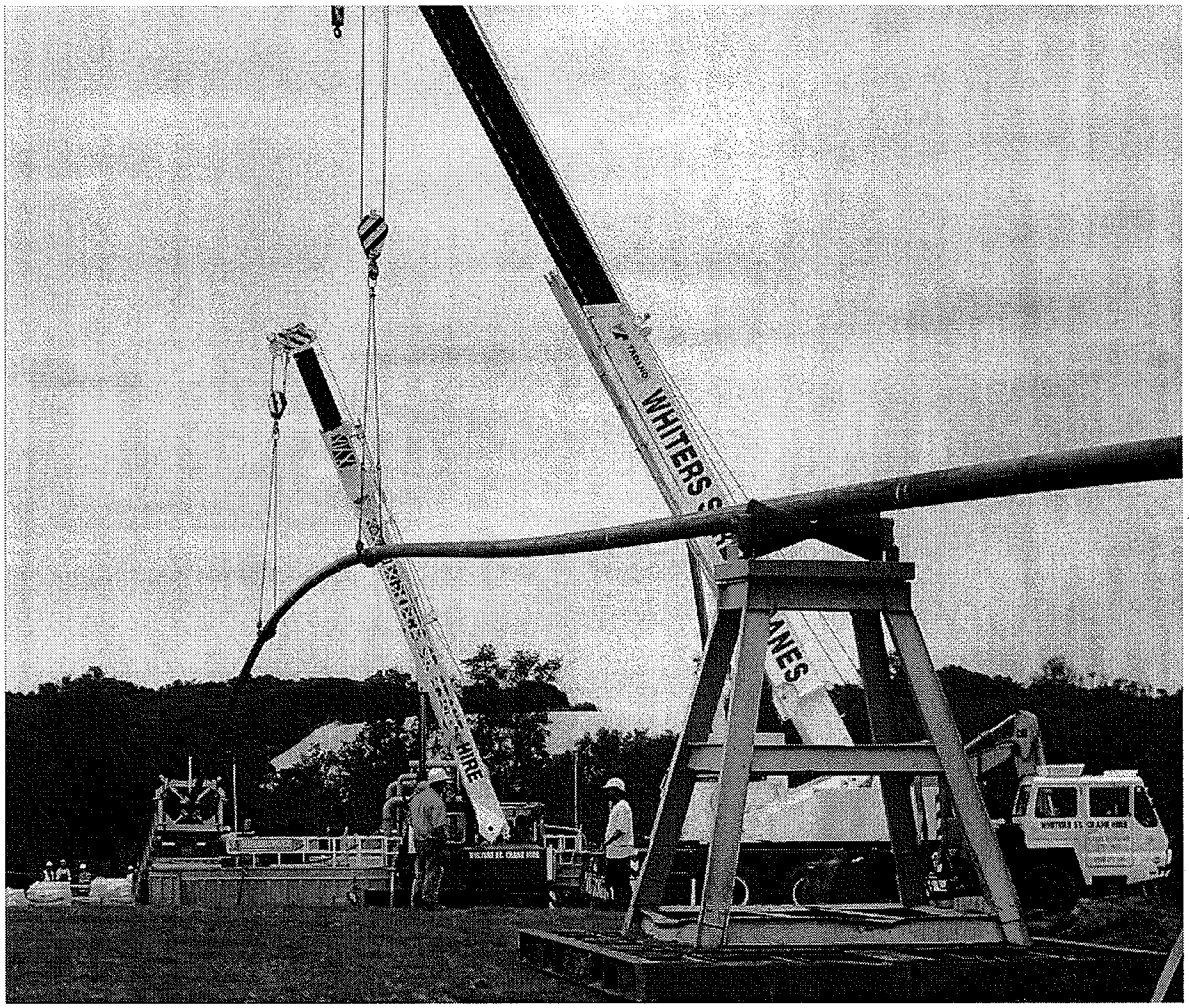


Figure 3-6 Pushing the Pipe into the HDD Hole



4. COST ESTIMATES

4.1 Methodology

The cost estimate for the outfall installation has been developed using in-house WorleyParsons spreadsheets. The costs are built up based on estimated quantities for procurement and fabrication plus installation costs estimated on durations and unit rates.

Recent budget quotations have been sourced for the major cost items including pipeline material and coatings.

For other project components historical data held by WorleyParsons has been escalated to current day costs. Civil works have been calculated by estimating quantities and unit rates.

All of these costs are combined to give the raw installed cost estimate (direct costs). Bottom line factors have been applied to the installed cost to cover engineering, project management, spares, insurance, freight and certification to give the base estimate.

The cost estimate has been prepared based on the following data:

- Concept design information provided by Stearns & Wheler, LLC
- Construction methodology outlined in Section 3 above
- Budget quotes for materials

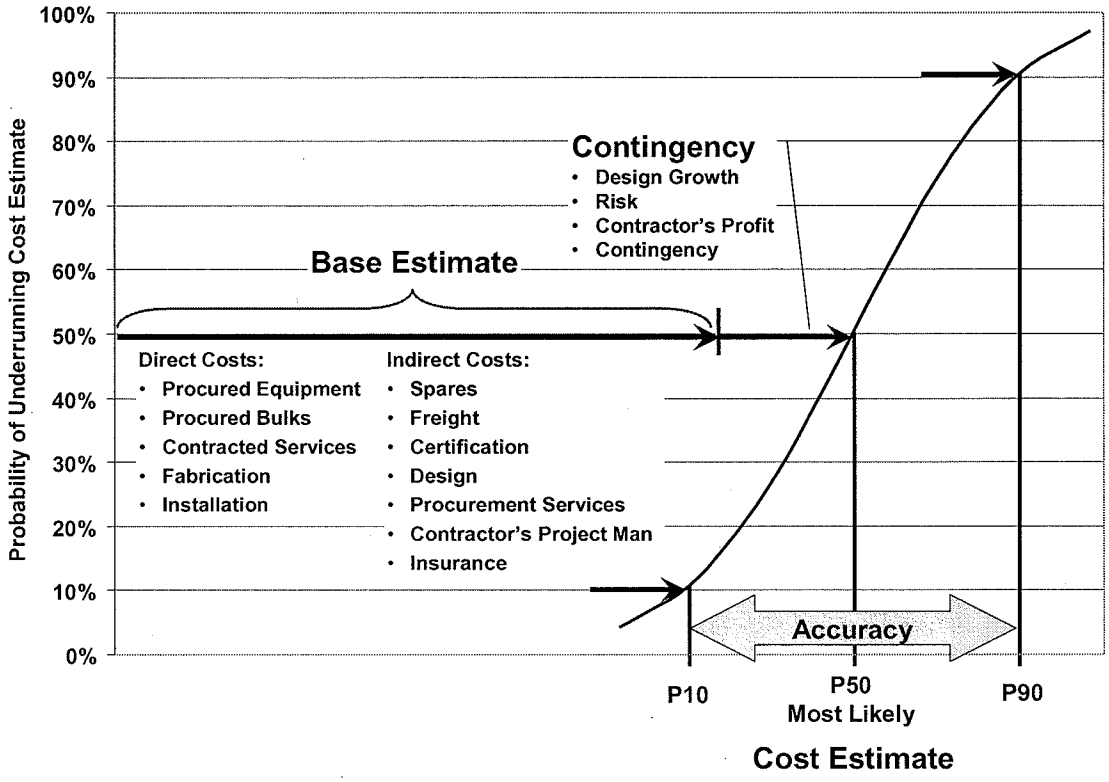
4.2 Estimate Accuracy and Contingency

The base cost is made up of procurement, labour and installation equipment plus allowances for engineering, project management; insurance, weather downtime etc added as a percentage of the base cost. A 30% contingency has been added to the bottom line to incorporate design growth allowances and allowances for risks and unknowns. The contingency factor is based on historical values for a project at the concept selection stage.

The contingency of 30% takes the base estimates up to a P_{50} or most likely estimate. The estimated accuracy range of +35% to -25% on the P_{50} number gives an upper P_{90} and lower P_{10} bound on the estimate. These costs are at 3rd quarter 2008 and do not include any allowance for escalation.

The graph below demonstrates the definitions of base estimate, contingency, P_{10}, P_{50} and P_{90} accuracy adopted by WorleyParsons.

Figure 4-1: Cost Probability Curve



4.3 Cost Estimate

A high level break down of cost by component is given in the Table 4-1. This table shows subtotals for the various components of the project and includes procurement, fabrication and installation, indirect costs and contingency.

A detailed breakdown of the cost estimates is included in Appendix 1.

Table 4-1: Cost Estimate Summary

	Costs in 1,000's USD		
Cost Component	**Trenched HDPE**	**Steel Pipe Partially trenched**	**HDD HDPE**
Line Pipe and fittings	568	1,399	568
Pipeline coatings		491	
Pipe backfill material	1,341	90	241
HDD drilling consumables			650
Onshore construction	2,856	4,181	10,296
Marine Construction	7,959	1,650	1,637
Subtotal direct costs	**12,724**	**7,811**	**13,392**
Engineering	1,018	625	1,071
Project management	1,272	781	1,339
Insurance & certification	382	234	402
30% Contingency	4,619	2,835	4,861
Total Cost P50	**20,015**	**12,286**	**21,066**
P90 Cost	**27,020**	**16,586**	**28,439**

The cost estimates for the Trenched HDPE pipe (base case) and the HDD outfall are similar at approximately $20 million (P50). The cost for the steel outfall pipe which is only buried in the nearshore zone is significantly less at $12 million. The major difference is that the cheaper pipeline option does not have rock armour protection.

These costs are P50 numbers i.e. the most likely cost that has an equal chance of being over run as under run. The P90 numbers are P50 plus 35%, this is the cost that is judged to have a 90% chance of being under run.

4.4 Cost Assumptions

4.4.1 General

- All costs are in US Dollars
- Costs are at 4th Quarter 2008
- An exchange rate of 1 Australian Dollar = 0.8 US Dollars has been used where applicable

4.4.2 Exclusions

- No allowance has been made for Goods and Services Tax, import duties or other taxes
- No allowance has been made for escalation
- Owner's costs are not included
- Land purchase or rental costs are not included
- Operations and start up costs are not included

4.4.3 Bottom Line factors

- 2 % allowance on fabricated cost for FEED / preliminary design
- 6 % allowance on fabricated cost for detailed design
- 9 % allowance on fabricated cost for contractors' project management
- 2.5 % allowance on fabricated cost for insurance
- 0.5 % allowance on fabricated cost for certification and approvals
- 30 % contingency is included to cover for design growth, contractor's risk and contingency
- These factors are based on historical norms and are applied to all components of the estimate

4.4.4 Material and Fabrication

- Pipeline costs HDPE at $2960 per tonne based on vendor quotation
- Steel pipeline material cost $2,600 per tonne
- Steel pipe corrosion coating $40 per m^2
- Steel pipe concrete coating $950 per m^3
- Onsite labour rate of USD100 per hour, inclusive of site allowance, all tools, consumables, overheads and site supervision

- Rock bedding and fill material supply $40 per m^3
- Rock ballast and armour supply $35 per m^3
- Sheet piling installed cost $360 per m^2

4.4.5 Construction Equipment

Spread rates are inclusive of equipment hire, labour, fuel and consumables

- HDD spread rate $80,000 per day
- Dredge spread rate $120,000 per day
- Dredge rate 250 m^3/hour, operating 12 hours per day
- Back fill spread rate, cargo barge with grab crane, $40,000 per day
- Workboat day rate $35,000 per day
- Diving spread rate $35,000 per day
- All marine equipment mobilisation from East Coast USA
- Weather and equipment downtime allowed at 50% of the estimated duration for the work

5. OPTION COMPARISON AND SENSISIVITIES

5.1 Steel Pipe versus HDPE

The base case estimate has been based on using a HDPE pipe for the outfall. The HDPE pipe is significantly cheaper than steel pipe and with corrosion coating and weight coat added the cost of the steel pipe increases further. The table below gives a comparison of the key material characteristics and costs.

Table 5-1: HDPE Vs Steel Pipe Comparison

Differentiator	HPDE	Carbon Steel
Diameter	24"	24"
Wall thickness	1 ¾" (45 mm)	½" (12.7 mm)
Material density	950 kg/ m^3	7,850 kg/ m^3
Weight	76 kg/m, 51lb/foot	278 kg/m, 187lb/foot
Specific Gravity (SG) empty	0.25	0..62
SG full of water	0.98	1.5
SG full with 1" concrete	NA	2.1
SG full with 2" concrete	NA	2.6
Bare pipe cost	$285/m, $87/foot	$667/m, $$205/foot
Corrosion coating	NA	$70/m, $20/foot
Concrete coating 50 mm	NA	$115/m, $35/foot
Total pipe plus coating cost	$285/m, $87/foot	$852/m, $260/foot
Total P50 cost	$20 million	$12 million
Corrosion and abrasion resistance	Best	Requires coatings
Dredging works	Required for the full length	Only required at the shore section

- HDPE has less structural integrity, making it more susceptible to damage during installation
- HDPE is buoyant when flooded making it more difficult to control during installation

- Steel pipe requires corrosion protection
- HDPE has better corrosion and abrasion resistant properties
- The HDPE pipe is fully armoured and protected, whereas the steel pipe would be stable but not buried for its full length so would be exposed on the sea bed.

5.2 Excavated Trench versus HDD

Differentiator	Excavate and Bury	HDD
Technically feasible	Yes	Yes
Previous application in similar environment and soils	Yes	Yes
Site access requirement	Requires large area across beach	Smaller area required confined to behind the beach
Trench stability	Requires sheet piling for first 500 feet	No sheet piling required
Weather impact	Extensive marine works requiring work in the surf zone which is highly weather sensitive	Only the diffuser installation is weather dependent, minimising weather impact
Water turbidity/sediments	Large amount of excavation and dredging	No near shore dredging or rock dumping would be required, only in the diffuser area
Impact on local beach users	Large impact beach will need to be closed off to the public for a significant period	Work confined to an area behind the beach
Cost	Approx $20 million	Approx $20 million

In summary the HDD and trench and excavate would cost a similar amount for the HDPE pipe option. Both methods would provide similar protection to the outfall pipe. The HDD option would have much less impact on beach users and less environmental impact with minimal dredging. The HDD methodology would be less likely to be impacted by bad weather.

The key downside of the HDD is that it is very dependent on the rocks or soils through which the drilling is to take place. Very hard soils, very weak soils or underground hollows could cause significant delays and cost increases. A brief investigation of the local geological conditions indicates

that the HDD method may be feasible at Rehoboth Beach. It is essential, however, that detailed geological investigations be carried out to ensure HDD would be suitable for this location.

6. FINDINGS AND RECOMENDATIONS

6.1 Design Comments

A brief review of the design was carried out, a few points which could be optimised for ease of construction or improved design are:

- The Y configuration of the diffuser makes the installation much more complex to install, a straight section would provide adequate diffusion of the effluent and halve the installation effort. WorleyParsons experience indicates that the diffuser nozzles could be located closer together on a straight section of pipe and achieve adequate dispersion.
- The diffuser section of the pipe is protected by rock armouring with the diffuser nozzles with in the rock material. With this configuration it is likely that the nozzles would be damaged during installation of the rock. A diffuser weighted by stabilisation mats or weight collars would be stable and simpler to install, flush nozzles would minimise the potential for damage.
- The shore section of the outfall has 5' of cover over the pipe. There is likely to be significant surf in this zone and 5' cover may not be adequate to protect the pipe from shifting sands in the surf zone, detailed stability analysis would be required if this option is progressed.
- The location chosen for the shore crossing is in a residential area and is very restricted in size for construction equipment and making up the pipeline. Ideally a long narrow plot is required so that a long sections of pipe can be made up to minimise the number of welds required during the pipeline pull. To provide this the pipe may have to be made up along a 1 km section of the beach or a road behind the site be closed off to traffic for a period while the pipe is being made up and pulled out to see. Another alterative would be to tow the pipeline from another location further along the coast.

6.2 Recommendations

- A straight section of diffuser be adopted rather than the Y configuration
- The diffuser nozzles are flush to the pipe to minimise the risk of damage.
- The diffuser section to be stabilised by weight to the pipe or piles rather than rock burial
- The shore crossing be made by HDD, it is similar in cost to the open trench but has a much lower risk for installation and environmental impact. The HDD option would:
    - minimise dredging and environmental impact of dredge cuttings
    - not require beach excavation or sheet pile works, the beach would remain the same and not have any rock protection visible.

- minimise exposure to weather downtime

- Thorough geotechnical investigations should be carried out to ensure the chosen solution is viable for the soils at the site.

Appendix 1 - Cost Estimate Details

WorleyParsons
resources & energy

Project Number 401010-00438
Date 22-Oct-08
Rev A
By Antony Perri
Check 0

Horizontal Directional Drill Cost Estimate
Rehoboth Beach Ocean Outfall

File: C:\Documents and Settings\antony.perri\My Documents\Home Work\Rehoboth bay\report\[Rehoboth Beach Outfall 15 Oct 08.xls]cost basis

Outfall pipe and diffuser HDPE

LENGTH PIPELINE 1830m plus 2 by 200 m diffusers	km	2.230		
Pipeline Details				
PIPELINE OUTSIDE DIAMETER	in (nom.)	24	mm	609.6
PIPELINE WALL THICKNESS	in	1.77	mm	45.0
CONC.COAT THICKNESS (High Density @ 3044 kg/m^3)	in	0.0	mm	0.0
PIPELINE MATERIAL		HDPE		

PROCUREMENT

LINEPIPE TYPE			LINE PIPE OD (mm)	Wall Thick. (mm)	WEIGHT kg/m	CONC. COAT (mm)
Pipeline			609.6	45.0	75.8	0.0

MATERIAL REQUIREMENTS	mm	km	QUANTITY	UNIT	Rate (US$*1000)	COST (US$*1000)
Pipeline material	45	2.23	169	Tonnes	3.0	501
Anti-Corrosion Coating			4,399	M2	0.0	-
Field joint coating			186	Unit	0.0	-
Concrete Coating - Thickness (mm), Length (km)	0.0	2.23	-	M3	0.0	-
Cathodic Protection			-	Tonnes	5.0	-
Handling at coating yard			169	Tonnes	0.0	-
Outlet nozzles			52	off	0.1	5
Outlet check valves			52	off	0.2	10
Flanges			12	off	1.5	18
Transport of Linepipe to Site			169	Tonnes	0.2	34
Bedding material at diffusers	Area m2	0.9	360	m3	0.040	14
Back fill at diffusers	Area m3	2.8	1,120	m3	0.040	45
Ballast Rock at diffusers	Area m4	8.2	3,280	m3	0.035	115
Armor rock at diffusers	Area m5	4.75	1,900	m3	0.035	67
Bentonite			200	Tonnes	1.5	300
Cutters / Hole Openers			1	unit	350	350
PROCUREMENT COST TOTAL						**1,458**

HDD CONSTRUCTION

CONSTRUCTION ACTIVITIES	QUANTITY	UNIT	RATE	COST (USD$,000)
Site Set Up clear and level area	300	m2	10	3
Site Set Up fence site	250	m	75	19
Site offices 8 container 6 months	48	unit	600	29
Prepare / Weld Up HDPE Strings	2230	m	25	56
Mobilisation / Demobilisation of Drilling Equipment / Personnel	8.0	days	80,000	640
Drill Pipeline Bore Hole and back ream to 30"	110.0	days	80,000	8800
Install HDPE Pipeline in Bore Hole	5.0	days	80,000	400
Grouting works including mobilisation, demoblisation & materials	1.0	unit	350,000	350
HDD CONSTRUCTION				10296

Backfilling

Installation	QUANTITY	UNIT	RATE m3/h	DURATION(days)
Bedding material	360	m3	60	1
Back fill	1,120	m3	60	2
Ballast Rock	3,280	m3	60	5
Armor rock	1,900	m3	60	3
UNFACTORED VESSEL DURATION				11.1
WAITING ON WEATHER/EQUIPMENT DOWNTIME		%	50	5.6
TOTAL DREDGE Duration				16.7

Diving

Installation of diffuser sections	Qty	Unit	Rate Items per day	
Preparation Works, clean up at HDD exit set up rigging	5	day	1	5.00
Lower in and make up diffuer sections	8	Sections	2	4.0
Install weight on diffuser	60	ring weights	8	7.5
Survey & Clean up	2	day	1	2.00
UNFACTORED VESSEL DURATION				18.5
WAITING ON WEATHER/EQUIPMENT DOWNTIME		%	50	9.3
TOTAL DREDGE Duration				27.8

Marine Construction

Cargo barge for back fill material	16.7	40	666
Diving Spread for diffuser tie ins and HDD exit	27.8	35	971
CONSTRUCTION COST TOTAL			**11,934**
SUBTOTAL Procurement and Installation		US$k	**13,392**

DESIGN & CONSTRUCTION ENGINEERING	RATE %	COST (US$*1000)
	8.0	1,071.4
PROJECT MANAGEMENT (Contractors & Owners)	RATE %	COST (US$*1000)
	10.0	1,339.2
INSURANCE & CERTIFICATION	RATE %	COST (US$*1000)
	3.0	401.8
SUBTOTAL B	US$k	**2,812**
PROJECT CONTINGENCY (% RATE 30)	US$	4,861.3
TOTAL COST	US$k	**21,066**

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Project Number 401010-00438
Date 22-Oct-08
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Excavate and Fill Cost Estimate
Rehoboth Beach Ocean Outfall

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Outfall pipe and diffuser HDPE

LENGTH PIPELINE 1830m plus 2 by 200 m diffusers		km	2.230		
Pipeline Details					
PIPELINE OUTSIDE DIAMETER		in (nom.)	24	mm	609.6
PIPELINE WALL THICKNESS		in	1.77	mm	45.0
CONC.COAT THICKNESS (High Density @ 3044 kg/m^3)		in	0.0	mm	0.0
PIPELINE MATERIAL			HDPE		

PROCUREMENT

LINEPIPE TYPE			LINE PIPE OD (mm)	Wall Thick. (mm)	WEIGHT kg/m	CONC. COAT (mm)
Pipeline			609.6	45.0	75.8	0.0
MATERIAL REQUIREMENTS	mm	km	QUANTITY	UNIT	RATE	COST (US$*1000)
Pipeline material	45	2.23	169	Tonnes	3.0	501
Anti-Corrosion Coating			4,399	M2	0.0	-
Field joint coating			186	Unit	0.0	-
Concrete Coating - Thickness (mm), Length (km)	0.0	2.23	-	M3	0.0	-
Cathodic Protection			-	Tonnes	5.0	-
Handling at coating yard			169	Tonnes	0.0	-
Outlet nozzles			52	off	0.1	5
Outlet check valves			52	off	0.2	10
Flanges			12	off	1.5	18
Transport of Linepipe to Site (after Coating)			169	Tonnes	0.2	34
Bedding material	Area m2	0.9	2,007	m3	0.040	80
Back fill	Area m3	2.8	6,244	m3	0.040	250
Ballast Rock	Area m4	8.2	18,286	m3	0.035	640
Armor rock	Area m5	4.75	10,593	m3	0.035	371
PROCUREMENT COST TOTAL						**1,909**

Sheet piling, Excavation and shore based works

ACTIVITY	QUANTITY	Unit	RATE	COST (US$*1000)
Install sheet pile, 150 m by 8m by 2 sides	2,400	m2	0.360	864.00
Excavate trench, 200 m by 2.4 m deep by 3m wide	1,440	m3	0.050	72.00
Remove sheet piles	2,400	m2	0.050	120.00
Construction spread onshore 20 people plus equipment	45	days	40.000	1800.00
TOTAL Piling and excavation cost				**2,856**

Dredging operations

Dredge equipment	QUANTITY	UNIT	RATE	DURATION(days)
Dredge 6000 ft long 2.4 m deep , by 6 m wide average	32,112	m3		
Dredge rate		m3/hour	250	
Estimated duration		hours per day	12	10.7
UNFACTORED VESSEL DURATION				10.7
WAITING ON WEATHER/EQUIPMENT DOWNTIME		%	50	5.4
TOTAL DREDGE Duration				16.1

Backfilling

Installation	QUANTITY	UNIT	RATE m3/h	DURATION(days)
Bedding material	2,007	m3	60	3
Back fill	6,244	m3	60	10
Ballast Rock	18,286	m3	60	30
Armor rock	10,593	m3	60	18
UNFACTORED VESSEL DURATION				61.9
WAITING ON WEATHER/EQUIPMENT DOWNTIME		%	50	30.9
TOTAL DREDGE Duration				92.8

Diving

Installation of diffuser sections	Qty	Unit	Rate Items per day	
Lower in and make up diffuer sections	8	Sections	2	4.0
Install weight on diffuser	60	ring weights	8	7.5
UNFACTORED VESSEL DURATION				11.5
WAITING ON WEATHER/EQUIPMENT DOWNTIME		%	50	5.8
TOTAL DREDGE Duration				17.3

CONSTRUCTION

Dredge mobilisation & demobilisation	10.0	80	800
Dredge spread	16.1	120	1,927
Cargo barge for cuttings	26.1	15	391
Cargo barge for back fill material	92.8	40	3,713
Workboat/tug to pull the pipeline	15.0	35	525
Diving Spread for diffuser tie ins	17.3	35	604
CONSTRUCTION COST TOTAL			**10,815**

SUBTOTAL Procurement and Installation		US$k	12,724
DESIGN & CONSTRUCTION ENGINEERING	RATE %		COST (US$*1000)
	8.0		1,017.9
PROJECT MANAGEMENT (Contractors & Owners)	RATE %		COST (US$*1000)
	10.0		1,272.4
INSURANCE & CERTIFICATION	RATE %		COST (US$*1000)
	3.0		381.7
SUBTOTAL B		US$k	2,672
PROJECT CONTINGENCY	% RATE 30		4,618.8
TOTAL COST		US$k	20,015

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resources & energy

Project Number 401010-00438
Date 22-Oct-08
Rev A
By Antony Perri
Check 0

Excavate and Fill Cost Estimate
Rehoboth Beach Ocean Outfall

File: C:\Documents and Settings\antony.perri\My Documents\Home Work\Rehoboth bay\report\[Rehoboth Beach Outfall 15 Oct 08.xls]cost basis

Outfall pipe and diffuser HDPE

LENGTH PIPELINE 1830m plus 2 by 200 m diffusers	km	2.230

Pipeline Details

PIPELINE OUTSIDE DIAMETER	in (nom.)	24	mm	609.6
PIPELINE WALL THICKNESS	in	0.50	mm	12.7
CONC.COAT THICKNESS (High Density @ 3044 kg/m^3)	in	2.4	mm	60.0

PIPELINE MATERIAL: Carbon steel

PROCUREMENT

LINEPIPE TYPE			LINE PIPE OD (mm)	Wall Thick. (mm)	WEIGHT kg/m	CONC. COAT (mm)
Pipeline			609.6	12.7	186.9	60.0

MATERIAL REQUIREMENTS	mm	km	QUANTITY	UNIT	RATE	COST (US$*1000)
Pipeline material delivered to coating yard	12.7	2.23	417	Tonnes	2.600	1,084
Anti-Corrosion Coating			4,399	M2	0.040	176
Field joint coating			186	Unit	0.100	19
Concrete Coating - Thickness (mm), Length (km)	60.0	2.23	290	M3	0.950	275
Cathodic Protection			4	Tonnes	5.000	21
Handling at coating yard			417	Tonnes	0.050	21
Outlet nozzles			52	off	0.100	5
Outlet check valves			52	off	0.200	10
Flanges			12	off	1.500	18
Transport of Linepipe to Site (after Coating)			1,302	Tonnes	0.2	260
Bedding material shore section only	Area m2	0.9	135	m3	0.040	5
Back fill, shore section only	Area m3	2.8	420	m3	0.040	17
Ballast Rock, shore section only	Area m4	8.2	1,230	m3	0.035	43
Armor rock, shore section only	Area m5	4.75	713	m3	0.035	25
PROCUREMENT COST TOTAL						**1,980**

Sheet piling, Excavation and shore based works

ACTIVITY	QUANTITY	Unit	RATE	Cost k USD
Install sheet pile, 150 m by 8m by 2 sides	2,400	m2	0.360	864.00
Excavate trench, 200 m by 2.4 m deep by 3m wide	1,440	m3	0.050	72.00
Remove sheet piles	2,400	m2	0.050	120.00
Back fill trench	2,498	m3	0.050	124.88
Construction spread onshore 30 people plus equipment	50	days	60.000	3000.00
TOTAL Piling and excavation cost				**4,181**

Dredging operations

Dredge equipment	QUANTITY	UNIT	RATE	DURATION(days)
Dredge 6000 ft long 2.4 m deep , by 6 m wide average	-	m3		
Dredge rate		m3/hour	250	
Estimated duration		hours per day	12	0.0
UNFACTORED VESSEL DURATION				0.0
WAITING ON WEATHER/EQUIPMENT DOWNTIME		%	50	0.0
TOTAL DREDGE Duration				0.0

Backfilling

Installation	QUANTITY	UNIT	RATE m3/h	DURATION(days)
Bedding material		m3	60	-
Back fill		m3	60	-
Ballast Rock		m3	60	-
Armor rock		m3	60	-
UNFACTORED VESSEL DURATION				0.0
WAITING ON WEATHER/EQUIPMENT DOWNTIME		%	50	0.0
TOTAL DREDGE Duration				0.0

Diving

Installation of diffuser sections	Qty	Unit	Rate Items per day	
Lower in and make up diffuer sections	8	Sections	1	8.0
Install weight on diffuser	-	ring weights	8	-
UNFACTORED VESSEL DURATION				8.0
WAITING ON WEATHER/EQUIPMENT DOWNTIME		%	50	4.0
TOTAL DREDGE Duration				12.0

CONSTRUCTION

Dredge mobilisation & demobilisation	0.0	80	-
Dredge spread	0.0	120	-
Cargo barge for cuttings	0.0	15	-
Cargo barge for back fill material	10.0	60	600
Workboat/tug to pull the pipeline	15.0	35	525
Diving Spread for diffuser tie ins	15.0	35	525
CONSTRUCTION COST TOTAL			**5,831**

SUBTOTAL Procurement and Installation	**US$k**	**7,811**

DESIGN & CONSTRUCTION ENGINEERING	RATE %	COST (US$*1000)
	8.0	624.9

PROJECT MANAGEMENT (Contractors & Owners)	RATE %	COST (US$*1000)
	10.0	781.1

INSURANCE & CERTIFICATION	RATE %	COST (US$*1000)
	3.0	234.3

SUBTOTAL B	**US$k**	**1,640**

PROJECT CONTINGENCY	% RATE	30	2,835.3
TOTAL COST	**US$k**		**12,286**

Appendix D
Pump Station and Force Main Pump Information and Cost Estimate

STEARNS & WHELER LLC
Environmental Engineers & Scientists

Item	Description	Quantity	Units	Unit Price	Installation Factor	Total	Source
Pump Station							
Modifications to Re-Aeration Tanks							
	Steel Beams to Support Walkway / Pumps / Discharge Piping	102	LF	$35	1.20	$4,284	RS Means 2008 - Site Work and Landscape Cost Data
	Steel Decking	180	SF	$30	1.20	$6,480	RS Means 2008 - Site Work and Landscape Cost Data
	Handrails	102	LF	$75	1.20	$9,180	RS Means 2008 - Site Work and Landscape Cost Data
	Misc Support and Anchors	1	EA	$5,000	1.40	$7,000	
	Concrete fill to slope floor	40	CY	$225	1.20	$10,800	RS Means 2008 - Site Work and Landscape Cost Data (03 30 53.4 6050)
	Misc. Electrical Work	1	EA	$5,000	1.00	$5,000	
	Discharge Piping						
	12" Fittings - 90 Deg Bends	3	EA	$550	1.30	$2,145	Star Pipe Products Catalogue
	12" x 24" Increaser	3	EA	$3,100	1.30	$12,090	Star Pipe Products Catalogue
	Spool Pieces	12	EA	$300	1.30	$4,680	
Pumps							
	Fairbanks Morse Model 19A, 1 Stage (60 HP)	3	EA	$36,000	1.30	$140,400	Fairbanks Morse Pump Rep
	Variable Speed Drives	3	EA	$17,000	1.30	$66,300	AMES email quote 10/31/08
	Level Sensors	1	LS			$5,000	
	Controls	1	LS			$60,000	Tim Reardon - 30k panels / 30k programming
Force Main to Connection							
	24" Pipe	600	LF	$190	1.00	$0	
	Pile supports	1	LS	$14,000	1.00	$0	
	TOTAL					$333,359	
	ADOPT					**$340,000**	

Item	Description	Quantity	Units	Unit Price	Installation Factor	Total	Source
Forcemain to Beach						**Sub-Total**	**#REF!**
	24" Pipe	12100	L.F.	$190.00	1.00	$2,299,000	2006 Project by WRA - 13,000 ft of 24" FM - 2 bids $160/LF and $230/LF
	24" Fittings - 45 Deg Bends	3	EA	$4,100	1.00	$12,300	RS Means 2008 - Site Work and Landscape Cost Data
	24" Fittings - 90 Deg Bends	2	EA	$5,100	1.00	$10,200	RS Means 2008 - Site Work and Landscape Cost Data
	Air Release Valves	5	EA	$7,000	1.00	$35,000	Estimate from projects recently bid in region (with WRA)
	Horizontal Boring under Rehoboth Ave	100	LF	$750	1.00	$75,000	RS Means 2008 - Site Work and Landscape Cost Data - Confirmed from Rockland Bids
	Prepare jacking pits	2	EA	$4,000	1.00	$8,000	RS Means 2008 - Site Work and Landscape Cost Data
	Site Restoration	1	LS	$40,000	1.00	$40,000	Review of canvass of bids from recent sewer projects
	Maintenance of Traffic	1	LS	$40,000	1.00	$40,000	Review of canvass of bids from recent sewer projects
	Sediment Control	1	LS	$40,000	1.00	$40,000	Review of canvass of bids from recent sewer projects
	TOTAL					$2,559,500	
	ADOPT					**$2,560,000**	

Pumping Station Hydraulics

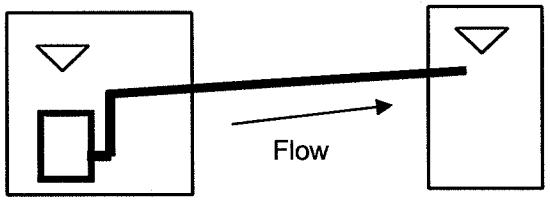
Date: Calc By:

Revised: **CENTRIFUGAL PUMP CONFIGURATION** Checked:

Elevation Head Data

Elevation Changes Discharge Side	
Pump Discharge Centerline	9
Forcemain Discharge Elevation	12
Elevation Change:	3 feet
Elevation Changes Suction Side	
Suction Pipe Invert	9
Pump Discharge Centerline	17
Elevation Change:	8 feet
Suction Pipe Invert	9
Pump Well Water Elevation	13
Elevation Change:	-4 feet
Total Static Head----------->	**7**

Pump Well



$f = (0.2083 (100/C)^{1.852} Q^{1.852} / di^{4.8655})(L/100)$

f = friction head loss in feet of water
C = Hazen-Williams roughness constant
Q = volume flow (gal/min)
di = inside diameter (inches)

Hazen Williams Friction Factor C=	**100**

Fitting Losses:
$f_L = K(V^2)/2g$

PIPING INFORMATION (Friction Losses)

Suction Piping

Pipe Size (Diameter, in)	24 in
Pipe Length (ft)	5 ft
Pipe Size (Diameter, in)	24 in
Pipe Length (ft)	0 ft

Pumping Station Hydraulics

Date: Calc By:

Discharge Piping

Pipe Size (Diameter, in) - ***(Force Main)***	24 in
Pipe Length (ft)	12,038 ft
Pipe Size (Diameter, in) **(Outfall)**	24 in
Pipe Length (ft)	6,000 ft
Pipe Size (Diameter, in)	6 in
Pipe Length (ft)	0 ft

Fitting & Bend Data (Minor Losses)

Suction Side Fittings	*QTY*	*K-Value*	*Effective K*
24-Inch Fittings	Fitting Diameter -> **10**		
Reducer 12" to 10"	1	0.25	0.25
Entrance	1	1	1
	0		0
12-INCH FITTING K-VALUE TOTAL			**1.25**
10-Inch Fittings	Fitting Diameter -> **10**		
	0		0
10-INCH FITTING K-VALUE TOTAL			**0**

Pumping Station Hydraulics

Date: Calc By:

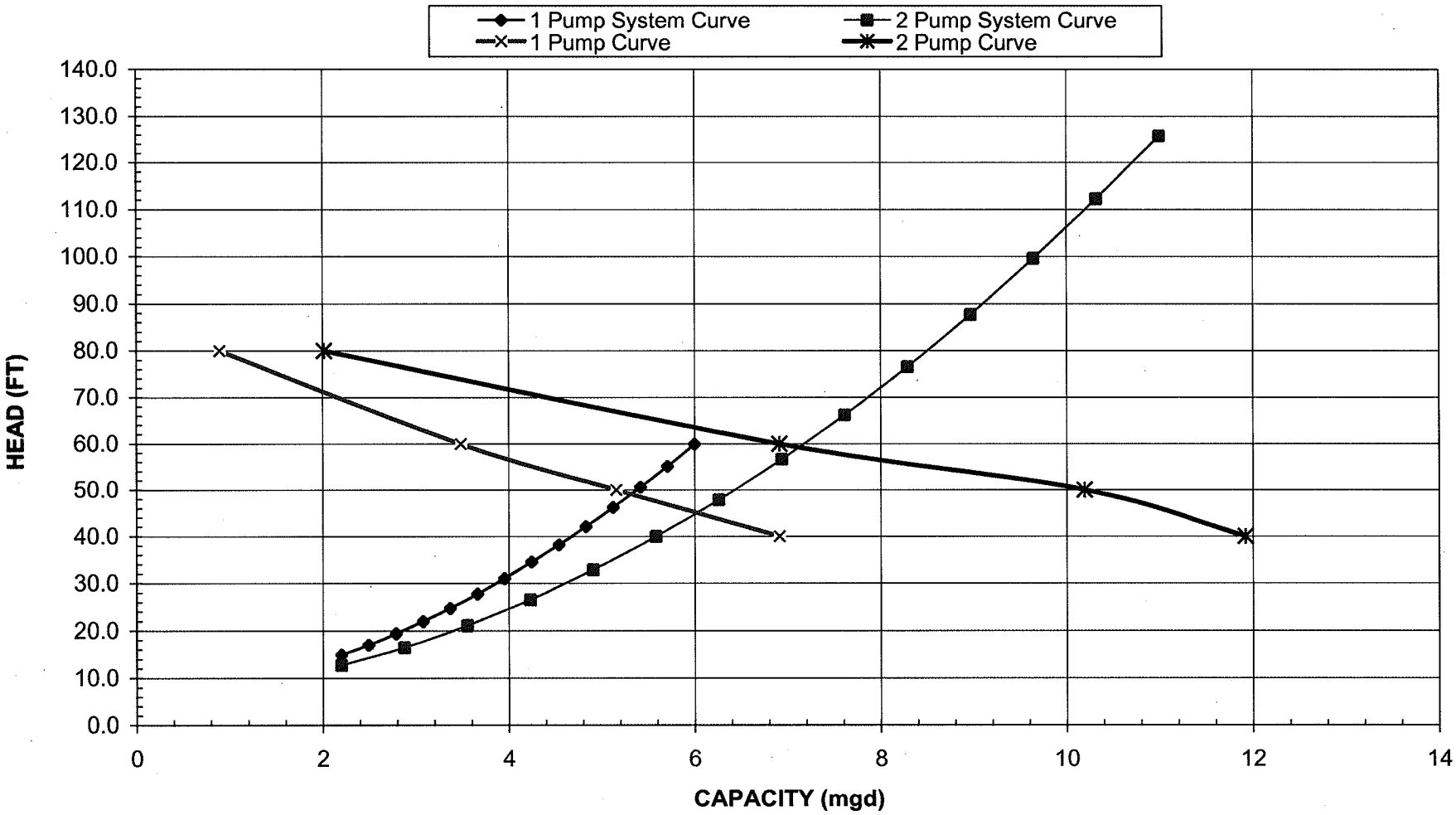
Discharge Side Fittings	*QTY*	*K-Value*	*Effective K*
12-Inch Fittings	Fitting Diameter -> **12**		
45 Deg Bend	4	0.21	0.84
12x14x14 Wye	1	0.5	0.5
	0		0
	0		0
12-INCH FITTING K-VALUE TOTAL			**1.34**
10-Inch Fittings	Fitting Diameter -> **10**		
	0		0
	0		0
	0		0
	0		0
10-INCH FITTING K-VALUE TOTAL			**0**
14-Inch Fittings ***(Force Main)***	Fitting Diameter -> **14**		
Check Valve	1	5.2	5.2
Gate Valve	1	0.1	0.1
12x14 Increaser	1	0.03	0.03
90 Deg Bend	1	0.26	0.26
8x12 reducer	1	0.06	0.06
Pipe Exit	1	1	1
14-INCH FITTING K-VALUE TOTAL			**6.65**

System Curves

Flow (GPM)	Elevation Loss Discharge	Pipe Friction Loss Suction	Pipe Friction Loss Discharge	Fitting-Bend Loss Suction	Fitting-Bend Loss Discharge	Total Static and Dynamic Head Loss
	1 PUMP					
1528	7	0.00	5.71	0.76	1.44	14.9
1731	7	0.00	7.19	0.97	1.84	17.0
1934	7	0.00	8.83	1.21	2.30	19.3
2137	7	0.00	10.62	1.48	2.81	21.9
2340	7	0.00	12.57	1.77	3.37	24.7
2543	7	0.00	14.66	2.09	3.98	27.7
2746	7	0.00	16.90	2.44	4.64	31.0
2949	7	0.01	19.29	2.82	5.36	34.5
3152	7	0.01	21.82	3.22	6.12	38.2
3355	7	0.01	24.49	3.64	6.93	42.1
3558	7	0.01	27.30	4.10	7.80	46.2
3761	7	0.01	30.26	4.58	8.71	50.6
3964	7	0.01	33.35	5.09	9.68	55.1
4167	7	0.01	36.59	5.62	10.69	59.9
	2 PUMPS					
1528	7	0.00	4.33	0.19	1.14	12.7
1998	7	0.00	7.12	0.32	1.96	16.4
2468	7	0.00	10.53	0.49	2.99	21.0
2938	7	0.00	14.55	0.70	4.23	26.5
3408	7	0.00	19.15	0.94	5.70	32.8
3878	7	0.00	24.33	1.22	7.37	39.9
4348	7	0.00	30.07	1.53	9.27	47.9
4818	7	0.00	36.37	1.88	11.38	56.6
5288	7	0.00	43.21	2.26	13.71	66.2
5759	7	0.01	50.59	2.68	16.26	76.5
6229	7	0.01	58.51	3.14	19.02	87.7
6699	7	0.01	66.95	3.63	22.00	99.6
7169	7	0.01	75.91	4.16	25.20	112.3
7639	7	0.01	85.38	4.72	28.61	125.7
	3 PUMPS					
2000	7	0.00	6.68	0.14	1.87	15.7
2200	7	0.00	7.97	0.17	2.26	17.4
2400	7	0.00	9.36	0.21	2.69	19.3
2600	7	0.00	10.86	0.24	3.16	21.3
2800	7	0.00	12.46	0.28	3.66	23.4
3000	7	0.00	14.15	0.32	4.20	25.7
3200	7	0.00	15.95	0.37	4.78	28.1
3400	7	0.00	17.85	0.42	5.40	30.7
3600	7	0.00	19.84	0.47	6.05	33.4
3800	7	0.00	21.93	0.52	6.74	36.2
4000	7	0.00	24.11	0.58	7.47	39.2
4200	7	0.00	26.39	0.63	8.24	42.3
4400	7	0.00	28.77	0.70	9.04	45.5

Rehoboth Beach WWTP Pump Station

C=70



A.M.E.S., Inc.
8918 Herrmann Drive
Columbia, MD 21045

Rehoboth Beach, Delaware

Sussex County, MD

Engineer : Stearns & Wheler. LLC
One Remington Park Drive
Cazenovia, NY 13035
(P) (315) 655-8161

Preliminary Information Packet #01

Vertical Turbine Pumps

Fairbanks Morse Model 19A, 1 Stage Pump Unit

Submission Date: October 30, 2008

Information Packet Table of Contents

Clarifications

01) Efficiencies shown on data sheet curves are based on calculations made by our selection program and not from recorded data from actual pump tests. These efficiencies are provided for reference only. Efficiencies are only guaranteed when Fairbanks Morse reviews previously tested pump records and provides a written guarantee.

02) Pump dimensions on pump Dimensional Drawings are approximate. For guaranteed values, dimensional drawings must be signed by an engineer at Fairbanks Morse.

Scope of Supply

(3) Fairbanks Morse Pump Corporation Model 19A Single Stage Vertical Turbine Pump. Standard construction features include cast iron suction bell, bronze bowl bearings and sand collar, bronze impeller, bronze bowl and impeller wear rings, stainless steel pump shaft, open lineshaft lubrication, 12 inch steel column, above ground discharge head, sole plate, and strainer.

Design conditions = 3,472 GPM @ 50 Feet TDH

(3) US Motors 60 horsepower, 1180 RPM Premium Efficiency, hollow shaft, inverter duty motor having a TEFC enclosure. Capable of VFD operation.
460 volt / 3 phase / 60 hertz

Budgetary Pricing

PUMP UNITS

Pump Unit	$ 34,315.00	List Each
Quantity	x 3	
	$102,945.00	
Estimated Cost of Additional Services & Freight	+ $ 5,500.00	
TOTAL BUDGETARY PRICE	$ 108,445.00	

Pump Data Sheet - Fairbanks Morse Pump, 60 Hz

Company: AMES, Inc.
Name: Keith Slemp
Date: 10/30/2008

Stearns & Wheler, LLP
Rehobeth Beach , Delaware
Vertical Turbine Pumps

Fairbanks Morse
Pentair Water

Pump:

Size: 19A.1+ (1 stage)

Type: VERT.TURBINE
Synch speed: 1200 rpm

Speed: 1180 rpm
Dia: 13.9375 in

Curve: 12-155

Impeller:

Specific Speeds:

Ns: ---
Nss: ---

Dimensions:

Suction: ---
Discharge: 14 in

Vertical Turbine:

Bowl size: 18.5 in
Max lateral: 0.62 in
Thrust K factor: 32 lb/ft

Pump Limits:

Temperature: 150 °F
Pressure: 300 psi g
Sphere size: 1.25 in

Power: 431 hp
Eye area: ---

Search Criteria:

Flow: 3472 US gpm

Head: 50 ft

Fluid:

Water
Density: 62.25 lb/ft³
Viscosity: 1.105 cP

Temperature: 60 °F
Vapor pressure: 0.2563 psi a
Atm pressure: 14.7 psi a

NPSHa: ---

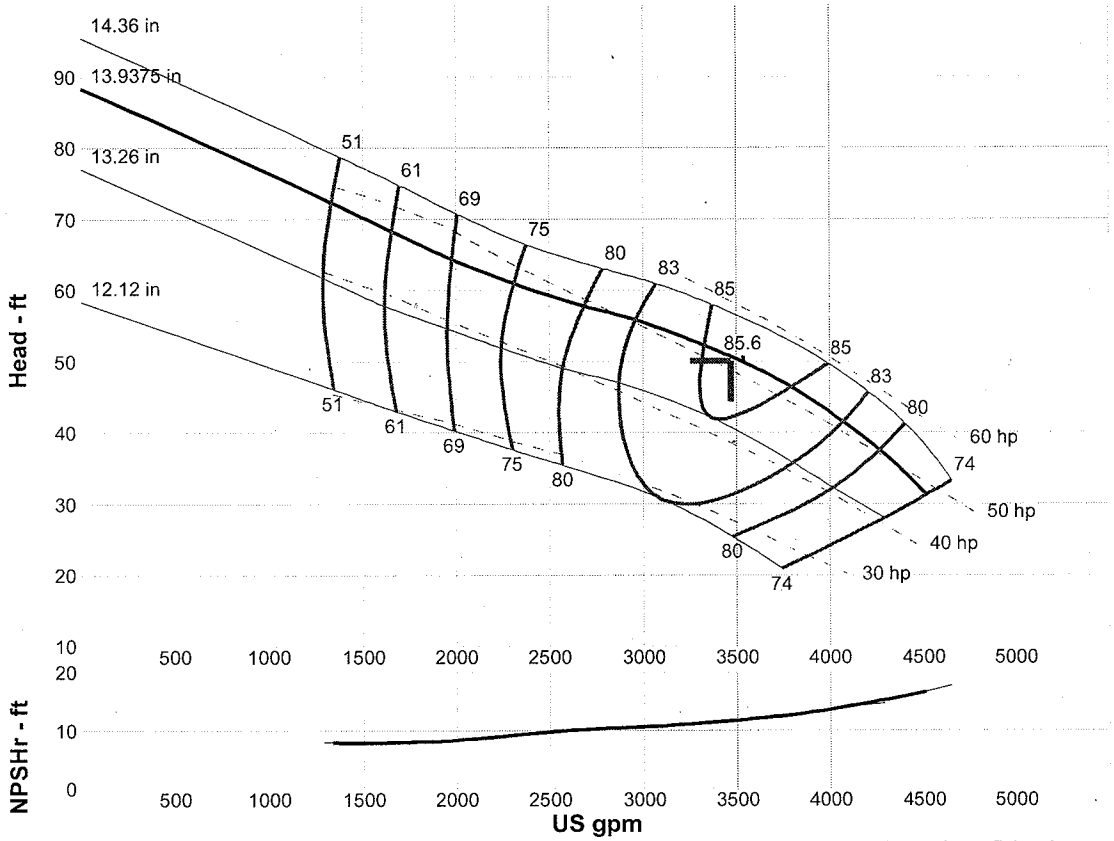
Motor:

Standard: NEMA
Enclosure: TEFC

Size: 60 hp
Speed: 1200
Frame: 404T

Sizing criteria: Max Power on Design Curve

---- Data Point ----	
Flow:	3472 US gpm
Head:	50.6 ft
Eff:	85.4%
Power:	51.9 hp
NPSHr:	11.7 ft
---- Design Curve ----	
Shutoff head:	88.4 ft
Shutoff dP:	38.2 psi
Min flow:	---
BEP:	85.6% @ 3536 US gpm
NOL power:	52.3 hp @ 3788 US gpm
-- Max Curve --	
Max power:	58.9 hp @ 3986 US gpm

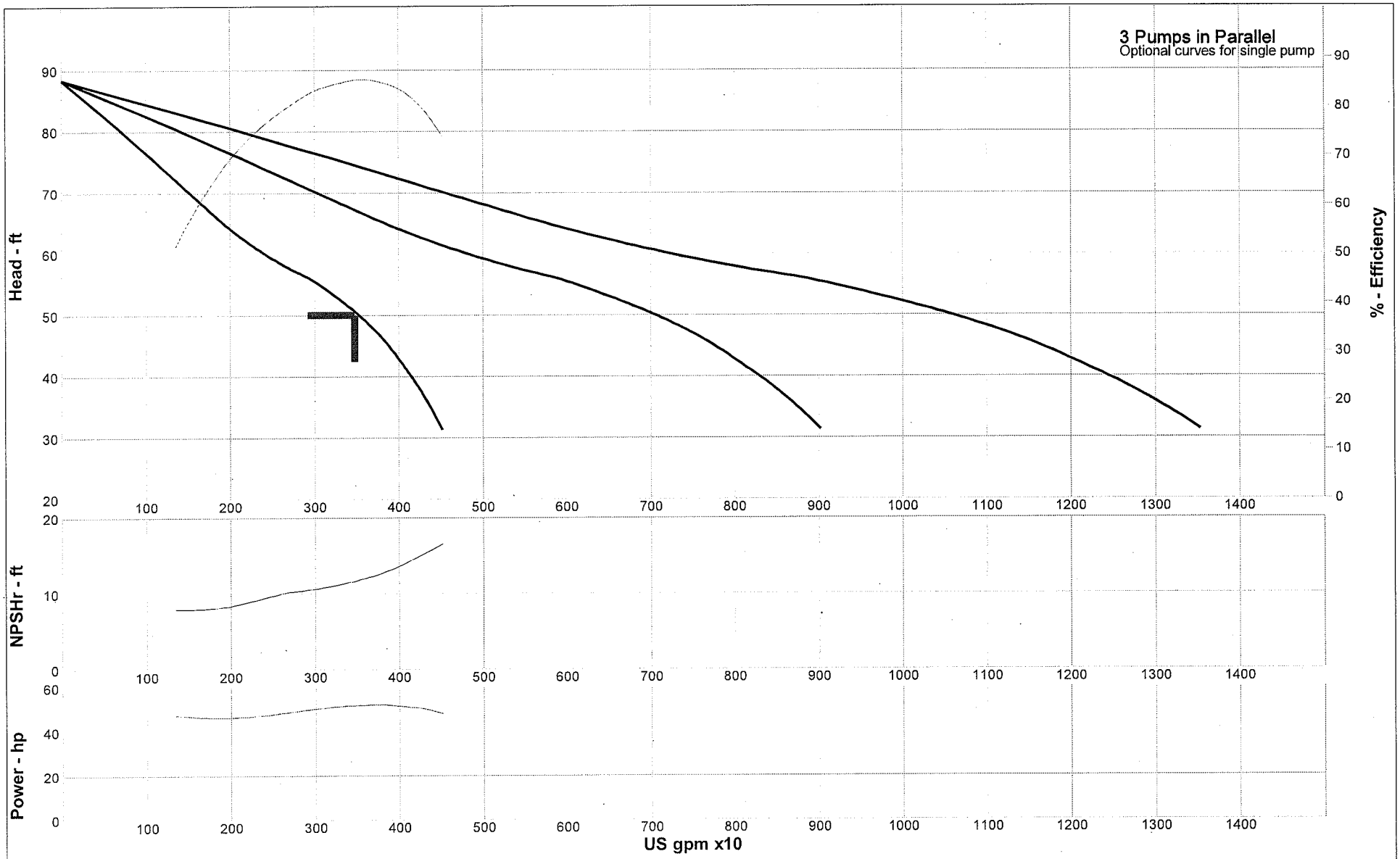


Curve efficiencies are typical. For guaranteed values, contact Fairbanks Morse or your local distributor. Las eficiencias en curvas son típicas. Para valores garantizados contacte a Fairbanks Morse o a su distribuidor local.

Performance Evaluation:

Flow US gpm	Speed rpm	Head ft	Efficiency %	Power hp	NPSHr ft
4166	1180	39.5	81.5	51	14.6
3472	1180	50.6	85.4	51.9	11.7
2778	1180	57.1	81.1	49.4	10.4
2083	1180	63.3	70.9	46.8	8.66
1389	1180	71.6	52.8	47.5	7.99

Selected from catalog: Fairbanks Morse Turbine.60 Vers: 3



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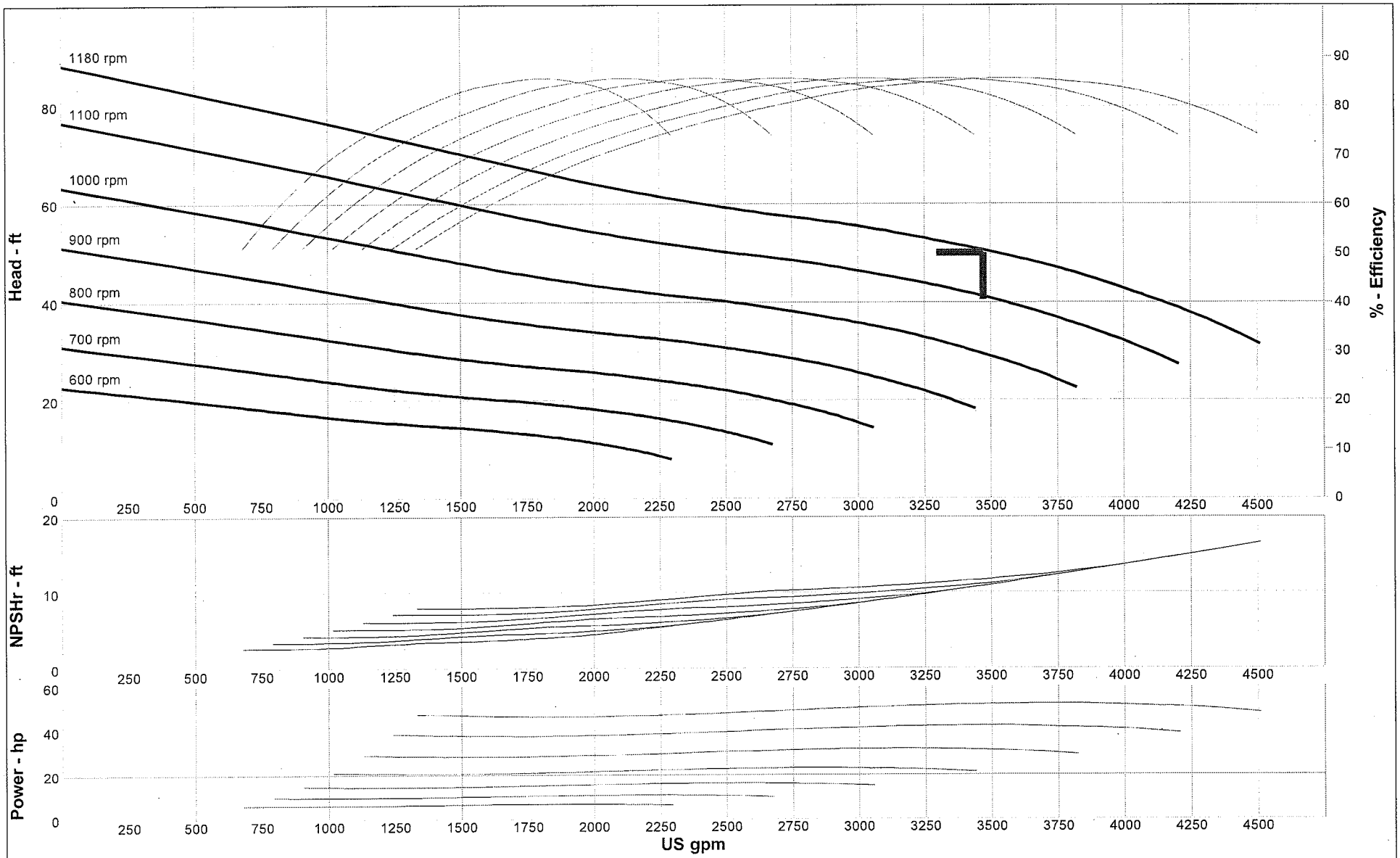
Company: AMES, Inc.
Name: Keith Slemp
10/30/2008

Fairbanks Morse Pump, 60 Hz
Catalog: Fairbanks Morse Turbine.60, Vers 3
VERT.TURBINE - 1200

Size: 19A.1+
Speed: 1180 rpm
Dia: 13.9375 in
Curve: 12-155

Fairbanks Morse
Pentair Water



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Size: 19A.1+
Speed: 600 - 1180 rpm
Dia: 13.9375 in
Curve: 12-155

Fairbanks Morse
Pentair Water

Fairbanks Morse
Pentair Pump Group

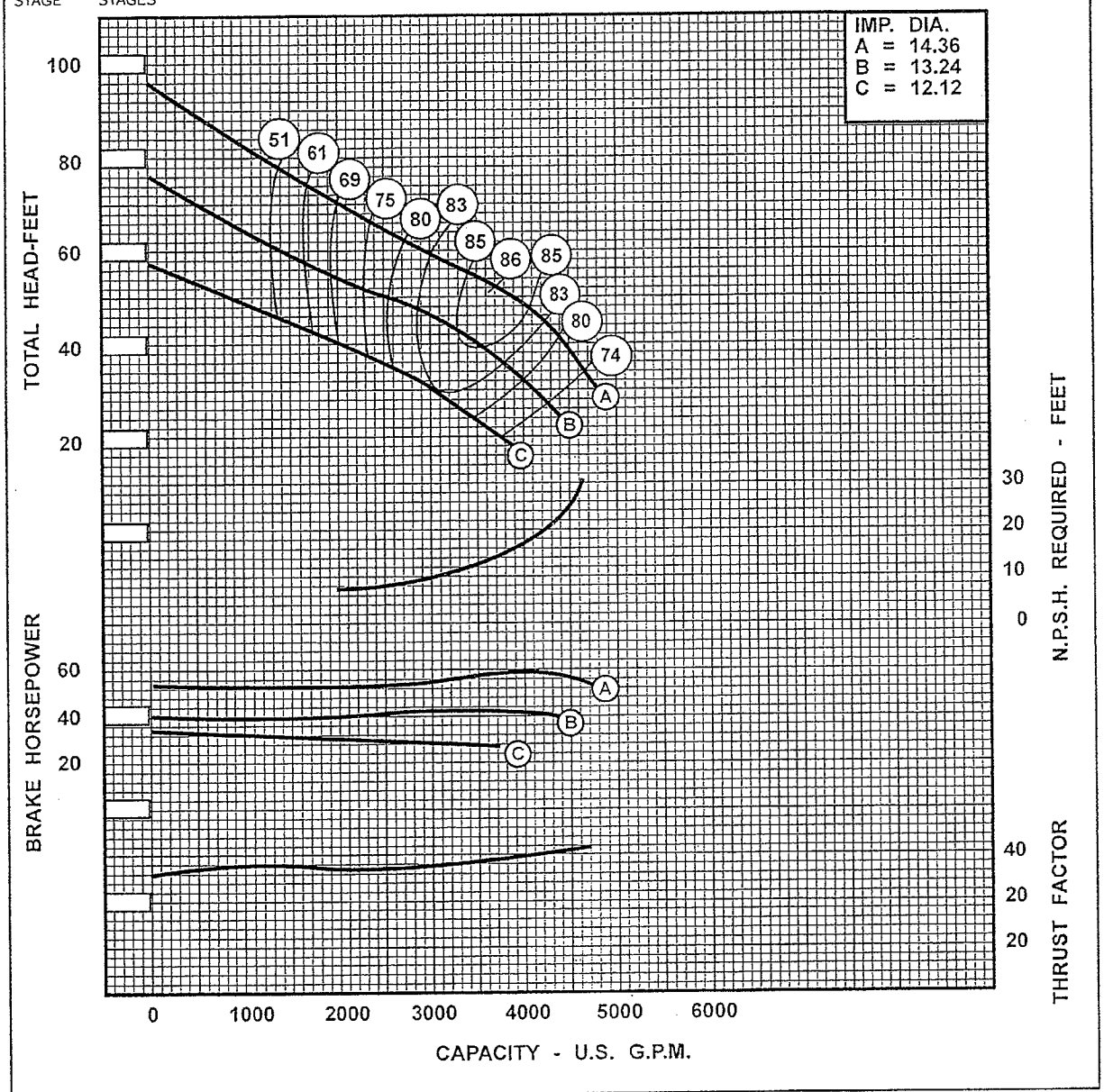
No. Stages	Eff. Change	MATERIAL	Eff. Change
1	0	IMP. - C.I.	-1
2		IMP. - NI-RI	-1
3		BOWL- BRZ.	-1
4		BOWL- NI-R.	-1

19 A — 1180 R.P.M.

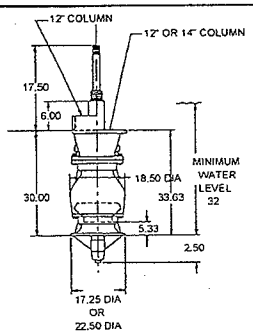
SINGLE STAGE LAB PERFORMANCE WITH STANDARD MATERIALS. EFFICIENCY SHOWN FOR 1 OR MORE STAGES. HORSE POWER SHOWN FOR ONE STAGE BASED ON 1 STAGE EFFICIENCY. CORRECTIONS SHOULD BE MADE FOR STAGES AND MATERIAL.

ONE STAGE ( ) STAGES

PUMP PERFORMANCE



Maximum Operating Speed	1800	Maximum Sphere Size - Inches	1.25
Pump Shaft Diameter – Inches	2.187	Thrust Factor – K_t	32
Bowl Weight, 1st Stage – Lbs.	610	WR^2	7.45
Bowl Weight, Ea. Add. Stage–Lbs.	350	Running Position (above seat)-In.	0.125
Allowable Shaft Stretch – Inches	0.62	Submergence- Inches	32
Maximum Working Pressure – PSI	300	Max. Bowl Brg Clearance-In.Dia.	0.010/0.011
Maximum Hydro Pressure – PSI	450	Max Wear Ring Clearance-In.Dia.	0.027
Impeller Eye Area – Sq. In.	69.50	Max Bowl O.D. – Inches	18.50
Rotor Weight 1st/add stages-(K_a)	100/80	Suct Bell O.D. – Inches	17.5/22.5
Add 17-5/8" per additional stage.		Maximum Number of Stages	7
Discharge - Inches	12, 14	Suction - Inches 17-1/4" or	22-1/2" Bell



7000 VERTICAL TURBINE PUMP SPECIFICATIONS
OPEN LINESHAFT CONSTRUCTION

PART 1. GENERAL

1.01 This specification includes the supply of ____ vertical turbine product lubricated open lineshaft pump(s). Each unit shall include a bowl assembly, suction strainer, column and open lineshaft, discharge head, sealing assembly and driver.

1.02 QUALITY ASSURANCE

A. All pumping equipment furnished under this Section shall be of a design and manufacture that has been used in similar applications, and it shall be demonstrated to the satisfaction of the Owner that the quality is equal to equipment made by that manufacturer specifically named herein.

B. Unit responsibility. Pump(s), complete with motor, necessary guards and all other specified accessories and appurtenances shall be furnished by the pump manufacturer to insure compatibility and integrity of the individual components, and provide the specified warranty for all components.

C. The vertical turbine pump(s) specified in this section shall be furnished by and be the product of one manufacturer.

D. Pumps are to be engineered and manufactured under a written Quality Assurance program. The Quality Assurance program is to be in effect for at least ten years, to include a written record of periodic internal and external audits to confirm compliance with such program.

E. Pump(s) are to be engineered and manufactured under the certification of ISO-9001:2000.

1.03 PERFORMANCE

A. The pump(s) shall be designed for continuous operation and will be operated continuously under normal service.

B. OPERATION CRITERIA

	Flow (GPM)	TDH (ft.)	Max. Pump Speed (RPM)	Max. Solids Passage	Max. Shutoff Head (ft.)	Minimum Submergence (inches)
Design Condition						
Secondary Condition						

C. Total dynamic head shall be as measured at the discharge of the pump and shall include velocity head and vertical static head from the minimum water level to the centerline of the pump discharge.

D. Minimum water level shall be at elevation _____ feet.

E. Pump(s) are to be mounted at _____ feet elevation with the sump floor at _____ feet elevation.

F. Pump discharge centerline shall be at _____feet elevation.

G. Maximum pump speed shall not exceed _____ RPM.

H. Driver size shall be limited to _____ HP maximum.

I. Liquid pumped is _____ with a maximum temperature of ___ deg. F.

PART 2, PRODUCTS

2.01 PUMPS

A. Manufacturers
1. Pump(s) shall be the product of Fairbanks Morse Pump.
2. Manufacturer shall have installations of like or similar application with a minimum of 5 years service for this pump size.

B. Design
1. Rotation
   a. The pump will be counterclockwise rotation when viewed from the driver end looking at the pump.
2. Impeller
   a. The impeller shall be of bronze construction conforming to ASTM B584, C83600. They shall be of one-piece construction, single suction, enclosed, and radial flow design. The waterways through the impeller shall have extremely smooth contours, devoid of sharp corners, so as to promote maximum efficiency.
   b. The impeller is to be balanced and secured to the shaft by means of a stainless steel drive collet for bowl sizes 18" diameter and smaller. For bowl sizes larger than 18" impellers shall be secured to the shaft using a combination of a thrust washer, key and/or snap rings.
   c. Impellers shall be adjustable by means of a top shaft-adjusting nut.

3. Bowls
   a. The bowls shall be made of close-grained cast iron conforming to ASTM A48 CL30. Castings shall be free from blowholes, sand holes and shall be accurately machined and fitted to close dimensions.
   b. Bowls 14" and above shall be flange connected. Bowls below 14" nominal diameter may use either flanged or threaded connections.
   c. Bowls shall be designed with smooth passages to ensure efficient operation. The interior shall be coated with Tnemec N140 Pota-Pox Plus, or equal, for bowl sizes 21" and below.
4. Impeller Shaft
   a. Impeller shaft shall be of stainless steel construction conforming to ASTM A582 (416 stainless steel).
   b. The shaft shall be supported by bronze or neoprene bearings located on both sides of each impeller.
   c. Impeller shaft coupling shall be of stainless steel construction conforming to ASTM A582 (416 stainless steel).
5. Wear Rings
   a. Wear rings shall be provided on both the impellers and bowls on bowls of nominal diameter of 8" or larger so that clearances can be maintained throughout the life of the rings and minimize recirculation.
   b. Impeller wear rings shall be of the radial-type.
   c. Bowl wear rings shall be of the radial-type.
   d. Wear rings shall be attached to the impellers and bowls using an interference fit and Loctite.
   e. Wear rings shall be bronze conforming to ASTM, B505 C93200.
6. Column
   a. Total length of discharge column shall be ___ feet, ____ inches.
   b. Column pipe shall be not less than ___ inches inside diameter and weigh not less than ___ pounds per foot.
   c. Column pipe in sizes 4" through 12" diameter shall be furnished in interchangeable sections not over ten feet in length, and shall be connected with threaded, sleeve-type couplings. Column pipe 14" diameter and larger shall be flanged and furnished in interchangeable sections not over ten feet in length.
   d. Threaded column sections shall be connected with threaded, sleeve-type couplings. Column joints are to be butted to insure perfect column alignment after assembly.
7. Lineshafts
   a. Lineshafting shall be of ample size to transmit the torque and operate the pump without distortion or vibration.
   b. Lineshafting shall be made of carbon steel conforming to AISI 1045 and be furnished in interchangeable sections not over ten feet in length.
   c. Lineshafting shall be coupled with extra-strong threaded steel couplings machined from solid bar steel.
   d. Lineshafting shall be fitted with stainless steel replaceable sleeves at each bearing and shall conform to AISI 304 material.
   e. Lineshaft bearings shall be of neoprene material construction.
   f. Lineshaft bearings shall be retained in bronze guides that are fitted into the column coupling and secured in place by the butted column pipe ends. (for column sizes larger than 16" retainers shall be steel and fabricated into the column assembly.
8. Discharge Head Assembly (above ground, packed box)
   a. The pump discharge head shall be of the above ground type of either cast iron or fabricated steel construction with an ANSI 125# or 250# discharge flange.
   b. The discharge head shall be of sufficient design to support the entire weight of the pump and driver.
   c. If the application uses a variable frequency drive, the discharge head shall be fabricated steel and specifically designed to elevate the discharge head natural frequency above the operating speed.
   d. A drive shaft of stainless steel construction conforming to ASTM A582 (416 stainless steel) shall extend through the sealing assembly of the discharge head and be coupled to a vertical hollow shaft driver.
   e. The shaft sealing assembly shall consist of a cast iron packing box, cast iron packing gland, bronze packing box bushing, stainless steel packing gland nuts and bolts, and synthetic packing.
   f. Packing box for 125# discharge head shall be rated for 175 PSI. Packing box for a 250# discharge head shall be rated for 400 PSI.
   g. The 175 PSI rated by-pass packing box (optional) and 400 PSI rated packing box shall also incorporate a Teflon water seal ring.
   h. Discharge head openings shall be fitted with guards to prevent access to the rotating shaft and/or coupling.

OR

9. Discharge Head Assembly (above ground, mechanical seal)
   a. The pump discharge head shall be of the above ground type of either cast iron or fabricated steel construction with an ANSI 125# or 250# discharge flange.
   b. The discharge head shall be of sufficient design to support the entire weight of the pump and driver.

c. If the application uses a variable frequency drive, the discharge head shall be fabricated steel and specifically designed to elevate the discharge head natural frequency above the operating speed.
d. A drive shaft of stainless steel construction conforming to ASTM A582 (416 stainless steel) shall extend through the sealing assembly of the discharge head and be coupled to a vertical solid shaft driver using a spacer type coupling to permit easy field removal of the mechanical seal.
e. The shaft sealing assembly shall consist of a cast iron packing box, bronze packing box bushing, and mechanical seal.
f. Packing box for 125# discharge head shall be rated for 175 PSI. Packing box for a 250# discharge head shall be rated for 400 PSI.
g. Discharge head openings shall be fitted with guards to prevent access to the rotating shaft and/or coupling.

OR

10. Discharge Head Assembly (below ground, packed box)
    a. The pump discharge shall be of the below ground construction and consist of a driver mounting-base, underground elbow and riser pipe.
    b. The driver mounting-base shall be of sufficient design to support the entire weight of the pump and driver.
    c. If the application uses a variable frequency drive, the mounting-base shall be fabricated steel and specifically designed to elevate the mounting-base natural frequency above the operating speed.
    d. The underground elbow shall be of fabricated steel and have an ANSI 150# or 300# discharge flange.
    e. A driveshaft of stainless steel construction conforming to ASTM A582 (416 stainless steel) shall extend through the sealing assembly of the driver-mounting base and be coupled to a vertical hollow shaft driver.
    f. The shaft sealing assembly shall consist of a cast iron packing box, cast iron packing gland, bronze packing box bushing, stainless steel packing gland nuts and bolts, and synthetic packing.
    g. Packing box for 150# discharge head shall be rated for 175 PSI. Packing box for a 300# discharge head shall be rated for 400 PSI.
    h. The 175 PSI rated by-pass packing box (optional) and 400 PSI rated packing box shall also incorporate a Teflon water seal ring.
    i. Driver mounting-base shall be fitted with guards to prevent access to the rotating shaft and/or coupling.

OR

11. Discharge Head Assembly (below ground, mechanical seal)
    a. The pump discharge shall be of below ground construction and consist of a driver mounting-base, underground elbow and riser pipe.
    b. The driver mounting-base shall be of sufficient design to support the entire weight of the pump and driver.
    c. If the application uses a variable frequency drive, the mounting-base shall be fabricated steel and specifically designed to elevate the mounting-base natural frequency above the operating speed.
    d. The underground elbow shall be of fabricated steel and have an ANSI 150# or 300# discharge flange.
    e. A drive shaft of stainless steel construction conforming to ASTM A582 (416 stainless steel) shall extend through the sealing assembly of the discharge head and be coupled to a vertical solid shaft driver using a spacer type coupling to permit easy field removal of the mechanical seal.
    f. The shaft sealing assembly shall consist of a cast iron packing box, cast iron packing gland, bronze packing box bushing, and mechanical seal.
    g. Driver mounting-base shall be fitted with guards to prevent access to the rotating shaft and/or coupling.

12. Vibration Limitations (Field)
    a. The limits of vibration as set forth in the standards of the Hydraulic Institute shall govern.

13. Testing
    a. A certified factory hydrostatic and performance test shall be performed on each bowl assembly in accordance with Hydraulic Institute Standards, latest edition. Tests shall be sufficient to determine the curves of head, input horsepower, and efficiency relative to capacity from shutoff to 150% of design flow. A minimum of six points, including shutoff, shall be taken for each test. At least one point of the six shall be taken as near as possible to each specified condition.
    b. Results of the performance tests shall be certified by a Registered Professional Engineer and submitted for approval before final shipment.
    c. The casing shall be hydrostatically tested to 1.5 times the design head or 1.25 times the shutoff head, whichever is greater.

BOWL TECHNICAL DATA

Bowl Size = 19A

Pump Shaft Diameter – Inches	2.187
Bowl Weight, 1st Stage – Lbs.	610
Bowl Weight, Each Additional Stage – Lbs.	350
Allowable Shaft Stretch – Inches	0.62
Maximum Working Pressure – PSI	300
Maximum Hydro Pressure – PSI	450
Impeller Eye Area – Square Inches	69.50
Rotor Weight 1st / Additional Stages – K_a	100.0 / 80.0
Maximum Sphere Size – Inches	1.25
Thrust Factor – K_1	32
WR2	7.45
Running Position (above seat) – Inches	0.125
Submergence – Inches	32
Maximum Bowl Bearing Clearance – Inch Diameter	0.010 / 0.011
Maximum Wear Ring Clearance – Inch Diameter	0.027
Maximum Bowl O.D. – Inches	18.50
Suction Bell O.D. – Inches	17.5 / 22.5

COLUMN TECHNICAL DATA

Vertical Turbine Pump Model 19A

Column Size = 12 Inches

.250 Wall Pipe

Schedule Number	20
Outside Diameter (Inches)	12.750
Inside Diameter (Inches)	12.250
Wall Thickness (Inches)	0.250
Weight Per Foot (Lbs./Ft.)	33.38

AWWA Standard Wall Pipe

Schedule Number	N?A
Outside Diameter (Inches)	12.750
Inside Diameter (Inches)	12.000
Wall Thickness (Inches)	0.375
Weight Per Foot (Lbs./Ft.)	49.56

Exact Column Lengths

Open Lineshaft Construction

5 Ft. Section	4'11-1/4"
10 Ft. Section	9'11-1/4"
Coupling Outside Diameter (Inches)	13.88
Coupling Weight (Lbs.)	47.21
Flange Outside Diameter (Inches)	16.38
Flange Weight (Lbs.)	29.81

LINESHAFT TECHNICAL DATA

Vertical Turbine Pump Model 19A

Shaft Size = 2-3/16 Inches

Exact Lengths	5 Foot Section	5 Ft., 0 Inches
	10 Foot Section	10 Ft., 0 Inches
	20 Foot Section	20 Ft., 0 Inches
Weight Per Foot (Lbs./Ft.)		12.78
Shaft Coupling Weight (Lbs.)		5.6
Open Lineshaft Sleeve Thickness (Inches)		0.093
Open Lineshaft Sleeve Length (Inches)		7
Open Lineshaft Sleeve Weight (Lbs.)		1.3
Open Lineshaft Bearing and Retainer Weight (Lbs.)		
8 Inch Column		9.8

DISCHARGE HEAD TECHNICAL DATA

Vertical Turbine Pump Model 19A

Discharge Type = F
Motor BD = 16-1/2 Inches
Column Size = 12 Inches

Discharge Flange Size (Inches)	12
Available Flanged Column Size (Inches)	12
NEMA Driver "AK" Size (Inches)	13-1/2
Maximum Discharge Pressure (PSI) (Non-Shock Rating At Room Temperature)	
150 lb. Flange	175
Weight (Including Packing Box) (Lbs.)	671

PACKING BOX TECHNICAL DATA

Vertical Turbine Pump Model 19A

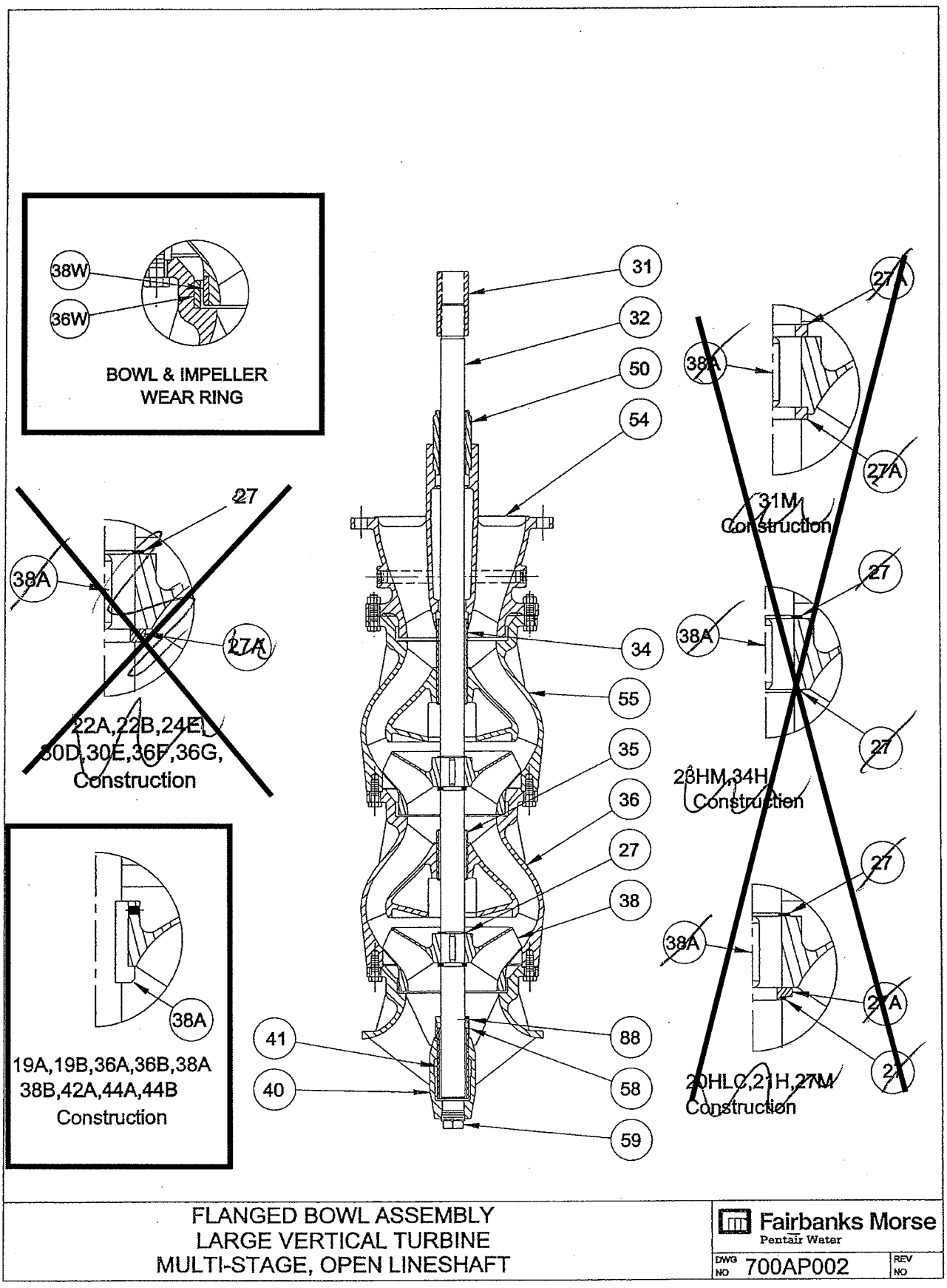
Shaft Size = 2-3/16 Inches

Inside Diameter of Box (Inches)	3-1/8
Depth of Box (Inches)	
Standard 175 PSI	1-5/8
Outside Diameter of Sleeve (Inches)	2-3/8
Packing Size (Inches)	3/8
Rings Per Box	4
Bearing Length (Inches)	3-3/4
Gland Bolt Size (Inches)	1/2 x 2-3/4
Maximum Working Pressure (PSI)	
Standard	175

Open Lineshaft Material Specifications

Item	Description	Material	Specifications
1	Top Shaft Adjusting Nut	Steel	A108 Grade 12L14
6	Water Slinger	Rubber	Neoprene
7	Discharge Head	Cast Iron / Steel	A48 Class 30 / A53 & A36 (3)
8	Gland Bolt	Stainless Steel	18-8
8A	Gland Nut	Stainless Steel	18-8
9	Packing Gland	Cast Iron	A48 Class 30
11	Gasket	Tag Board	F104
13	Top Shaft Sleeve	Stainless Steel	AISI 304
15	Packing	Synthetic	Commercial
15A	Water Seal Ring	Teflon	Teflon
16	Column Flange Gasket	Tag Board	F104
17	Packing Box	Cast Iron	A48 Class 30
17A	Packing Box Bushing	Bronze	B505 C93200
19B	Top Shaft	Stainless Steel	A582-416
19A	Drive Shaft	Steel	AISI 1045
21	Top Column	Steel	A53 & A36 (3)
23	Lineshaft	Steel	AISI 1045
25	Bearing Retainer	Bronze	B584 C83600
26	Bearing	Neoprene	Commercial
27	Snap Ring	Stainless Steel	A564 Alloy 632
29	Shaft Sleeve	Stainless Steel	AISI 304
30	Column	Steel	A53 & A36 (3)
31	Shaft Coupling	Steel (5)	A108 Grade 12L14
32	Pump Shaft	Stainless Steel	A582 – 416
34	Top Bowl Bearing	Bronze	B505 C93200
35	Inter Bowl Bearing	Bronze	B505 C93200
36	Inter Bowl	Cast Iron (2)	A48 Class 30
36W	Bowl Wear Ring	Bronze	B505 C93200
38	Impeller	Bronze	B584 C83600
38A	Impeller Key	Steel	A108 Grade 1018
38W	Impeller Wear Ring	Bronze	B505 C93200
40	Suction Bell	Cast Iron	A48 Class 30
41	Suction Bearing	Bronze	B505 C93200
50	Connector Bearing	Bronze	B505 C93200
54	Discharge Case	Cast Iron (2)	A48 Class 30
55	Top Inner Bowl	Cast Iron (2)	A48 Class 30
58	Sand Collar	Bronze	B505 C93200
59	Suction Bowl Plug	Cast Iron	Commercial
62	Driver Pedestal	Steel	A53 & A36 (3)
88	Set Screw	Stainless Steel	A320
Options			
95	Sole Plate	Cast Iron / Steel	A48 Class 30 / A36
456	Mechanical Seal	Commercial	Commercial

Notes:
1. All material specifications are ASTM unless otherwise noted and are for description of chemistry only.
2. Bowl interior is coated with Tnemec N140 Pota-Pox Plus, or Equal.
3. Circular sections are A53 & plate is A36
4. Factory option.
5. Pump shaft coupling is stainless steel, ASTM A582 S41600.



FLANGED BOWL ASSEMBLY
LARGE VERTICAL TURBINE
MULTI-STAGE, OPEN LINESHAFT

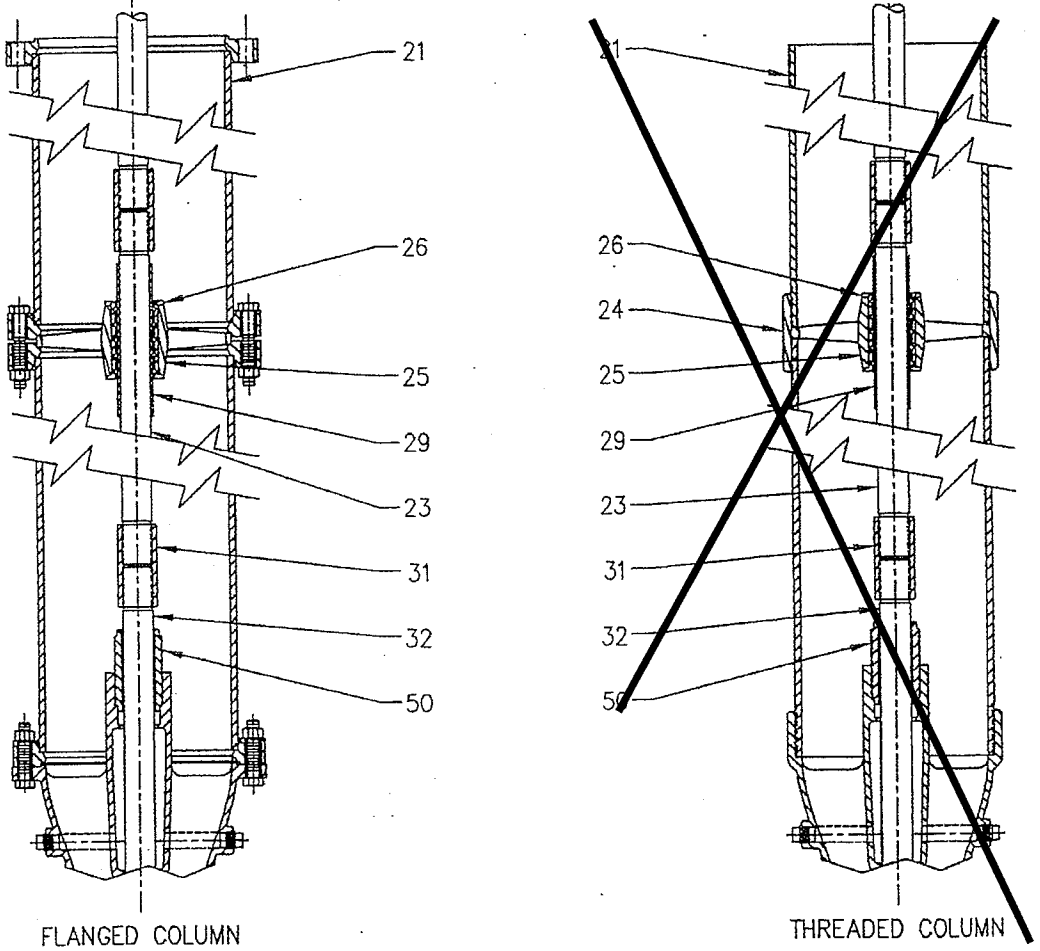
Fairbanks Morse
Pentair Water

DWG NO 700AP002 REV NO

⚠ WARNING

ALWAYS BE SURE LIFTING EQUIPMENT IS OF ADEQUATE SIZE TO PREVENT POSSIBLE SERIOUS PERSONAL INJURY OR DAMAGE TO THE EQUIPMENT.

SEE PACKING BOX
OR
MECHANICAL SEAL DETAIL



FLANGED COLUMN

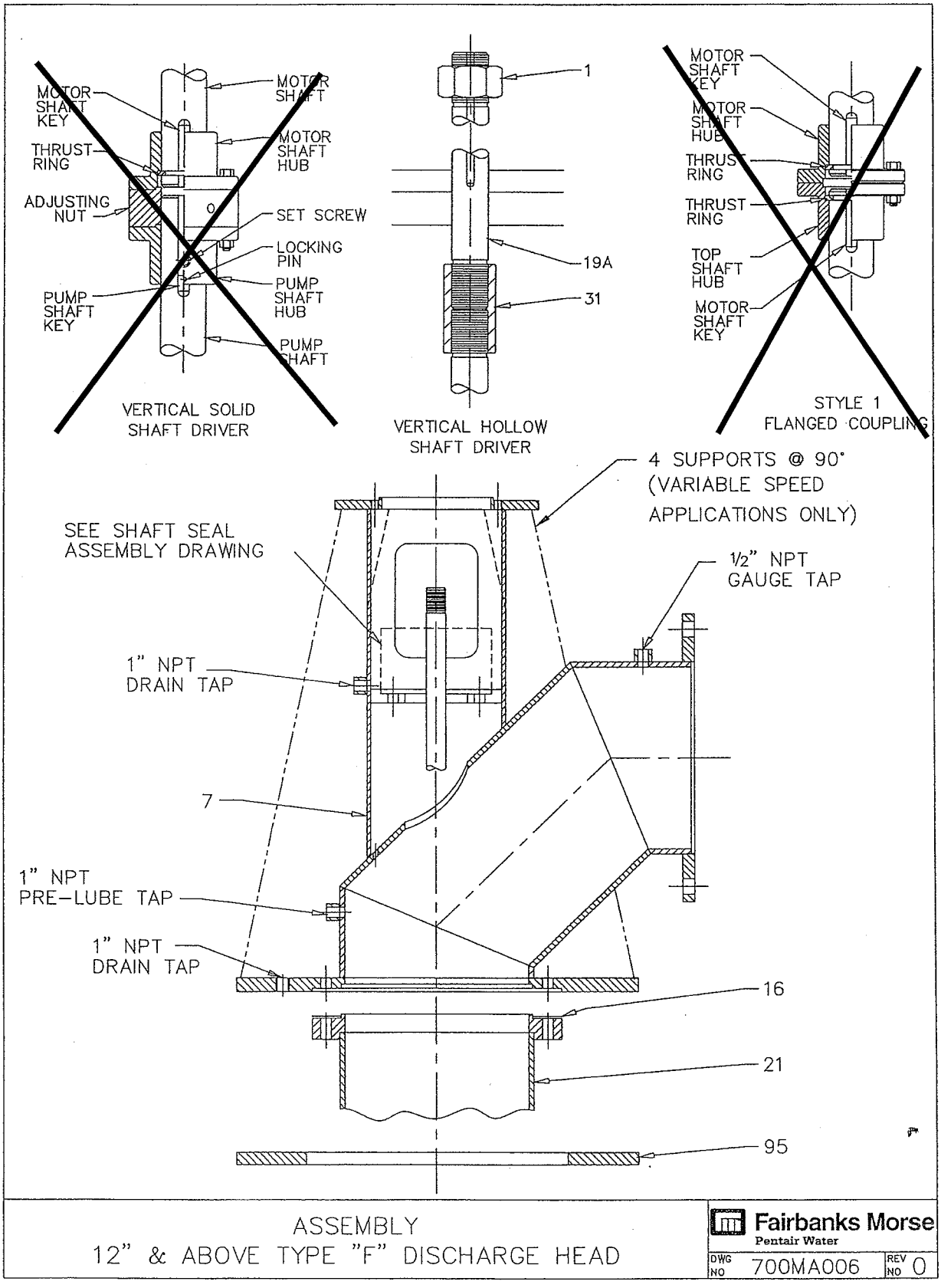
THREADED COLUMN

NOTES:
(1) COLUMN SECTIONS ARE TO BE LIFTED BY EYEBOLTS OR "COLUMN CLAMPS" (SUPPLIED BY OTHERS).
(2) COLUMN, AND SHAFT ASSEMBLIES SHOULD BE SECURED TOGETHER BY ROPE SLINGS OR OTHER SUITABLE MEANS.
(3) BEARING CENTERS (MAX)
TOP: 6.5'
INTER: 5'
COLUMN & SHAFT LENGTHS (MAX): 10'
SHAFT PROJECTION: 17.5"
(4) REFER TO TECHINICAL DATA PAGE FOR OTHER DIMENSIONS AND WEIGHTS.

OPEN LINESHAFT
COLUMN SECTIONS

Fairbanks Morse
Pentair Water

DWG NO 7000A041 REV NO 1



ASSEMBLY
12" & ABOVE TYPE "F" DISCHARGE HEAD

Fairbanks Morse
Pentair Water

DWG NO	700MA006	REV NO	0

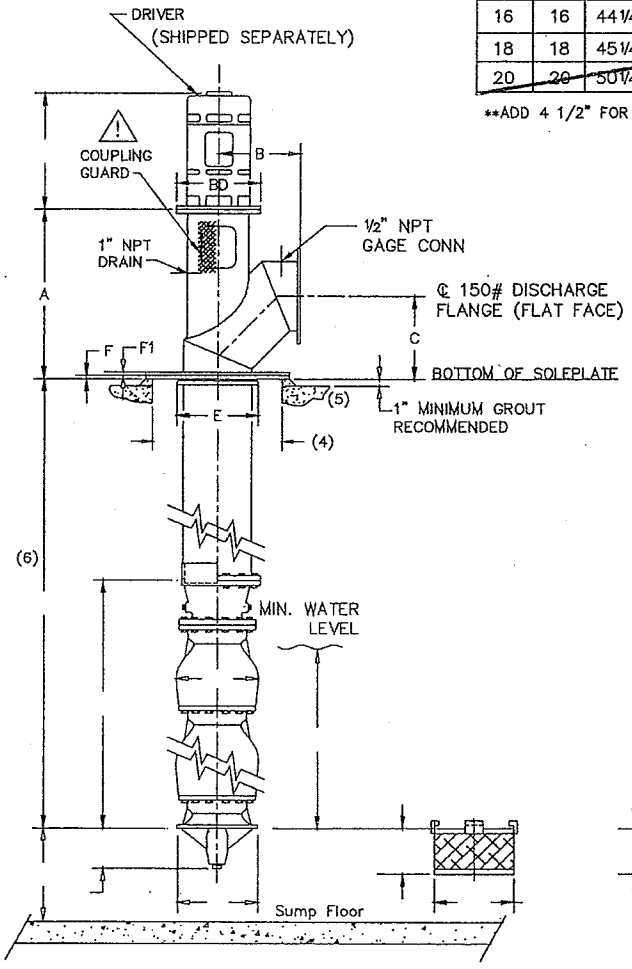
⚠ WARNING

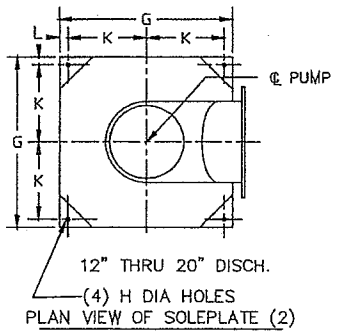
DO NOT OPERATE THIS MACHINE WITHOUT PROTECTIVE GUARD IN PLACE. ANY OPERATION OF THIS MACHINE WITHOUT PROTECTIVE GUARD CAN RESULT IN SEVERE BODILY INJURY.

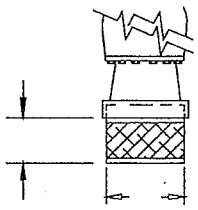
DISCHARGE HEAD DIMENSIONS

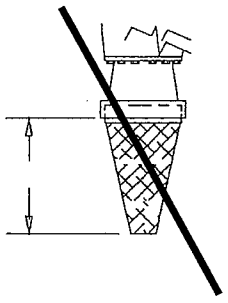
DISCH SIZE	COL SIZE	A** MTR BASE DIA (BD) 12	16½	20	24½	B	C	E	F	F1	G	H	K	L
12	12	~~37⅛~~	37⅛	~~37⅛~~		15	16½	16¼	1	1	31	⅞	13½	2
14	14	40¼	40¼	40¼	43	17	18½	17½	1½	1½	34	1	15	2
16	16	44¼	44¼	44¼	47	20	21½	19½	1½	1½	36	1	16	2
18	18	45¼	45¼	45¼	48	20	21½	22	1½	1½	38	1	17	2
20	20	50¼	50¼	50¼	53	24	25½	23¾	1½	1½	44	1	20	2

**ADD 4 1/2" FOR VSS DRIVER AND SPACER COUPLING









1. THIS DRAWING NOT FOR CONSTRUCTION OR INSTALLATION UNLESS CERTIFIED. DIMENSIONS SHOWN ARE TYPICAL AND MAY VARY DUE TO VARIOUS TOLERANCES.
2. SOLEPLATE MUST BE SUPPORTED ON ALL 4 SIDES AND GROUTED IN PLACE.
3. MINIMUM SUBMERGENCE REQUIRED AT MAXIMUM FLOW.
4. MINIMUM DIAMETER REQUIRED TO REMOVE BOWL ASSEMBLY
5. DETAIL SHOWN FOR ILLUSTRATION ONLY AND IS NOT INTENDED TO REPRESENT THE ACTUAL INSTALLATION.
6. CUSTOMER TO VERIFY OR ADVISE OVERALL LENGTH PRIOR TO OR AT RELEASE.

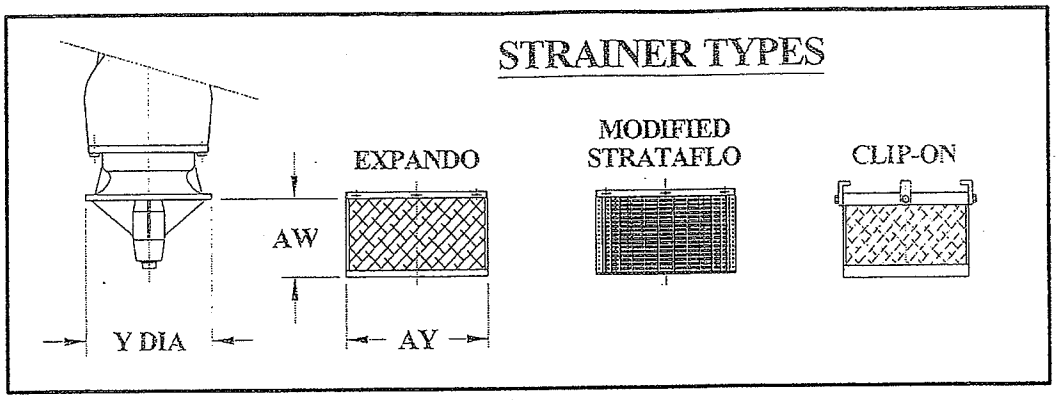
CUSTOMER					P.O.	
JOB NAME				SERVICE		
PUMP SIZE & MODEL	STAGES	GPM	TDH	RPM	ROT CCW	
MOTOR	HP	FRAME	PHASE	HERTZ	VOLTS	ENCL
CERTIFIED FOR		CERTIFIED BY			DATE	

Fairbanks Morse
Pentair Water

SETTING PLAN
MODEL 7000/7100 PUMP
TYPE "F" SURFACE HEAD
WITH SOLEPLATE
12" THRU 20" DISCH
FLANGED DISCHARGE

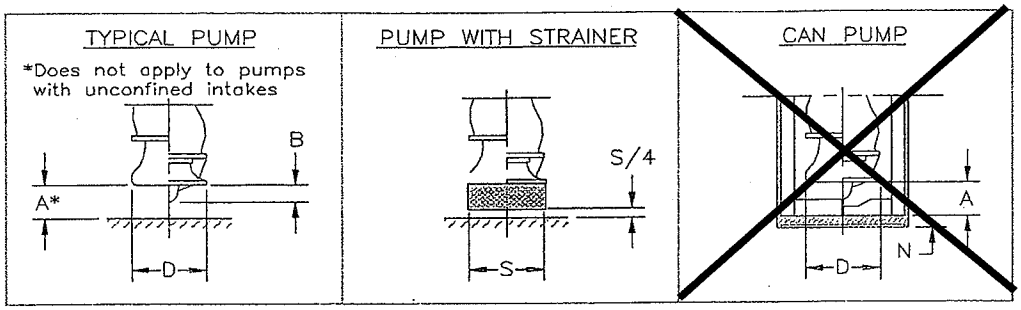
DWG. NO. 7000FS010 REV

BASKET STRAINERS NON-THREADED



BOWL DIMS.		STRAINER TYPE			STRAINER DIMENSIONS		QTY. OF FASTENERS		
BOWL DESIGN	BELL DIA 'Y'	EXPANDO	MODIFIED STRATFLO	CLIP-ON	AY	AW	EXP.	MOD.	CLIP.
6A,B	5.50	X	X	--	6.50	4.00	4	4	--
6D,F	5.50	X	X	--	6.50	4.00	4	4	--
6G,J	5.50	X	X	--	6.50	4.00	4	4	--
7A,B,D	7.50	X	X	--	8.50	5.00	4	4	--
8B	7.50	X	X	--	8.50	5.00	4	4	--
8P,T,V	9.50	X	X	--	10.50	5.00	4	4	--
8M	8.00	--	--	X	8.00	7.00	--	--	4
10A,B,D,E	9.50	X	X	--	10.50	5.00	4	4	--
10M	10.00	--	--	X	10.00	6.00	--	--	4
10G,J, HRO	9.50	X	X	--	10.50	5.00	4	4	--
11M	11.38	--	--	X	11.50	8.00	--	--	4
11H	11.38	--	--	X	11.50	8.00	--	--	4
12A,B,D,F	11.50	X	X	--	12.50	6.00	4	4	--
12K,S	11.50	X	X	--	12.50	6.00	4	4	--
12M	13.00	--	--	X	13.00	7.00	--	--	4
12E,G,I	13.00	X	X	--	14.13	7.00	4	6	--
12N,U,W	13.00	X	X	--	14.13	7.00	4	6	--
12V	11.50	X	X	--	12.50	6.00	4	4	--
13E,F	11.50	X	X	--	12.50	6.00	4	4	--
13H	13.00	--	--	X	13.00	11.00	--	--	4
14C,D,F	17.00	X	X	--	18.25	9.00	4	6	--
14HRO	14.00	X	X	--	15.25	7.0	4	6	4
14M	14.75	--	--	X	14.75	13.00	--	--	4
14I,J, 17HRO	17.00	X	X	--	18.25	9.00	4	6	--
15H	14.75	--	--	X	14.75	13.00	--	--	4
16E	17.25	X	X	--	18.25	9.00	4	6	--
16HRO	15.45	X	X	--	16.75	8.0	4	6	4
17H	16.75	--	--	X	16.75	9.00	--	--	4
17M, 18HRO	18.00	--	--	X	18.00	9.00	--	--	4
18H	17.25	X	X	--	18.25	9.00	4	6	--
19A,B	17.25	X	X	--	18.25	9.00	4	6	--
19A-1,B-1	22.50	X	X	--	23.50	12.00	8	8	--
20HL	21.50	--	--	X	20.75	8.00	--	--	6
21H	20.75	--	--	X	20.75	8.00	--	--	6
22A,B	22.50	X	X	--	23.50	12.00	8	8	--
23HL,M,H	--	*REFER TO FACTORY*			--	--	--	--	--
24E	22.50	X	X	--	23.50	12.00	8	8	--
27M	28.11	--	--	X	28.00	9.00	--	--	6
30D,E	27.00	--	X	--	28.00	15.00	--	--	--
31M	31.30	--	--	X	31.00	11.00	--	--	10
33HH	--	*REFER TO FACTORY*			--	--	--	--	--
34H	32.00	--	--	X	31.00	11.00	--	--	10
36F,G	40.00	--	X	--	41.00	20.00	--	8	--
38A,B	34.25	--	X	--	35.25	18.00	--	8	--
42A	40.00	--	X	--	41.00	20.00	--	8	--
44A,B	43.00	*REFER TO FACTORY*			44.00	22.00	--	--	--
57H	54.00	--	--	X	54.00	9.00	--	--	10

DISTANCE OF BELL TO FLOOR FOR TURBINE PUMPS



PUMP	A	B	D	S	PUMP	A	B	D	S
6A, 6B	4	3.25	5.50	6.00	15H	9	7.19	14.75	14.75
6M	3	N/A	5.50	N/A	16E	8.5	3.00	17.25	18.00
6D, 6F	4	3.25	5.50	6.00	17M	10	7.37	18.00	18.00
6G, 6J	4	3.25	5.50	6.00	17H	10	7.94	16.75	16.75
7M	3	N/A	5.75	N/A	18H	8.12	4.00	17.25	18.00
7A, 7B, 7D	8.75	0.75	7.50	8.00	19A, 19B	8.75	2.75	17.25[1]	18.00[2]
8M	6	3.82	8.00	8.00	20HLC	11	1.20	21.50	RTF
8P, 8T, 8V	5	4.25	9.50	10.00	21H	10	5.19	20.75	20.75
8B	4.5	3.88	7.50	8.00	22A, 22B	11.25	6.25	22.5	23.00
10M	7	4.63	10.00	10.00	23HH	14	2.50	29.00	29.00
10A, 10B, 10D, 10E	5.5	4.00	9.50	10.00	23HM	14	2.50	29.00	29.00
10G, 10J	5	4.18	9.50	10.00	23HL	14	2.50	29.00	29.00
11M	7	5.45	11.38	11.50	24E	11.25	6.25	22.5	23.00
11H	7	5.34	11.38	11.50	27M	14	5.99	28.11	28.00
12V	6	3.25	11.50	12.00	30D, 30F	13.5	4.75	27.00	27.50
12N, 12U, 12W	7	6.50	13.00	13.62	31M	15	12.19	31.30	31.00
12M	8	6.13	13.00	13.00	33HH	21	3.25	41.50	RTF
12E, 12G, 12I	6.5	6.00	13.00	14.00	33HM	21	3.25	41.50	RTF
12A, 12B, 12D, 12F	6.25	5.30	11.50	12.00	33HL	21	3.25	41.50	RTF
12K, 12S	5.75	4.80	11.50	12.00	34H	16	N/A	32.00	31.00
13E, 13F	6	3.00	11.50	12.00	36F, 36G	20	6.25	40.00	40.50
13H	6	4.13	13.00	13.00	38A, 38B	17.13	3.00	34.25	34.75
14I, 14J	8.5	6.75	17.00	18.00	42A	20	6.00	40.00	40.50
14M	9	6.85	14.75	14.75	44A, 44B	21.5	4.00	43.00	RTF
14C, 14D, 14F	8.5	8.00	17.00	18.00	57H	27	N/A	54.00	54.00

[1]Bell Diameter for wells or barrels. Bell diameter for sumps is 22.5".
[2]Basket diameter for wells or barrels. Basket diameter for sumps is 23".

Suction Pot	
Size	N
12	1.25
14	1.25
16	1.50
18	1.50
20	1.75
24	2.50
30	3.00
36	3.75
42	4.25
48	RTF
54	RTF
60	RTF
72	RTF
84	RTF
96	RTF

Coating Descriptions

Tnemec 20 Pota-Pox

Description Polyamide Epoxy. General use epoxy coating for submerged and non-submerged surfaces in contact with potable water. Certification by NSF International in accordance with ANSI/NSF Std. 61 requires 2 coats that result in 7 - 10 mils total DFT. Conforms to AWWA D 102 Inside Systems No. 1 and No. 2. DFT: Primer 3 mils/Finish 4 mils. Color will be White unless otherwise specified.

Tnemec N140 Pota-Pox Plus

Description Polyamidoamine Epoxy. Epoxy coating for submerged and non-submerged surfaces in contact with potable water which affords high-build edge protection. Certification by NSF International in accordance with ANSI/NSF Std. 61 NSF approval requires 2 coats that result in 7 - 10 mils total DFT. Conforms to AWWA D 102 Inside Systems No. 1 and No. 2. DFT: Primer 3 mils/Finish 4 mils. Color will be Black unless otherwise specified.

Tnemec 66 Hi-Build Epoxoline

Description Polyamide Epoxy. General use epoxy coating for submerged and non-submerged surfaces in industrial applications. Conforms to AWWA C 210 (not for potable water contact). DFT: Primer 3 mils/Finish 4 mils. Color will be 1211 Red unless otherwise specified.

Tnemec 104 High Solids

Description Cycloaliphatic Amine Epoxy. Suitable for submerged and non-submerged surfaces in contact with salt spray and chemical exposures with superior abrasion- and stain-resistance. Conforms to AWWA C 210 (not for potable water contact). DFT: 8 mils minimum per coat. Color will be Red unless otherwise specified.

Kop-Coat Bitumastic 300-M

Description Polyamide Epoxy-Coal Tar. Epoxy coating providing high-build corrosion resistance in a variety of chemical, immersion, and underground conditions. Conforms to AWWA C 210-84 (not for potable water contact).. No other colors are available. DFT (one or two coat system) 16 - 20 mils total. Color will be Black.

Plasite 7133

Description A combination of epoxy and polyamide resins designed specifically as a high chemical resistant, non-toxic, odorless coating. Intended for use in the food and beverage industry. Meets requirements of the US Food and Drug Administration, 21 CFR 175.300, the US Department of Agriculture for use in direct food contact areas, and the US Environmental Protection Agency for surfaces which contact potable water. DFT: 4 mils per coat. Color will be white unless otherwise specified.

Scotchkote 134

Description A one part, heat curable, semi-rigid, amine-cured, thermosetting powdered epoxy coating designed to provide maximum corrosion protection on metal surfaces. Certified by NSF International in accordance with ANSI/NSF Std. 61 for use in drinking water applications. Approved by the US Environmental Protection Agency for use on surfaces which contact potable water. Power spray applied with a minimum of 10 mils prior to heat curing resulting in 8 - 10 mils DFT. RTF for more than 8-10 mils DFT. Color is Forest Green.

TIGERFLOW®
Engineered Systems to the World

Budgetary Quotation

Date: 11-03-08

Quote#: 08-34585

Job: Rehoboth Beach, Delaware

Representative: Ames, Inc – Keith Slemp

We are pleased to quote the following equipment:

(1) U.L. Listed, Nema 4, 60hp, 460/3/60, Tiger's Eye **Mark V, E-Series** Solid State, Triplex Power and Control Panel

- (*) U.L./C-U.L. 508 Label
- (*) Micro controller:
  - -Memory non-volatile - no battery backup required
  - -Multi level security passwords
- (*) Touch screen operator interface Model **C-10 with 10" Color** scale screen
  Functions included:
  - **-(PID) pressure sequencing with read-out in psi**
  - -Suction and discharge pressure read-out in psi
  - -Basin Graphics display
  - -Event history log
  - -Individual pump run indication
  - -Hand-off-automatic selectors
  - -Elapsed time meter
  - -Low suction alarm with on-off time delays
  - -Low system with on-off time delays
  - -High suction "energy savings" shutdown with on-off time delays, enable /disable
  - -High system alarm with on-off time delays
  - -Automatic alternation of equal sized pumps
  - -32-bit RISC micro-controller
  - -USB port
  - -RS-232, RS-485, RS-422 communication ports
- (1) Thru-door control power disconnect
- **(3) ABB Series ACH, Nema 1, 60hp, 460/3/60, variable frequency drives with PWM, 5% line reactors, operator interfaces and thru-door disconnects,**
- (1) 24 volt U.L./C-U.L., CE Approved switching power supply
- (1) 120 volt fused control circuit transformer
- (1) Power on light
- (2) Common auxiliary alarm contacts
- (1) Ultrasonic Level Transducer
- **(1) Modbus communication**

System to be completely electrically tested before shipment

"errors & omissions: this quotation is for the items listed or stated above. No other items should be assumed or implied as being provided."

Estimated Cost (Includes Freight & Startup Services) ..... $ 50,000.00 Net + FRT

Estimated weight 800#

*Prices Quoted Are Firm For Thirty (30) Days.
*Prices Do Not Include Any: Federal, State, Local Or Use Taxes.

2001945 **8P55**

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WEB SITE: www.tigerflow.com

*Prices Do Not Include Any: Freight, Permits, Unloading, Or Rigging.
*Terms: Subject to Credit Approval. Terms Inconsistent with **TIGERFLOW** Standard Terms and Conditions Which May Appear On Purchaser's Formal Order Will Not Be Binding On Seller.
*Warranty: Standard **TIGERFLOW** Warranty Applies.
*Submittals: Standard **TIGERFLOW (1-2) Weeks** after Order Hold For Approval.
*Shipment: **(5-7)** Weeks After Full Approval and Full Release For Fabrication.

Sincerely,
TIGERFLOW Systems, Inc.

Keith Pirtle
Sales

2001945

8P55

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