Artesian Wastewater Management, Inc.
Rehoboth/Sussex Service Proposal
Cost Estimate Summary

Item	Description	Cost Estimate
1	Rehoboth to Wolfe Neck	$4,080,663
2	PS 210 to Cave Neck Road	4,758,621
3	Cave Neck Road to ANSRWRF	9,107,752
4	Wolfe Neck Modifications	1,500,000
5	PS 210 Modifications	1,000,000
6	Cave Neck Booster Pump Station	2,202,500
7	2.0 MGD ANSRWRF Capacity	21,000,000
8	Land/Easements	500,000
9	Engineering	750,000
	Total	$44,899,536

16" FORCE MAIN REH. TO WOLFE NECK

2 MILLION GALLONS TO GO TO 4 MILLION GALLONS

PS 210 TO CAVE NECK 24" FORCE MAIN

$20,000,000 TO ADD 2 MILLION GALLONS CAPACITY AT PLANT

CAVE NECK TO ANSRWRF 24" FORCE MAIN

$6.84/THOUSAND WITH A MINIMUM

LEGEND
FORCE MAIN FROM REHOBOTH WWTP TO WOLFE NECK RWF
WOLFE NECK RWF
21,810 LF
REHOBOTH WWTP

LEGEND
ARTESIAN DISPOSAL SITE
FORCE MAIN FROM CAVE NECK ROAD TO ANSRWRF
FORCE MAIN FROM PS 210 TO CAVE NECK ROAD
42,700 LF
ANSRWRF
21,012 LF
PS 210

Artesian Northern Sussex
Regional Water Recharge
Facility (ANSRWRF)

Preliminary
Engineer's Estimate

Sussex County, DE

		Force Main From Rehoboth WWTP to Wolfe Neck				
Item No.	Description	Size or Depth	Unit	Quantity	Unit Price	Total Price
1	Furnish and Install Sanitary Sewer Force Main by Open Cut Method	16"	LF	25,900	100.00	2,590,000.00
2	Furnish and Install Sanitary Sewer Force Main under Lewes and Rehoboth Canal by Directional Drill Method	16"	LF	500	250.00	125,000.00
3	Furnish and Install Air Release Valve and Manhole, complete	-	EA	17	5,000.00	85,000.00
4	Furnish and Install Erosion & Sediment Control Measures	-	LS	1	7,500.00	7,500.00
5	Furnish and Install 8" Graded Aggregate Type B Base Course	8"	CY	7,674	72.00	552,528.00
6	Furnish and Install Bituminous Concrete Binder Course	3"	SY	9,189	12.50	114,862.50
7	Furnish and Install Bituminous Concrete Surface Course	1.5"	SY	9,189	8.00	73,512.00
9	Contingent Items (15%)					532,260.00
Total Construction Cost Estimate						**$4,080,662.50**

Artesian Northern Sussex
Regional Water Recharge
Facility (ANSRWRF)

Preliminary
Engineer's Estimate

Sussex County, DE

		Force Main from PS 210 to Cave Neck Road				
Item No.	Description	Size or Depth	Unit	Quantity	Unit Price	Total Price
1	Furnish and Install Sanitary Sewer Force Main by Open Cut Method	24"	LF	20,012	150.00	3,001,800.00
3	Furnish and Install Sanitary Sewer Force Main under Red Mill Pond by Directional Drill Method	24"	LF	1,000	350.00	350,000.00
4	Furnish and Install Sanitary Sewer Force Main under Broadkill Creek by Directional Drill Method	24"	LF	0	350.00	0.00
5	Furnish and Install Air Release Valve and Manhole, complete	-	EA	14	5,000.00	70,000.00
6	Furnish and Install Erosion & Sediment Control Measures	-	LS	1	5,000.00	5,000.00
7	Furnish and Install 8" Graded Aggregate Type B Base Course	8"	CY	3,418	72.00	246,096.00
8	Furnish and Install Bituminous Concrete Binder Course	3"	SY	15,380	12.50	192,250.00
9	Furnish and Install Bituminous Concrete Surface Course	1.5"	SY	15,380	8.00	123,040.00
10	Furnish and Install Fertilizer, Topsoil, Seed, and Mulch	-	SY	9,983	15.00	149,745.00
12	Contingent Items (15%)					620,690.00
Total Construction Cost Estimate						**$4,758,621.00**

Artesian Northern Sussex
Regional Water Recharge
Facility (ANSRWRF)

Preliminary
Engineer's Estimate

Sussex County, DE

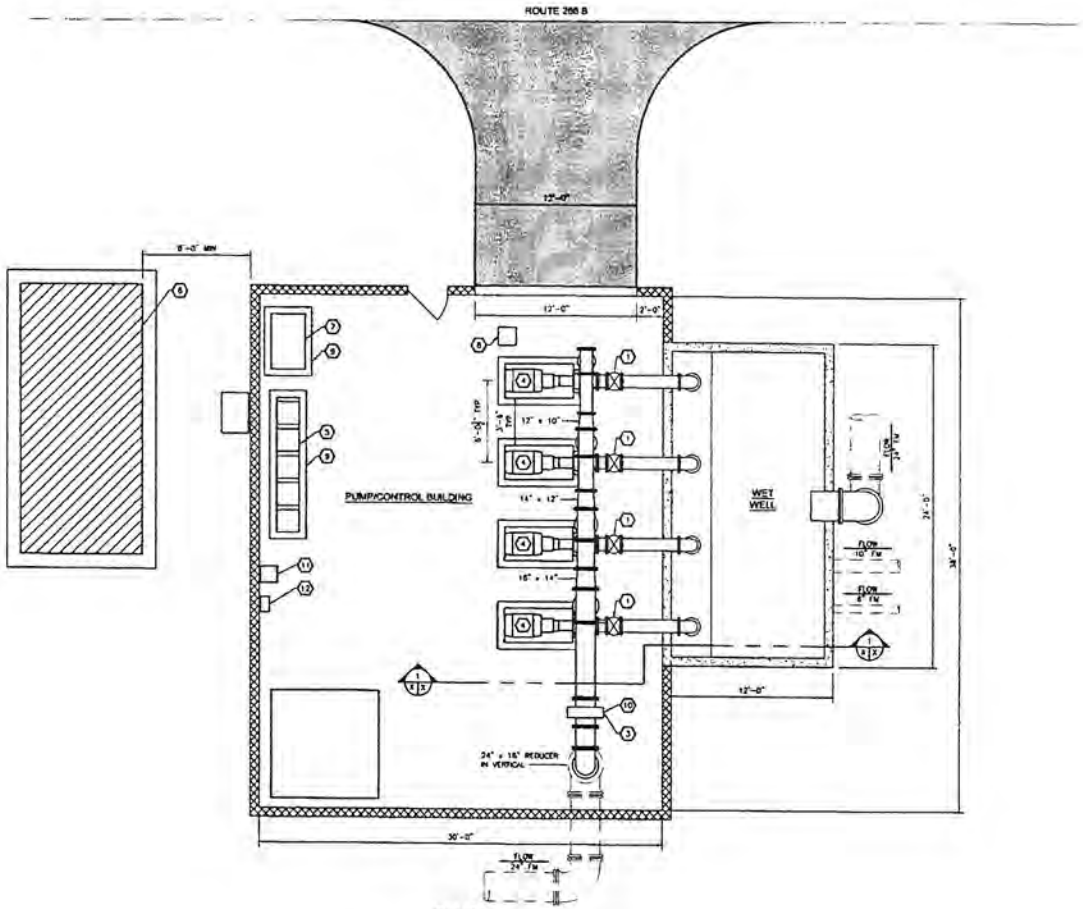
		Force Main from Cave Neck Road to ANSRWRF				
Item No.	Description	Size or Depth	Unit	Quantity	Unit Price	Total Price
1	Furnish and Install Sanitary Sewer Force Main by Open Cut Method	24"	LF	42,350	150.00	6,352,500.00
3	Furnish and Install Sanitary Sewer Force Main under Red Mill Pond by Directional Drill Method	24"	LF	0	350.00	0.00
4	Furnish and Install Sanitary Sewer Force Main under Broadkill Creek by Directional Drill Method	24"	LF	350	350.00	122,500.00
5	Furnish and Install Air Release Valve and Manhole, complete	-	EA	28	5,000.00	140,000.00
6	Furnish and Install Erosion & Sediment Control Measures	-	LS	1	10,000.00	10,000.00
7	Furnish and Install 8" Graded Aggregate Type B Base Course	8"	CY	4,630	72.00	333,360.00
8	Furnish and Install Bituminous Concrete Binder Course	3"	SY	20,833	12.50	260,412.50
9	Furnish and Install Bituminous Concrete Surface Course	1.5"	SY	20,833	8.00	166,664.00
10	Furnish and Install Fertilizer, Topsoil, Seed, and Mulch	-	SY	35,623	15.00	534,345.00
12	Contingent Items (15%)					1,187,970.00
Total Construction Cost Estimate						**$9,107,751.50**

ANSRWRF
Booster Pump Station

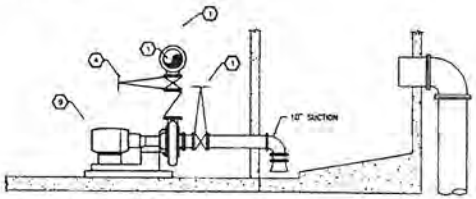
Preliminary Cost Estimate

August 20, 2008

1	General Conditions - Mobilization/demobilization	$	80,000
2	Site Work - Grading, paving, landscaping, fencing	$	50,000
3	Site Piping - exterior force mains and water service	$	75,000
4	Concrete- building foundation & wet well structure	$	125,000
5	Building Structure - 1,200 sq ft masonry	$	150,000
6	Coatings and painting	$	30,000
7	Interior piping, fittings, valves, surge device	$	200,000
8	Pump packages - four (4) at $50,000	$	200,000
9	Crane structure and hoist system	$	25,000
10	Odor control equipmet and appurtenances	$	40,000
11	Chemical Feed System	$	25,000
12	HVAC Systems	$	20,000
13	Emergency Power System	$	200,000
14	Electrical Service and Distribution	$	125,000
15	Controls and SCADA	$	100,000
16	Building Electrical	$	80,000
17	**Subtotal**	$	1,525,000
18	Contingency - construction	$	152,500
19	Land	$	200,000
20	Permits and Engineering	$	325,000
21	**TOTAL**	$	2,202,500



PLAN VIEW



SECTION THRU PUMP

PROPOED EQUIPMENT/PIPING

1. 10" GATE VALVE
2. 10" CHECK VALVE
3. PRESSURE RELIEF VALVE
4. DRY PIT SEWAGE PUMP
5. MCC
6. GENERATOR
7. TRANSFER SWITCH
8. HOIST
9. HOUSEKEEPING PAD
10. FLOW METER
11. DRY TYPE TRANSFORMER
12. PANEL BOARD
13. ACTIVATED CARBON ODOR CONTROL
14. SERVICE METER DISCONNECT

SCALE: 1/4" = 1'-0"

NO.	REVISIONS	DATE

GMB
GEORGE, MILES & BUHR, LLC
ARCHITECTS & ENGINEERS

PRELIMINARY LAYOUT
ANSRWRF
PUMP STATION

PLAN

SHEET NO.
C-1

Regulatory Background: Systematic Elimination of Point Sources in the Inland Bays Watershed

Rehoboth Beach
Board of Commissioners Meeting
October 20, 2008

Jennifer Volk

Federal Clean Water Act

- States must prepare and submit to the EPA every other year:
  - Watershed Assessment Report (305(b) Report)
  - List waters not meeting standards (303(d) List)

Water Quality Standards

- Designated uses
  - Agricultural Water Supply
  - Industrial Water Supply
  - Public Water Supply
  - Secondary Contact
  - Primary Contact
  - Aquatic Life and Wildlife
  - Cold Water Fish
  - Harvestable Shellfish
  - Exceptional Recreational and Ecological Significance
- Water quality criteria
  - Concentrations, parameter levels, or narrative statements
    - Dissolved Oxygen, Nitrogen, and Phosphorus

It is assumed that if criteria are met, designated uses will be protected.

Why should I care about DO and nutrient levels?

- Too many nutrients (eutrophication) offset the balance between photosynthesis and respiration so that there is too little dissolved oxygen in water

$$CO_2 + H_2O + N + P \leftrightarrow \text{Organic Matter} + O_2$$

»Loss of habitat
»Alteration of food web
»Fish and shellfish kills
»Human health effects

Dead-end canal of Rehoboth Bay, August 28, 2000

Total Maximum Daily Loads

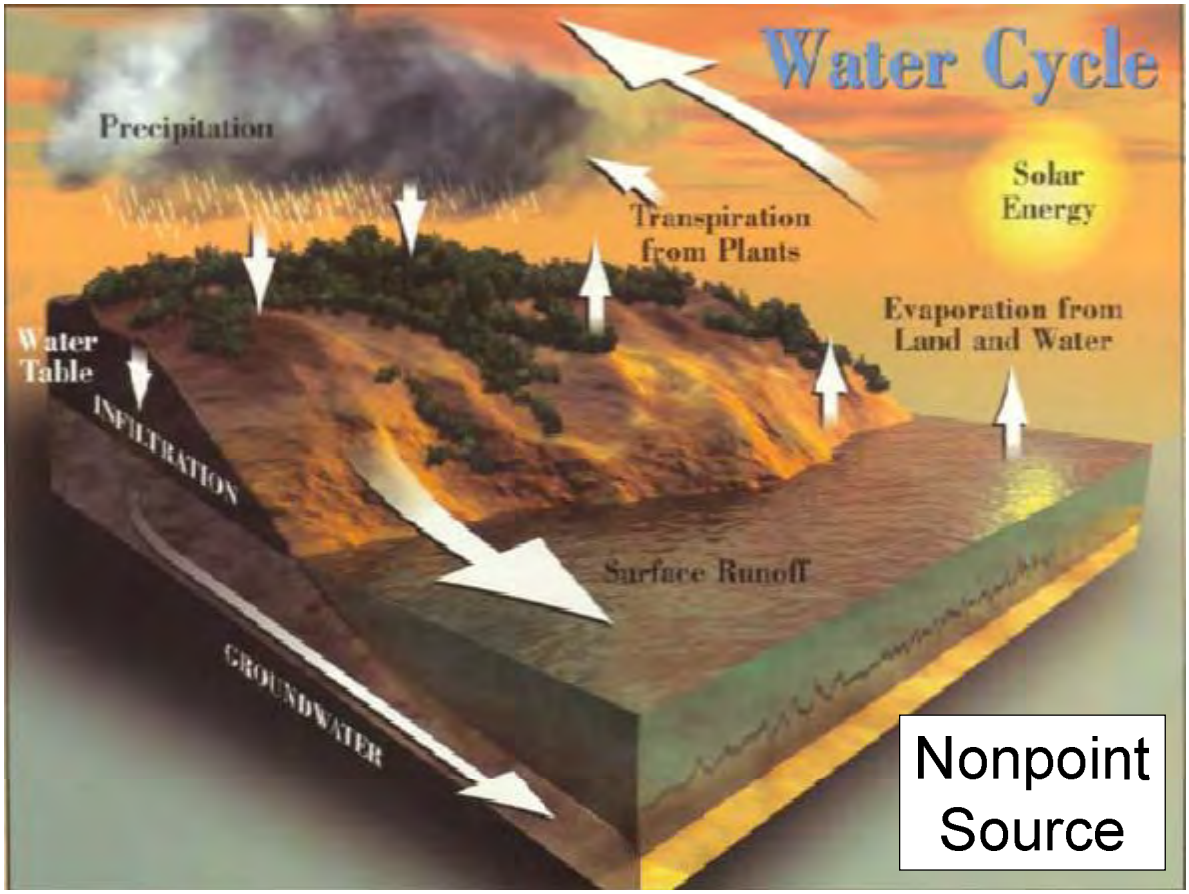
- The maximum amount of a pollutant that can enter surface waters and still meet water quality standards

TMDL = WLA + LA + MOS

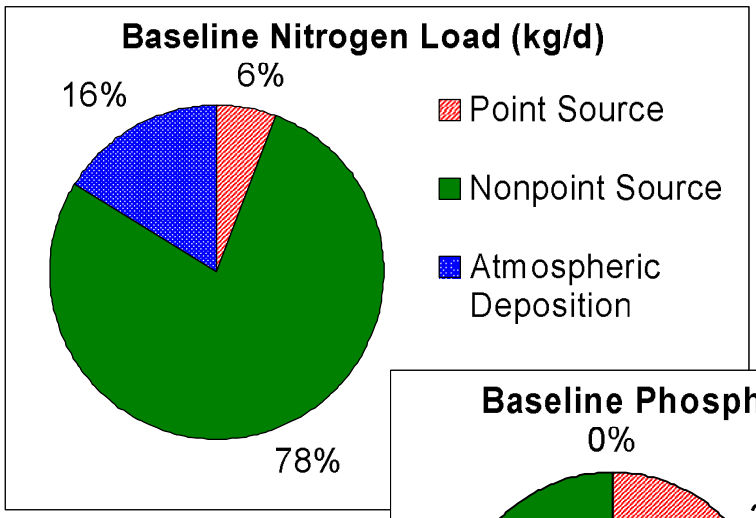
- WLA = waste load allocation (point sources)
- LA = load allocation (nonpoint sources)
- MOS = margin of safety

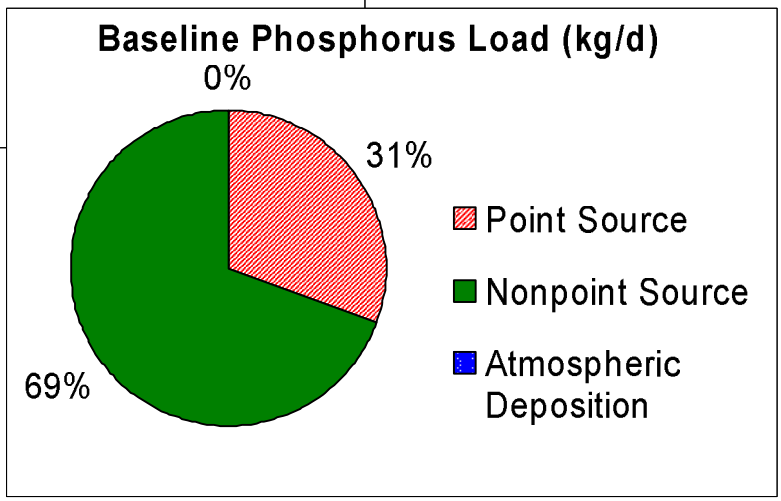
Point Source

Facility with a National Pollution Discharge Elimination System (NPDES) permit.



Inland Bays Sources of Pollution

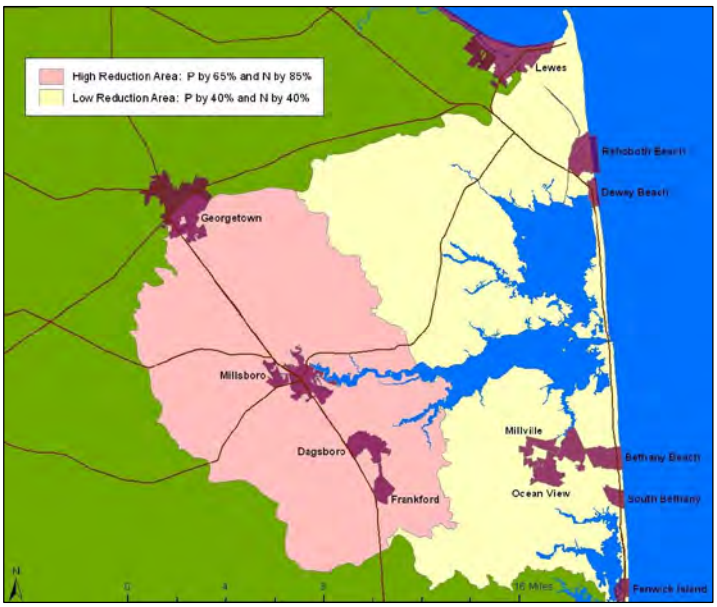




Based on TMDL modeling data from 1988-1990

Inland Bays TMDLs

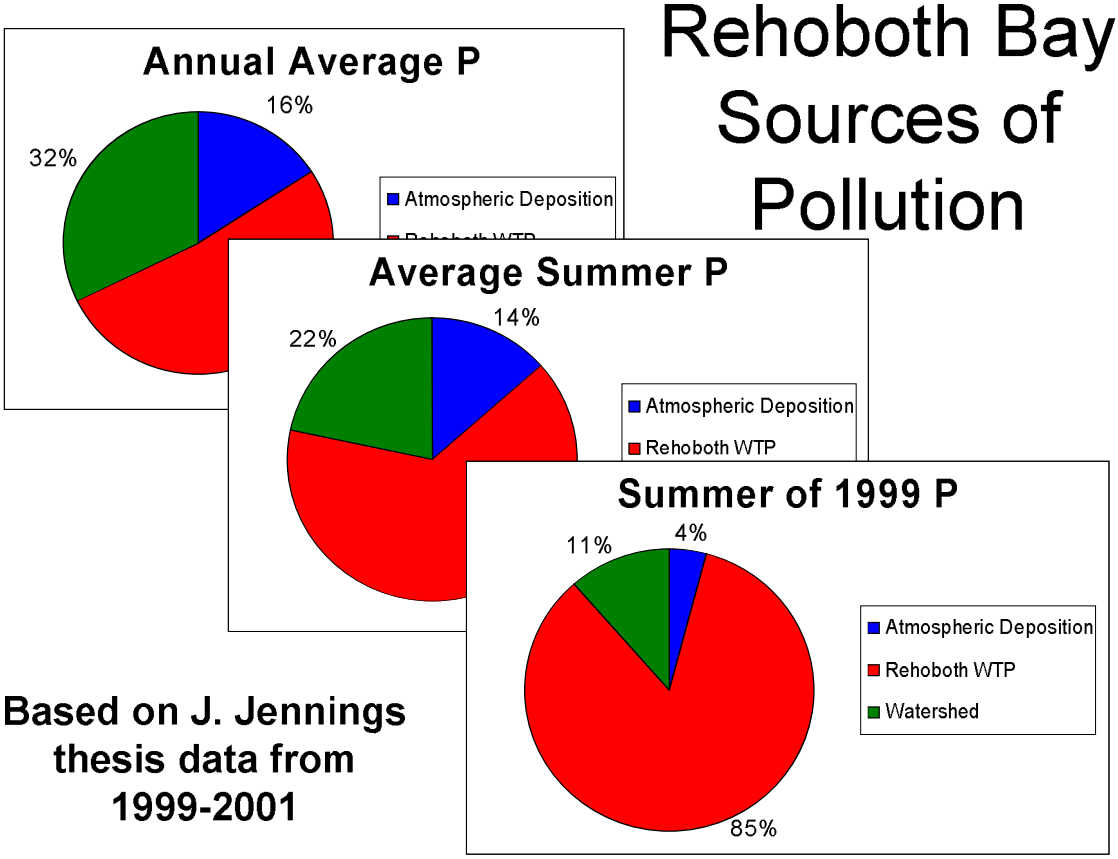
- **Systematic elimination of all point sources**
- Remove 40-85% nonpoint N
- Remove 40-65% nonpoint P
- 20% reduction in atmospheric deposition of N
- Implementation through Pollution Control Strategy



Point Sources

- Systematic elimination
  - To require the elimination of waste loading into the affected waterbody 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 facility's current NPDES permit unless a longer period of time is provided for in a State or Federally enforceable Consent Order, Decree, or Administrative Order.
- Water quality trading available as an option
  - 2:1 ratio
  - Must achieve the NPS reduction before can generate credit

Rehoboth Bay Sources of Pollution

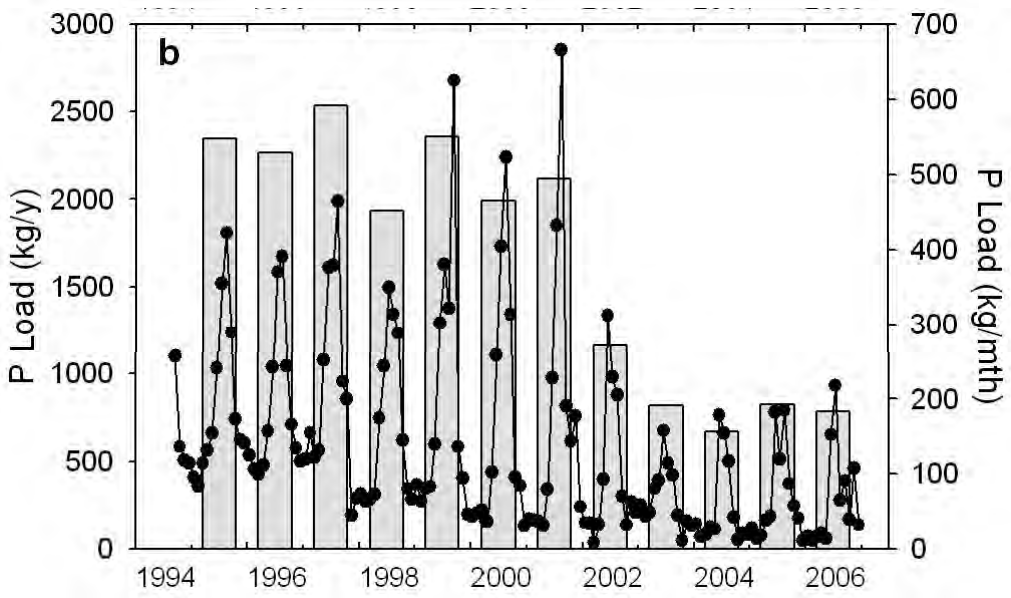


Based on J. Jennings thesis data from 1999-2001

Point Source Progress to Date

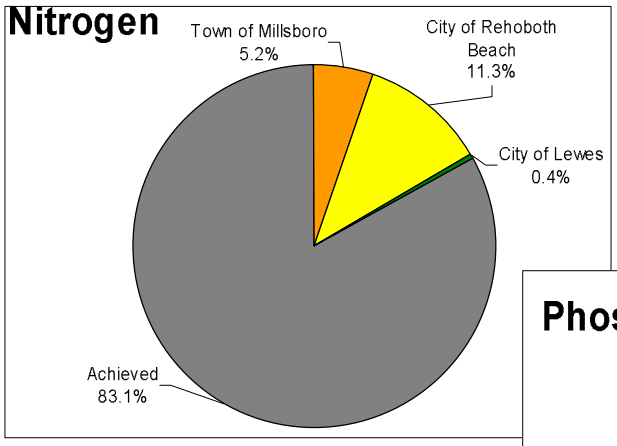
- 8 eliminated
  - Bayshore Mobile Home Park
  - Colonial East Mobile Home Park
  - Colonial Estates
  - Delaware Seashore State Park
  - Delaware State Housing Authority
  - Frankford Elementary School
  - George
  - town Wastewater Treatment Plant
  - Mountaire (previously Townsend's; 2 sources)
- 1 trade
  - Pinnacle Foods (previously Vlassic)
- NRG - not affected by TMDL
- 3 remaining
  - Lewes Wastewater Treatment Plant
    - Upgrades
    - Trading proposed
  - Millsboro Wastewater Treatment Plant
    - Upgrades
    - Exploring alternatives
  - Rehoboth Beach Wastewater Treatment Plant
    - Upgrades
    - Consent decree

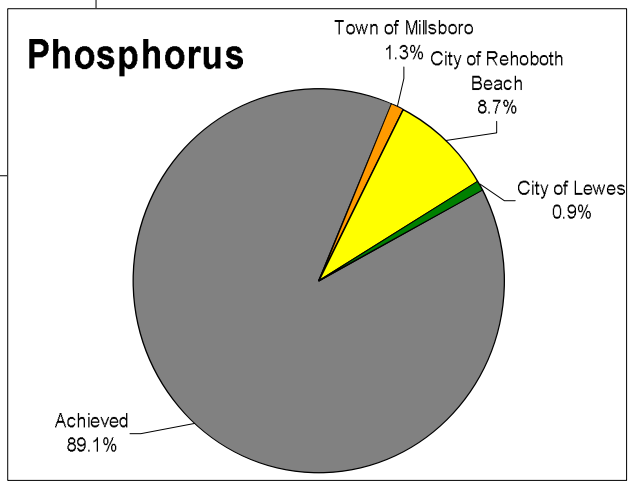
Rehoboth Progress To Date



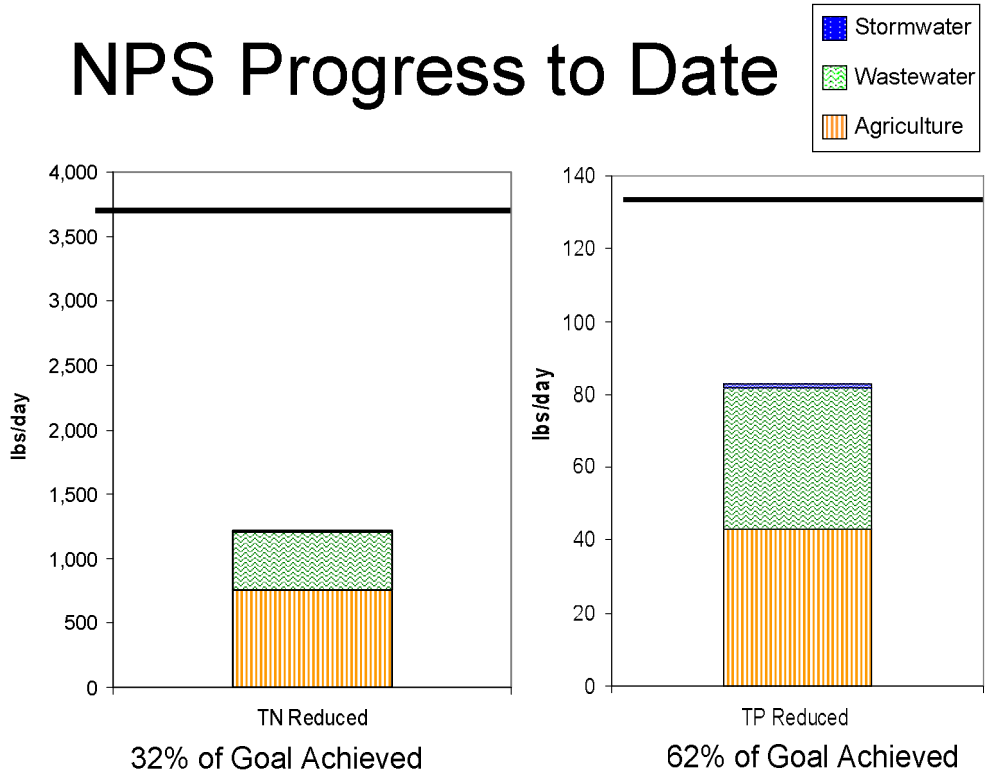
Data provided by R. Stenger (City of Rehoboth Beach)
Figures created by Dr. W. Ullman (UofD CMES)

Point Source Progress to Date





NPS Progress to Date



Options for Systematic Elimination

- Alternative disposal methods have various environmental and economic impacts
  - No option is cheap
  - Don't want to turn a point source into a nonpoint source
- Best management practices to achieve NPS reductions in the Inland Bays Watershed are estimated to cost $25,000,000/year.

The Pollution Control Strategy

- Based on recommendations from the Tributary Action Team (process began in 1998)
- Voluntary and regulatory actions to reduce nonpoint source pollution
  - Establishment of a buffer zone
  - Increased treatment of stormwater
  - Improved maintenance and performance of onsite wastewater treatment and disposal systems
  - Voluntary implementation of ag practices
- Regulations signed by the Secretary and will become effective November 11, 2008

The Pollution Control Strategy

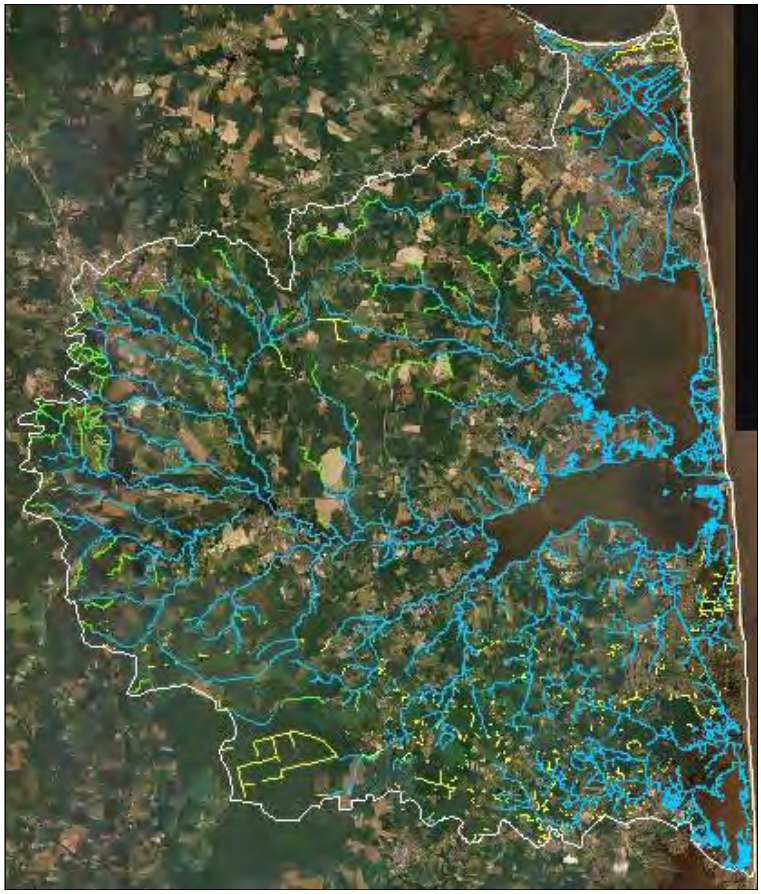
- Establishment of a buffer zone
  - For all new major subdivisions and new activities require a site or major subdivision plan
  - Water features to be buffered mapped

Map of Water Features to be Buffered in the Inland Bays Watershed

Perennial - Primary
(Blue)

Intermittent - Secondary
(Green)

Forested Ditch - Secondary
(Yellow)



The Pollution Control Strategy

- Establishment of a buffer zone
  - For all new major subdivisions and new activities require a site or major subdivision plan
  - Water features to be buffered mapped
  - 100-ft on primary & 60-ft on secondary waters
  - Can be reduced to 50-ft on primary and 30-ft on secondary waters when combined with
    - Advanced stormwater management options and
    - Development-wide nutrient management plan
  - Buffers will exist in community open space and will be managed by homeowners' associations

The Pollution Control Strategy

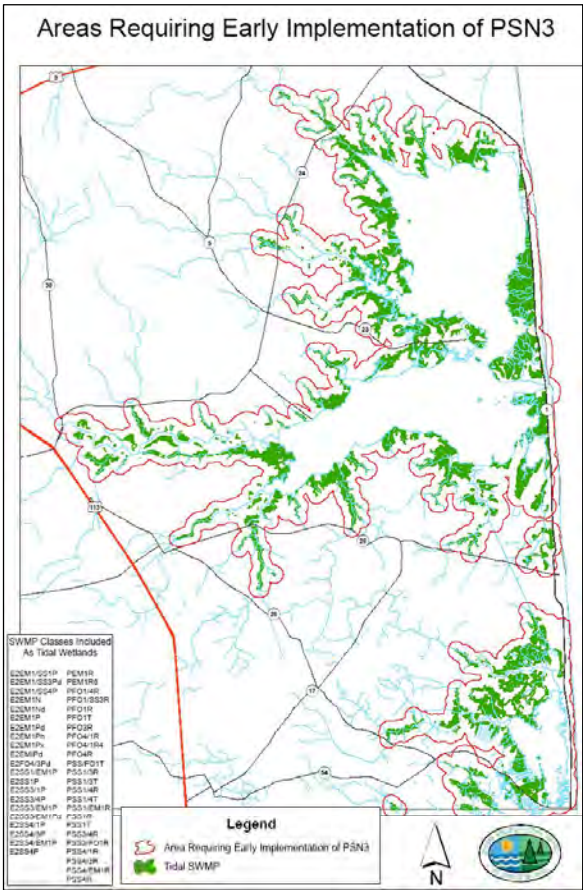
- Increased treatment of stormwater
  - If water features are present
    - Establish standard-width buffers
    - Establish reduced-width buffers in combination with other pollution reduction actions
  - If water features are not present, utilize one or more pollution reduction action that reduces nutrients and sediment in stormwater runoff
    - Vegetated stormwater collection areas
    - Stormwater collection areas that allow water to soak back into the ground
    - Preserve and create forested areas

The Pollution Control Strategy

- Improved maintenance and performance of onsite wastewater treatment and disposal systems
  - Eliminates cesspools and seepage pits
  - Septic systems must be pumped out and inspected at sale; other documents to prove system is in good working order can be submitted to DNREC to satisfy requirement
  - Septic systems must achieve a specified level of performance which depends on system size, location, and age.

Performance Standard Nitrogen 3

- Performance standards for small systems (<2,500 gpd) shall be effective for all permit applications whose site evaluations have been submitted to the Department 60 days or more after the date of publication of the final Regulations when those sites lie within 1000 feet of the mean high water line of tidal waters or from their associated tidal wetlands shown on Delaware's 1992 SWMP Maps
- All complete permit applications received on or after January 1, 2015 for new and replacement systems throughout the Inland Bays Watershed shall comply with Section 8.4 (PSN3)



Questions?

Regulations Governing Beach Protection and the Use of Beaches

December 27, 1983

The Beach Preservation Act

Title 7, Chapter 68.

Shoreline & Waterway Management Section

Regulations Governing Beach Protection and the Use of Beaches
December 27, 1983

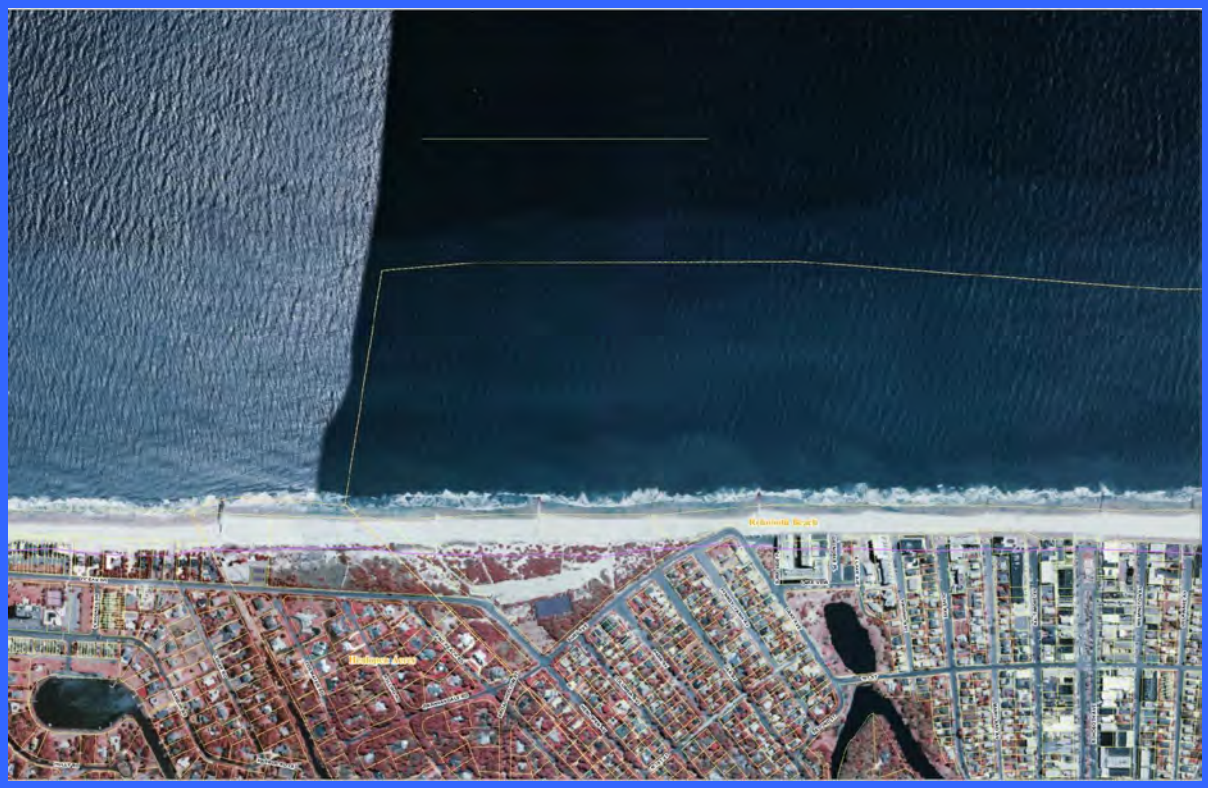
A Permit is required from the Division prior to the construction of any structure or facility on any beach seaward of the Building Line.

Shoreline & Waterway Management Section

Regulations Governing Beach Protection and the Use of Beaches
December 27, 1983

Beach – is that area which extends from the mean high waterline of the Atlantic Ocean landward 1,000 feet and seaward 2,500 feet, respectively.

Shoreline & Waterway Management Section



Shoreline & Waterway Management Section

Regulations Governing Beach Protection and the Use of Beaches

December 27, 1983

Section 4.03 Construction of Beach Erosion Pipelines or Harbor Works Seaward of the Building Line.

Section 4.04 Construction of Pipelines or Harbor Works Seaward of the Building Line.

Shoreline & Waterway Management Section

Procedures for Processing Permit Applications

- The permit application shall be advertised in a daily newspaper of statewide circulation and in a newspaper of general circulation in the county in which the activity is proposed.
- The Division mails notice of the Permit Application to all adjacent property owners.
- Application is available for public inspection.
- Comments are accepted for 15 calendar days.
- A decision can not be made until at least 20 days after the notice has been published and mailed to adjacent property owners

Hearing Request

- Schedule a Hearing
- Advertise the Hearing
- Hold the Hearing
- Wait for the Hearing Officers Report
- Make a decision on the application

Specific Information Examined by the Division

- Comments received by the Division.
- The effect of the proposed construction on shoreline recession, beach erosion, flooding, and potential damage to the parcel of real property that is the subject of the permit application, and potential damage to any other parcel of real property, public lands, or personal property .
- The design modifications which may mitigate the impact of the proposed construction.
- Any other factors or information that the Division determines to be relevant to the subject matter of the permit and carrying out the purposes and intent of the Regulations and the Act.

Other

- Approval from the U.S. Army Corps of Engineers

May be in the project area

Stan Mills
Commissioner

MEMO

Date: Monday, October 27, 2008
To: Wastewater Workshop Participants
Re: Workshop Notes….

Hello All,

Thank you for your willingness and availability to participate in our City Wastewater Discharge Alternative Workshop this Saturday. Everyone invited to participate has already committed many hours to this issue by attending the Regular and Workshop meetings of the Board of Commissioners. This extra workshop may well prove redundant at times but I am comfortable that the City is going the extra step to afford the citizenry – especially in a community with so many non-resident property owners – the additional opportunity to participate in the workshop on a non-weekday.

A copy of the two-sided mailer that was sent to all the City property owners and residents is attached below but only gives a broad overview of the program. Additional program notes follow.

Meeting Hall opens at 8:30 a.m. Beverages and pastries will be available. Refreshments are not being advertised but are an additional enticement for you! ☺

9:00 a.m.

Welcome and Review of Today's Workshop Agenda.

Introductions of Workshop Participants and Other Officials.

302-542-1909 Email: smills@cityofrehoboth.com
Home: 38 Maryland Avenue, Rehoboth Beach, DE 19971
City: 229 Rehoboth Avenue, P.O. Box 1163, Rehoboth Beach, DE 19971

Bob Stenger, City Wastewater Department. 10 minutes. (Suggested topics. Stormwater vs sewage piping systems in the city; service area outlined; treatment process: bio-solids/treated effluent; explain levels of treatment: secondary, tertiary; genesis of mandate; consent order timeline; plant operations currently and anything different by going with spray irrigation and with ocean outfall discharge alternatives.)

Rip Copithorn, Stearns & Wheler. 15 minutes. (Suggested topics. "History" of viable options: Original report recommends ocean outfall; Land application became viable with solicitations from outside vendors; RFP process explained with results; Alternative to partner witwh the County by sending effluent to the County's Inland Bays facility; Artesians current proposal to partner with the County and Rehoboth Beach (brief overview – not discussed publicly by Rehoboth Officials yet, needs evaluation). Apparent viable discharge alternatives to date reiterated. Plant upgrades required: land application with County; ocean outfall. Ocean outfall. Ocean outfall terminus: how determined. Explain ocean modeling. Ocean outfall route from WWTP to ocean: how determined. Give some details on possible construction methods and materials. Review timeline.)

Michael Izzo, Sussex County Engineer. 10 minutes. (Suggested topics. County interest; 1/3 are county customers. County Council's decision to not partner with Rehoboth in a regional solution. From engineer's and operator's perspectives, efficiency/ease of operations and maintenance of a spray irrigation facility versus a facility that uses ocean outfall. Update on Artesian proposal to partner with the county. Map/poster of Sussex County showing where Wolfe Run WWTP and Inland Bays WWTP/land application sites are located.)

Dr. Ullman, University of Delaware, College of Marine & Earth Sciences. 10 minutes. (Suggest to condense version of presentation – see minutes. Scientific perspectives on dilution and ocean outfall; scientific perspectives on ground water recharge and nutrients eventually entering the inland bays.)

Kathy Bunting-Howarth. 20-25 minutes. (Suggested topics. Introduction of other DNREC representatives, their departments and areas of interests. [Identify everyone as they are invited to participate in the Q&A sessions.] Overview of DNREC perspective on advantages/disadvantages/positive attributes/areas of caution of land application/spray irrigation and of ocean outfall. Permitting process overview and timeline.

10:15 – 11:15.

Questions and Answers. (Two sessions – all DNREC, etc. attendees are invited to participate.) Questions posed by the moderator (myself) from questions, concerns and comments generated from the audience at meetings and from the recent solicitation for comments by the City. At the end of this session I would offer the panelists the opportunity to pose questions. You may also submit questions in advance.

11:15 – 11:30. Break.

1**1:30 – 12:30.** Q&A from the audience.

1**2:30 p.m.** Workshop Closes.

Location of Meeting: Second floor meeting room, Rehoboth Beach Fire Department, Rehoboth Avenue, adjacent to city hall, ocean side.

We are anticipating 75 in the audience.

If you want us to copy and distribute any handouts, please submit by Thursday morning.

PowerPoint projector and laptop will be available. Please advise in advance if needed.

As attendees will be standing around at times, the City can enlarge some of your slides for use as posters. Please submit by Wednesday. An example would be the proposed route for the ocean outfall piping through the city from treatment plant to the ocean (I already have this one in hand). Another example might be a land and/or aerial map of Sussex County showing locations of Wolfe Run and Inland Bays WWTP/Spray Irrigation sites.

Additionally, please find below a compilation of meeting agendas and (approved) minutes to date on topic. The minutes appear to highlight the important issues from each presentation. Other than the few suggestions above, you may determine the content of your presentations you desire to best highlight the important issues. You might also advise me if you find anything unclear or erroneous about your topics within the minutes so we can clarify at the workshop or at some future meeting.

I look forward to seeing everyone this Saturday morning.

Thank you again in advance for your participation.

Please feel free to contact me directly with any questions or to make copies or posters, etc.

And did I mention we'd have refreshments? ☺

Regards,
Stan

Attachments: Compilation of agendas and minutes
Workshop mailer notices.

City of Rehoboth Beach

Wastewater Discharge Alternative Workshop

November 1, 2008

9:00 a.m. – 12:30 p.m.

Program

Welcome

Presentations from agencies on their areas of interest and comments with respect to their field on alternative discharge methods.

Bob Stenger, City Wastewater Department

Rip Copithorn, Stearns & Wheler Engineers

Michael Izzo, Sussex County Engineer

Professor Ullman, University of Delaware, College of Marine & Earth Studies

Kathy Bunting-Howarth, DNREC

Maria Sadler, DNREC

Sarah Cooksey, DNREC

Questions and Answers I:
Questions posed by the moderator from questions, concerns and comments generated from the audience at previous meetings and from the recent solicitation for comments by the City

Break

Questions and Answers II:
Audience Participation

Who's Who?

Robert Stenger, Wastewater Department Supervisor, City of Rehoboth Beach

Rhodes R. Copithorn, P.E., BCEE, Vice President, Stearns & Wheler, LLC, Environmental Engineers and Scientists. Engineer/consultant to City of Rehoboth Beach

Michael Izzo, Engineer, Sussex County

William J. Ullman, Professor and Program Director Oceanography, University of Delaware, College of Marine and Earth Studies. http://www.ocean.udel.edu/people/profile.aspx?ullman

Department of Natural Resources and Environmental Control (DNREC) Personnel:

Kathy Bunting-Howarth, J.D., Ph. D., Director, Division of Water Resources. 302-739-9949, katherine.howarth@state.de.us

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Excerpts from DNREC online: http://www.dnrec.delaware.gov/Pages/Divisions.aspx

The mission of the Division of Fish and Wildlife is to conserve and manage the fish and wildlife resources of the state, to provide safe and enjoyable fishing, hunting, and boating opportunities to the citizens of Delaware and its visitors, to manage and make available for public use and enjoyment the lands with which it has been entrusted, and to improve the publics understanding and interest in the state's fish and wildlife resources through information and outreach programs.

The Division of Soil and Water Conservation is responsible for preserving and protecting the state's soil, water and coastal resources by managing the state's shoreline, coastal zone and navigable waterways, by regulating coastal and urban land use and construction activities and by promoting wise agricultural land management practices. Specifically, the Division:

- Provides for the preservation & enhancement of the state's beaches
- Maintains & improves navigational channels in Delaware's inland waterways
- Provides planning & organizational assistance for the development & maintenance of tax ditches to ensure the conservation of both agricultural & urban areas through improved drainage & water management
- Provides technical assistance to landowners regarding sound conservation practices
- Serves as the administrative lead for the Delaware Coastal Management Program
- Provides for the development & implementation of the state's recently mandated Sediment and Stormwater & Nonpoint Source Pollution Programs

At A Glance

The Division of Water Resources manages and protects water resources through various regulatory programs by providing technical assistance, laboratory services, and educational services; performing applied research; and helping finance water pollution control measures. Our staff serves over 15,000 individual water resources customers each year and protects water resources for Delaware's visitors and residents.

The Division consists of seven sections; each is sized to promote efficient operations:

Division Management Section (Katherine E. Bunting-Howarth, Director) - coordinates Division operations and provides centralized information management, fiscal, personnel, and legal services. The section also administers the water utility certification program and provides a link with external programs including the Delaware Estuary Program, Inland Bays Estuary Program, Delaware River Basin Commission, Appalachian States Low-Level Radioactive Waste Commission, Delaware Authority on Radiation Protection, and Delaware Emergency Management Agency.

The Financial Assistance Branch (Terence L. Martin, Acting Administrator) provides planning, engineering, and technical assistance for wastewater systems and financial aide to help reduce water pollution. Other staff members provide education/information services, centralized computer and geographic information system services, and better access to the Division through a Community Liaison.

Environmental Laboratory Section (Sergio Huerta M.D., Manager) - operates a full-service environmental laboratory to test and assess water, air, soil, hazardous materials, and biological samples. Water quality and biological monitoring of surface waters is an important section function. Fee-for service quality environmental testing is provided to a variety of customers in a cost-effective manner. The Section performs basic water quality testing for Delaware citizens at no charge.

Surface Water Discharges Section (R. Peder Hansen, P.E., Manager) - issues permits for industrial and municipal wastewater treatment systems (including storm water) and sludge management. Technical assistance is provided directly to wastewater treatment facilities to help address operational problems. The Section also provides support to the Board of Certification that licenses wastewater treatment plant operators.

Ground Water Discharges Section (Dave J. Schepens, Manager) - conducts site reviews, field checks and approves site evaluations for the installation of septic systems, underground injection wells, spray irrigation wastewater systems, and other systems associated with wastewater treatment. This section also issues sludge transport permits and licenses to septic system designers, percolation testers, site evaluators, and system installers.

Water Supply Section (Stewart Lovell, P.G., Manager) - issues well and water allocation permits and licenses to well contractors/drillers and pump contractors/installers. Section responsibilities also include statewide drought management, ground water quality monitoring, wellhead and source water protection programs, and water withdrawal quantities in coordination with the Delaware River Basin Commission.

Watershed Assessment Section (John W. Schneider, Manager) - monitors the health of the State's aquatic resources and protects the health of swimmers and shellfish consumers. The section provides technical support for programs within the Department; performs soils evaluations, develops water quality monitoring strategies and modeling, and watershed basin evaluations; and works to integrate wetlands and watershed management.

Wetlands and Subaqueous Lands Section (Laura M. Herr, Manager) - provides permitting services for activities that affect subaqueous lands, tidal wetlands, and marinas. Tidal maps of wetlands and planning for the resource management of these natural resources are also provided.

Review of wastewater discharge alternatives past and present

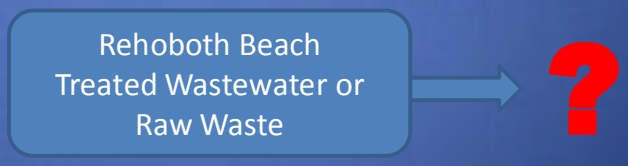
Slide presentation prepared by Stan Mills

of December 15, 2008

Objective: Selection of alternate discharge

Current permitted discharge

Alternate discharge to be in operation by December 30, 2014 per consent order



Alternative: Technically feasible, cost effective, environmentally responsible, complies with

Four alternative [discharge methods] identified for consideration through discussions with the City, the County and DNREC:

Land Application

Treated effluent is sprayed on agricultural land to irrigate crops and provide nutrients. The effluent percolates through the soil to the groundwater.

Rapid Infiltration Beds

Treated effluent is flooded onto sand beds allowing the water to percolate down into the groundwater.

Subsurface injection

Treated effluent is injected either through a shallow well in an area where the groundwater is contaminated or through a deep well into an aquifer that is confined below the drinking water aquifers.

Ocean Outfall

Treated effluent is discharged through an outfall and diffuser into the ocean at a depth and distance from the shore that insures public health and environmental standards are met.

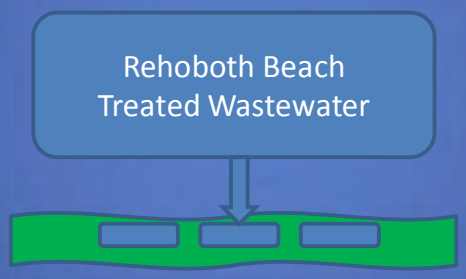
Stearns & Wheler Report of August 2005 cited.

Compilation of wastewater discharge alternatives, past & present.

Status of same.

Rapid Infiltration Beds (RIBs)

Treated effluent is flooded onto sand beds allowing the water to percolate down into the groundwater.

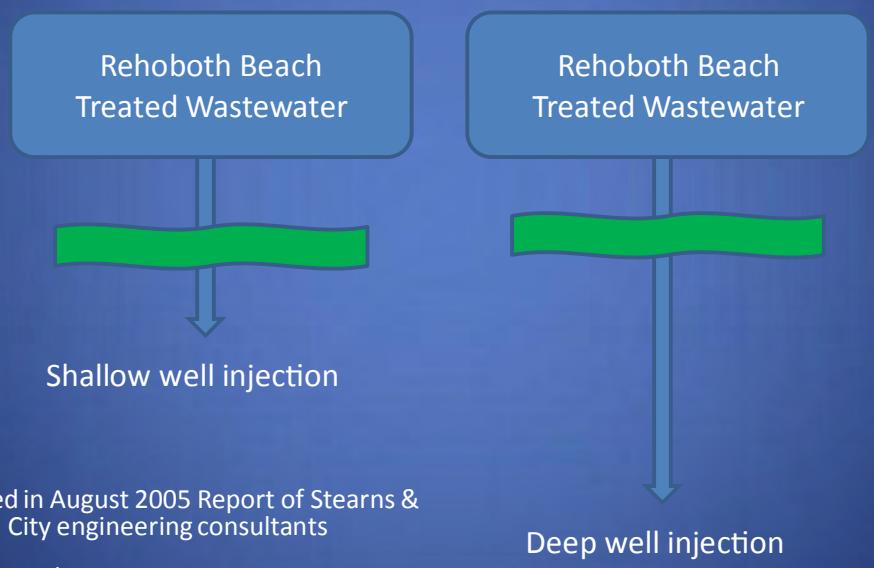


Evaluated in August 2005 Report of Stearns & Wheler, City engineering consultants

Eliminated

Subsurface Injection

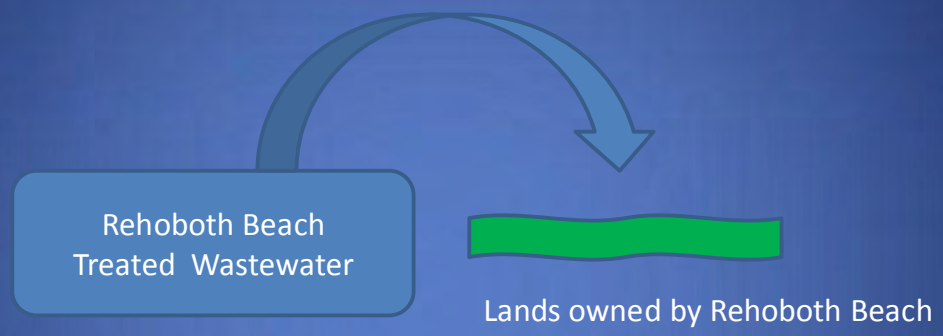
Treated effluent is injected either through a shallow well in an area where the groundwater is contaminated or through a deep well into an aquifer that is confined below the drinking water aquifers.



Evaluated in August 2005 Report of Stearns & Wheler, City engineering consultants

Both rejected

Spray irrigation onto lands purchased/owned by the City of Rehoboth Beach



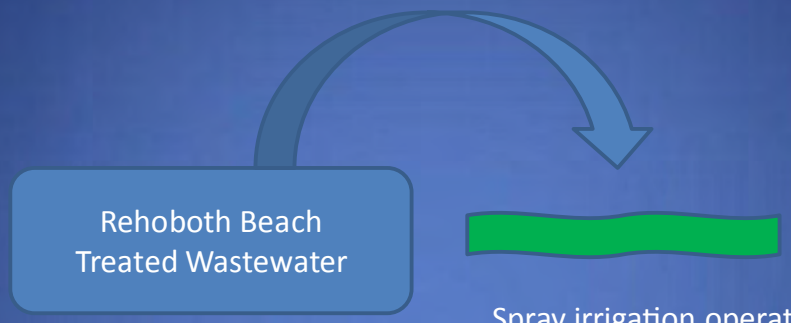
Evaluated in August 2005 Report of Stearns & Wheler, City engineering consultants

Rejected.

Ocean Outfall

Stearns & Wheler is developing estimates based on figures obtained in-house and from outside marine contractors.

Spray Irrigation via a vendor

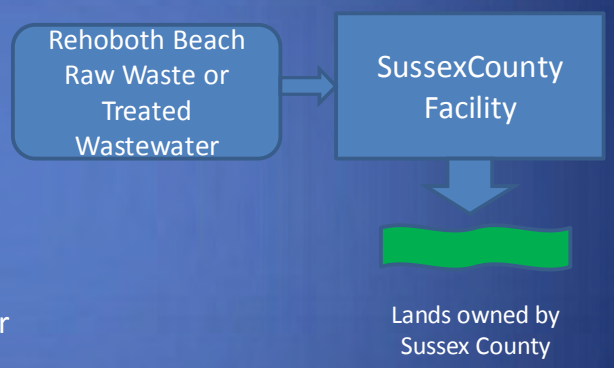


Spray irrigation operations by an outside vendor on lands owned/leased by an outside vendor.

Option eliminated.

Spray irrigation via partnering with Sussex County and sending RBs raw waste or treated wastewater to County facilities for spray irrigation

Possible routing of



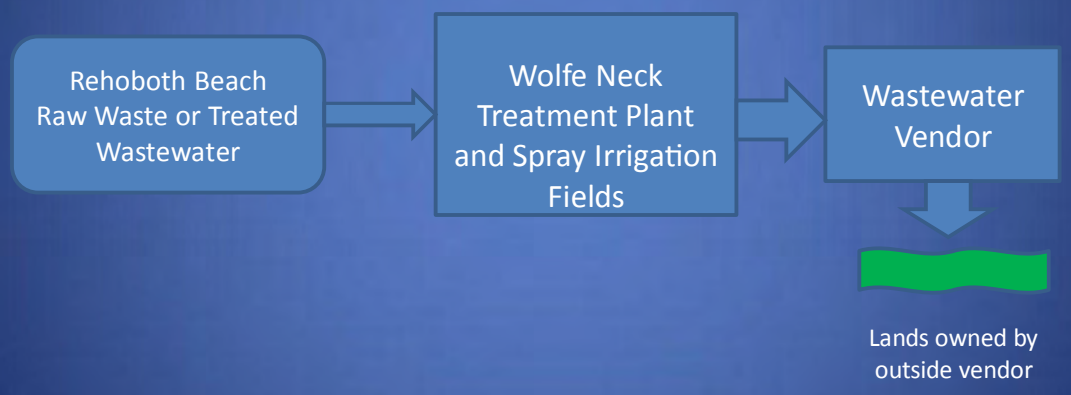
Wastewater Treatment Plant for treatment and spray irrigation.

Treated effluent sent to Wolfe Neck WWTP or

facility for spray irrigation?

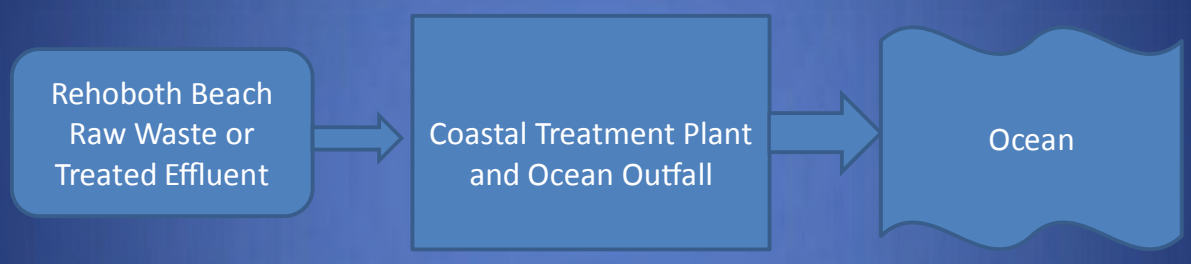
Currently being addressed by seeking funding through Clean Water Advisory Council to perform engineering studies and costing analysis

Spray Irrigation via three-way partnership with outside vendor, Sussex County and Rehoboth Beach



Under consideration

Ocean Outfall via sending raw waste or treated wastewater to the South Coastal facility



?

What other alternatives have been considered in the past?

Have we overlooked any alternatives?

Viable alternatives as of December 15, 2008

Ocean outfall

Land application by Sussex County

Land Application by an outside vendor?

Next steps.

- Pursue pricing of each alternative
- Determine user fees
- Identify funding
- Debate the merits of each alternative

DEPARTMENT OF NATURAL RESOURCES
AND
ENVIRONMENTAL CONTROL

Delaware Water Pollution Control Revolving Loan Fund

City of Rehoboth Beach

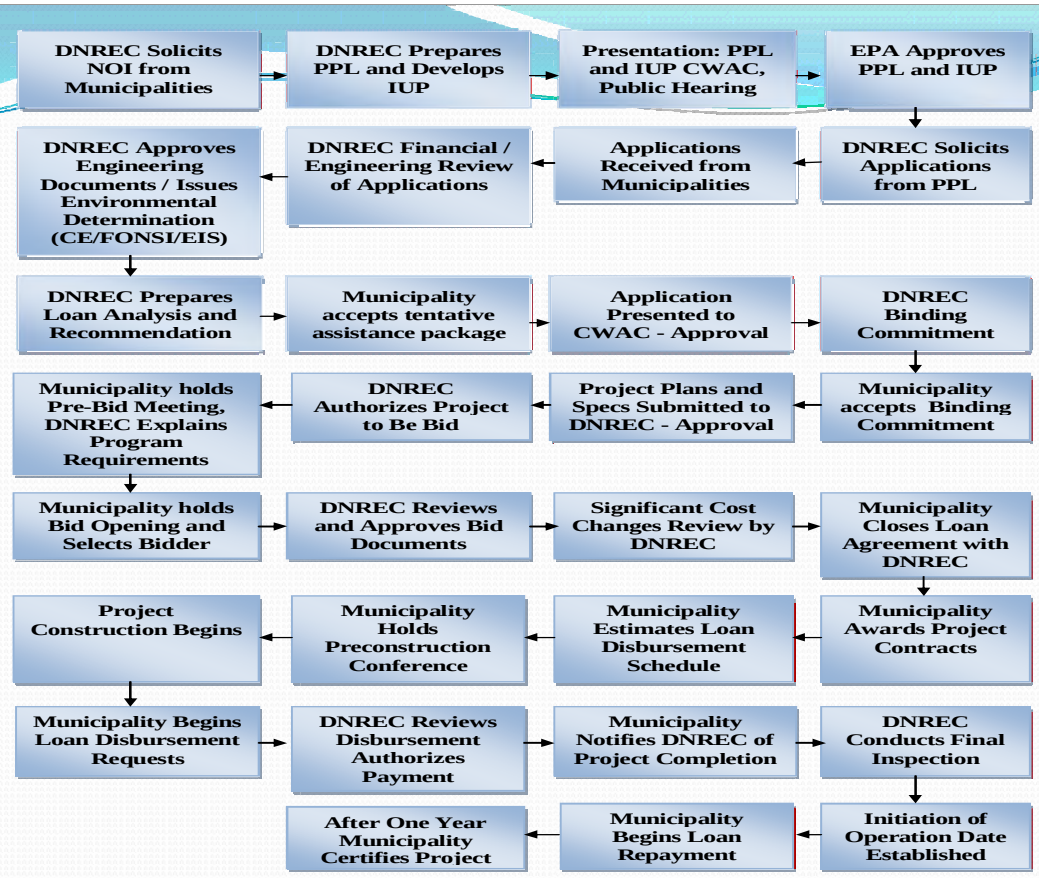
December 15, 2008

DIVISION OF WATER RESOURCES
FINANCIAL ASSISTANCE BRANCH
Terry L. Deputy, CEcD

Delaware Water Pollution Control Revolving Loan Fund
City of Rehoboth Beach

- Presentation Purpose
  - To provide the City of Rehoboth Beach with an overview of the Delaware Water Pollution Control Revolving Loan Fund (WPCRLF)
  - To provide an overview of possible wastewater user rates, given an **assumed project cost**, **assuming that the project is fully funded through the WPCRLF**, and other cost variables taken from the Stearns & Wheler Report.
  - To be a resource to the City of Rehoboth Beach once a wastewater disposal option is selected.

- Clean Water SRF Overview
  - 1987 - Federal grant assistance for construction of wastewater facilities was replaced with a revolving loan fund program
  - Communities are required to repay wastewater infrastructure loans, thereby providing a source of funds for new loans
  - 1990 - Delaware Water Pollution Control Revolving Loan Fund program was created; federal capitalization grants seed the program along with required twenty percent state matching funds
  - Clean Water Advisory Council, is charged with evaluating, establishing, and recommending strategies, plans, and procedures to help ensure the long-term provision of adequate wastewater facilities in Delaware



Delaware Water Pollution Control Revolving Loan Fund
City of Rehoboth Beach

- **Assumption**: Project Cost - CWSRF loan $36,000,000

- Annual Debt Service @ 3.06% /20 years 2,419,951
- Estimated annual O,M, R cost* 418,000
- Total Annual Cost $ 2,837,951

- Initiation of Operations: 2012
- Projected MHI: 2012 $ 72,051

- EDU's @ Initiation of Operations:*
  - Residential: 2,115
  - Commercial: 1,302
  - Total EDU's 3,417

- Residential share of Total SRF loan annual cost @ 62% $ 1,759,530

- Projected Annual Residential Cost per EDU $ 832
- Existing Annual Rate per EDU(in 2012 $s)* 344
  $ 1,176

- Affordability index per EDU **1.63**

* Stearns & Wheeler, LLC report, 2005

Delaware Water Pollution Control Revolving Loan Fund
City of Rehoboth Beach

Questions

Rehoboth Beach Wastewater

Treatment Plant

Alternative Discharge Cost Evaluation

March 2009

STEARNS & WHELER LLC
Environmental Engineers & Scientists

Alternative Discharge Cost Evaluation
for
Rehoboth Beach Wastewater Treatment Plant

Prepared for:

CITY OF REHOBOTH BEACH
P.O. Box C
229 Rehoboth Avenue
Rehoboth Beach, DE 19971

Prepared by:

STEARNS & WHELER, LLC
16701 Melford Boulevard
Suite 330
Bowie, MD 20715

March 2009

S&W Project No. 81079

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Appendix C Capital Cost Estimates
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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.

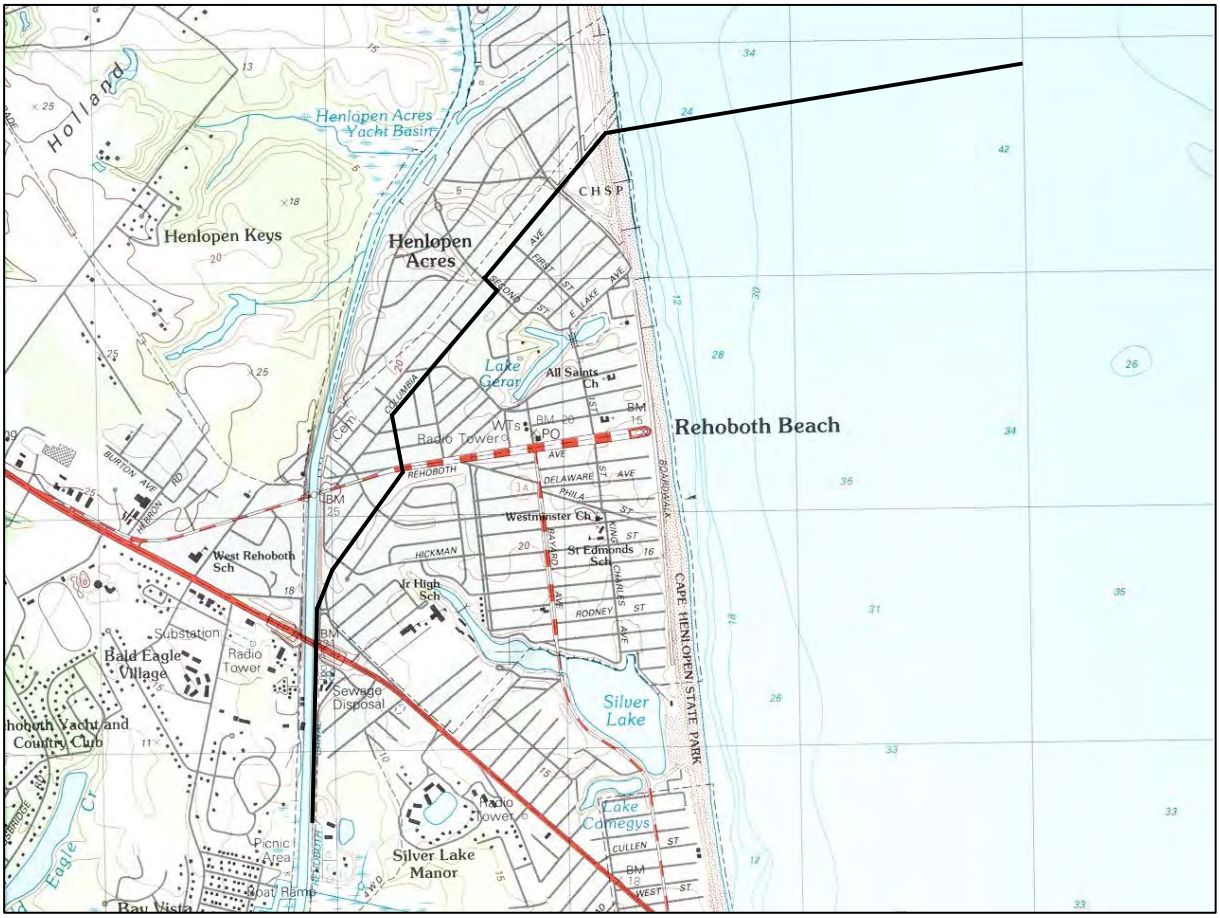

Figure 2.2-1: Proposed Alignment of Force Main and Ocean Outfall

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

Deleted: r

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

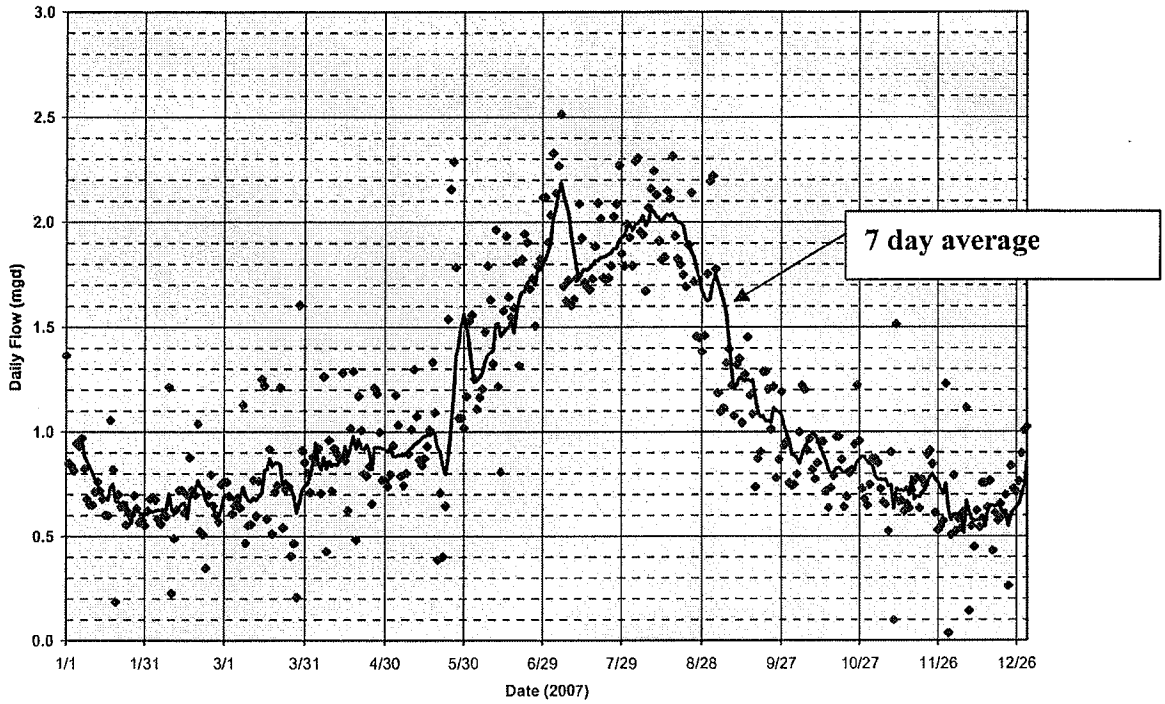
WINTER	
Average	0.786
Min	0.037
Max	2.289

Peaking Factors

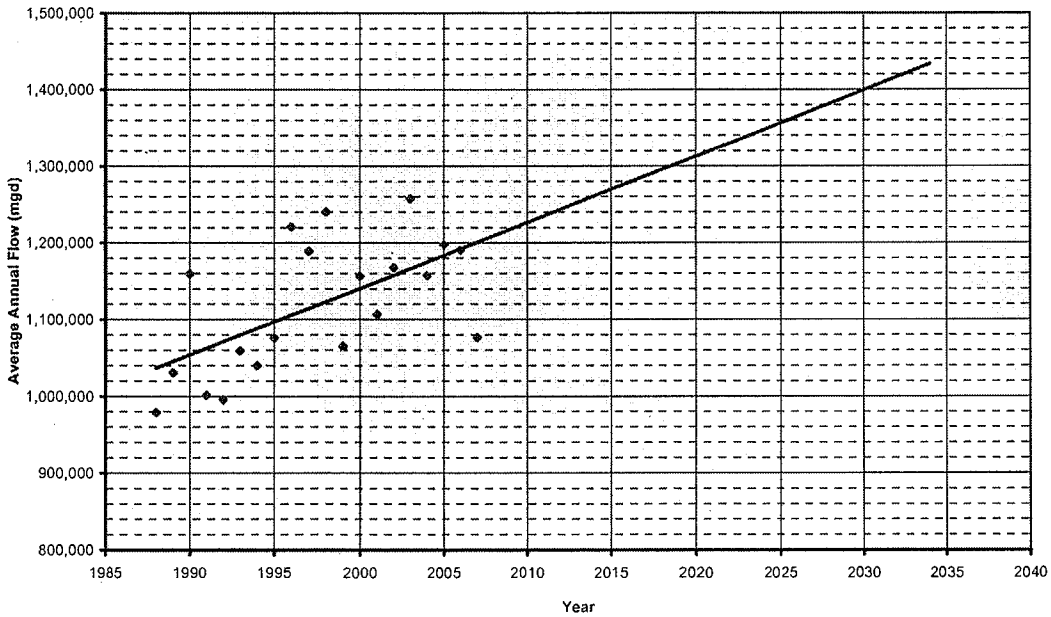
Summer/Winter Average	2.10
Summer/Annual Average	1.53
Winter/Annual Average	0.73

		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

RECEIVED
SEP 23 2005
CITY MANAGER'S OFFICE

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

Delaware's good nature depends on you!

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.

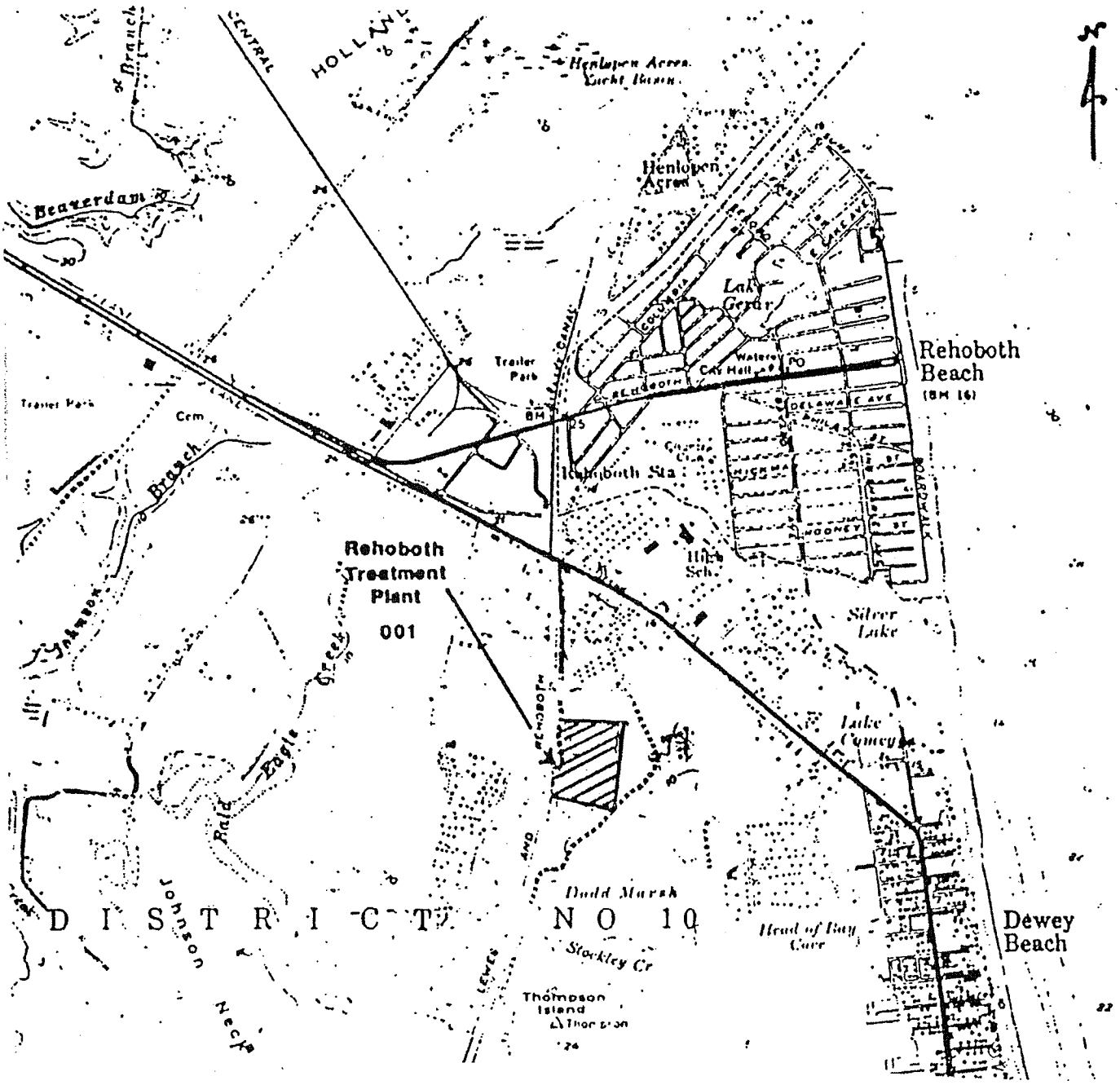
R. Peder Hansen, P.E.
Surface Water Discharges Section
Division of Water Resources
Department of Natural Resources and Environmental Control

September 21, 2005
Date Signed

A. General Description of Discharges and Facilities

1. **Site Location Map**

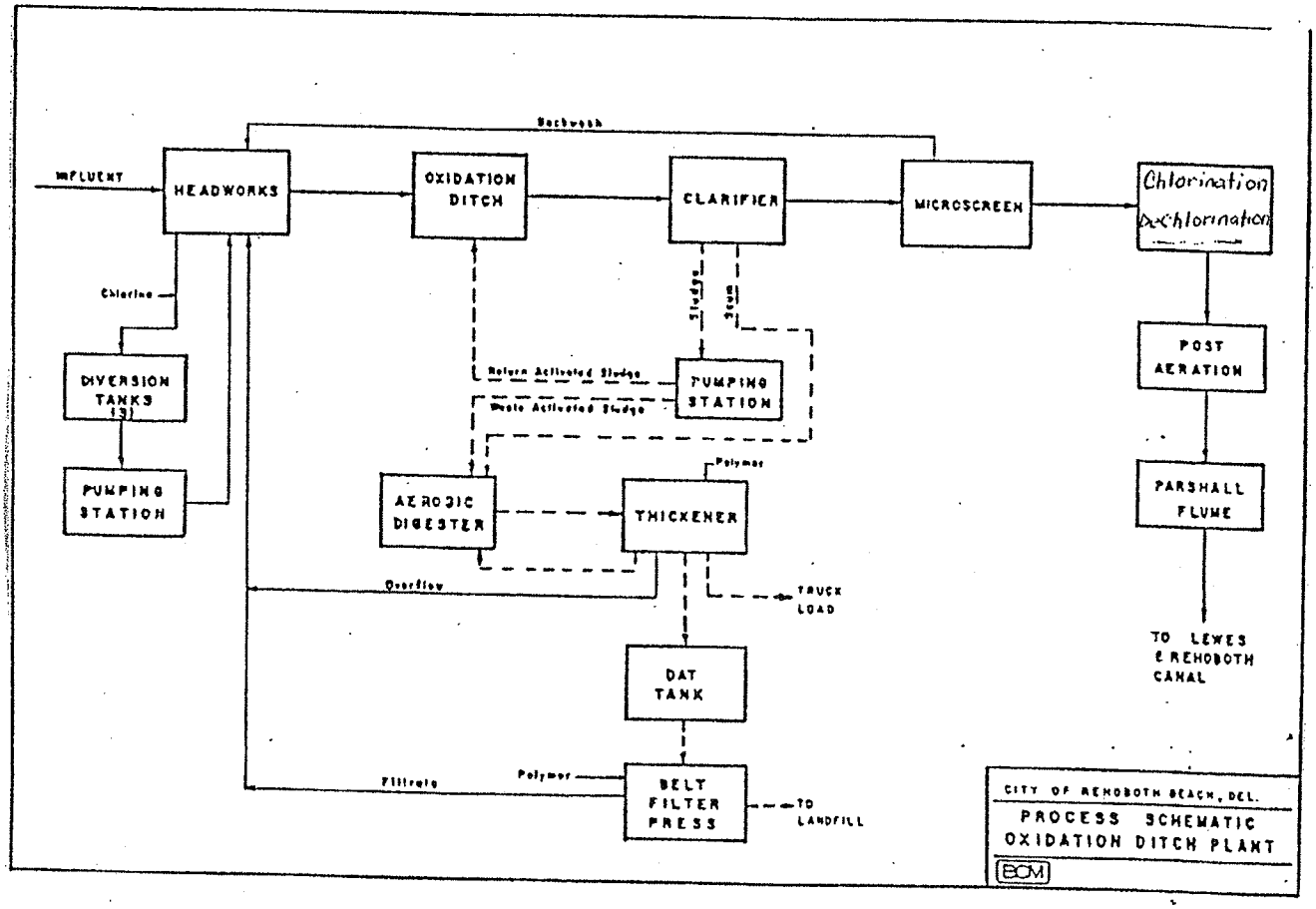
Outfall 001 - Effluent from the wastewater treatment facilities. The discharge is conveyed to the Rehoboth segment of the Lewes-Rehoboth Canal.



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	
BOD5	539	822	lbs/day	19	29	mg/L		Composite
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, $s = (\sum(x-x)^2/(n-1))^{1/2}$, 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
FAX: (302) 739-8369

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).

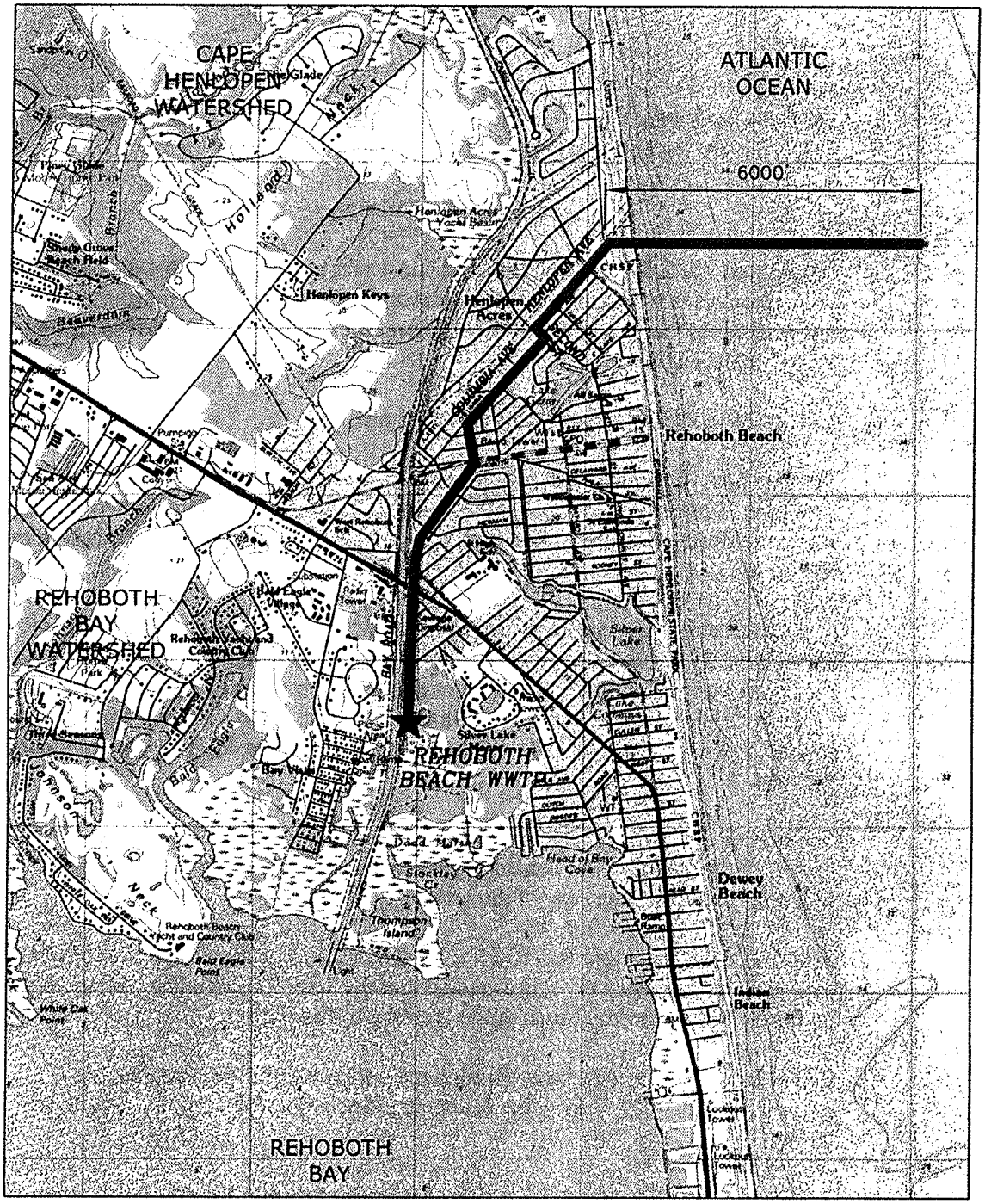
5. The outfall and diffuser pipe will be ballasted with concrete collars located 20-feet on center. There will also be helical screws located 20-feet on center. The helical screw will be placed on either side of the concrete collars.

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

DATE:09/04 JOB No.:20212.10

REHOBOTH BEACH
EFFLUENT DISPOSAL STUDY

FIGURE 7-11
PROPOSED REHOBOTH BEACH
OCEAN OUTFALL

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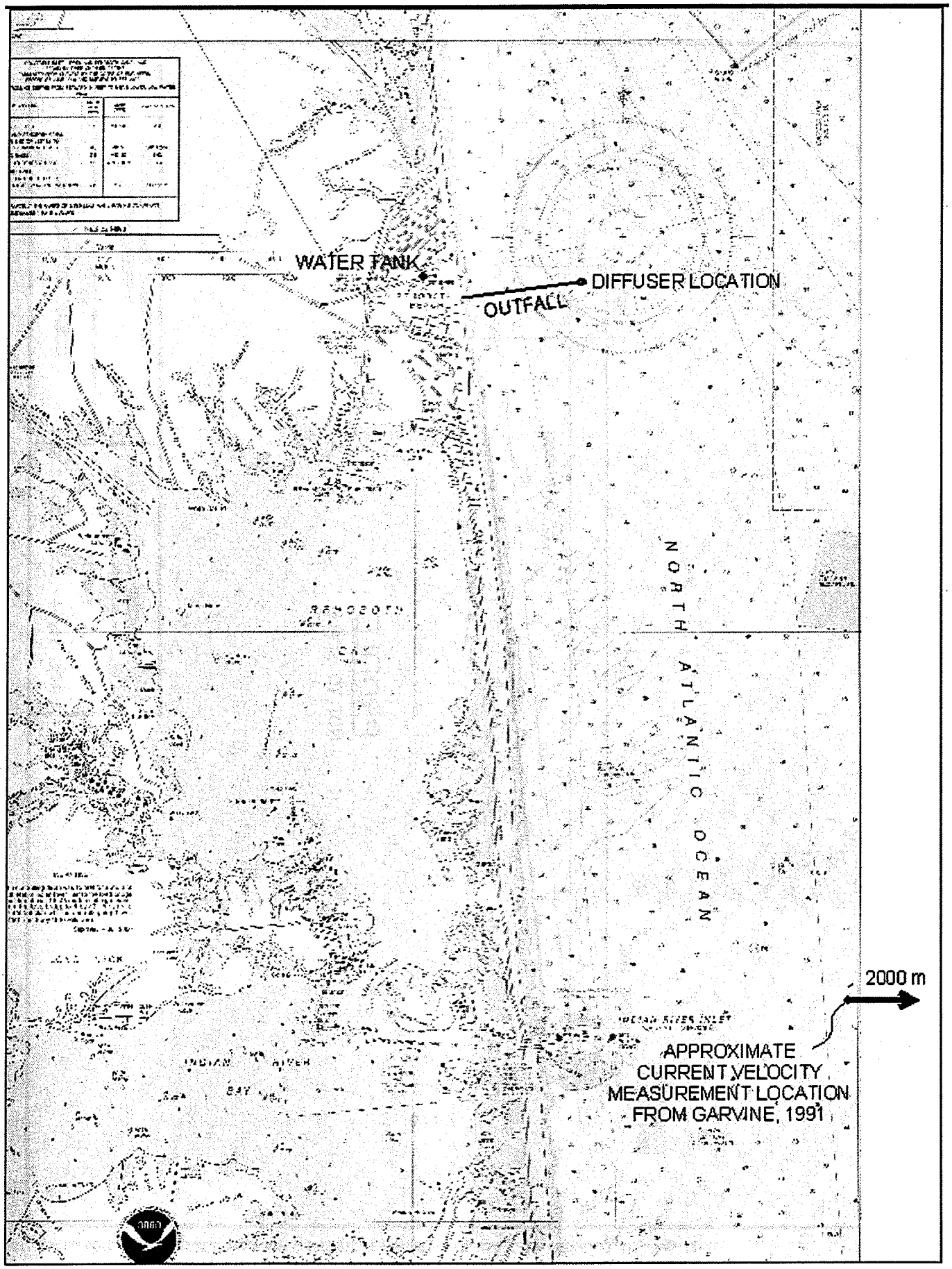
WATER TANK
DIFFUSER LOCATION
OUTFALL
NORTH ATLANTIC OCEAN
2000 m
APPROXIMATE CURRENT VELOCITY MEASUREMENT LOCATION FROM GARVINE, 1991

08/04 BOWIE LB
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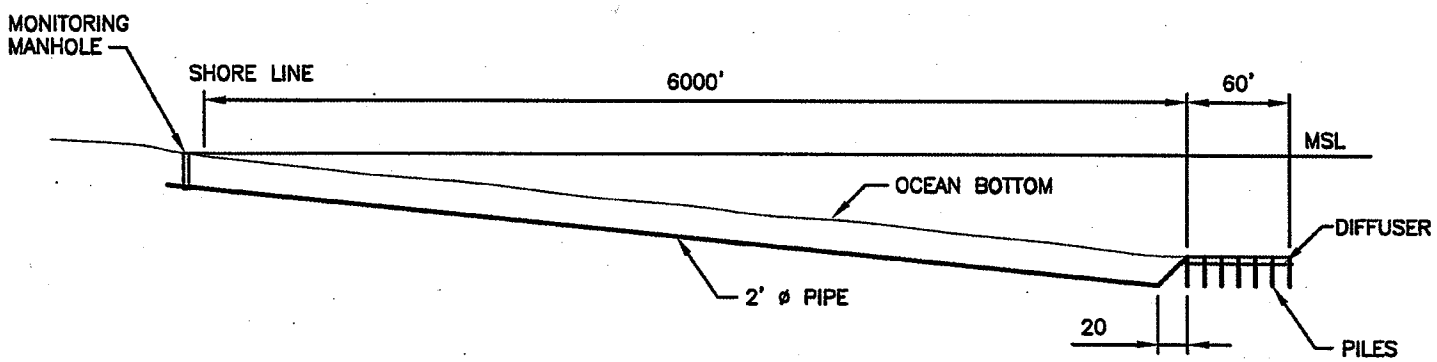

PROFILE

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
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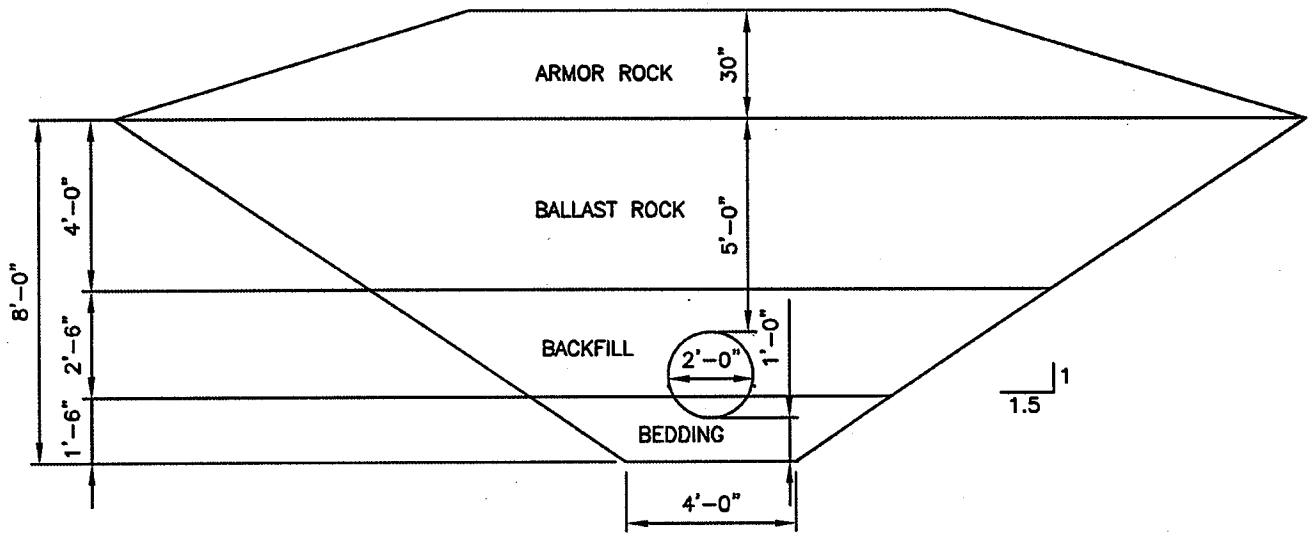

TYPICAL OCEAN OUTFALL CROSS SECTION

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

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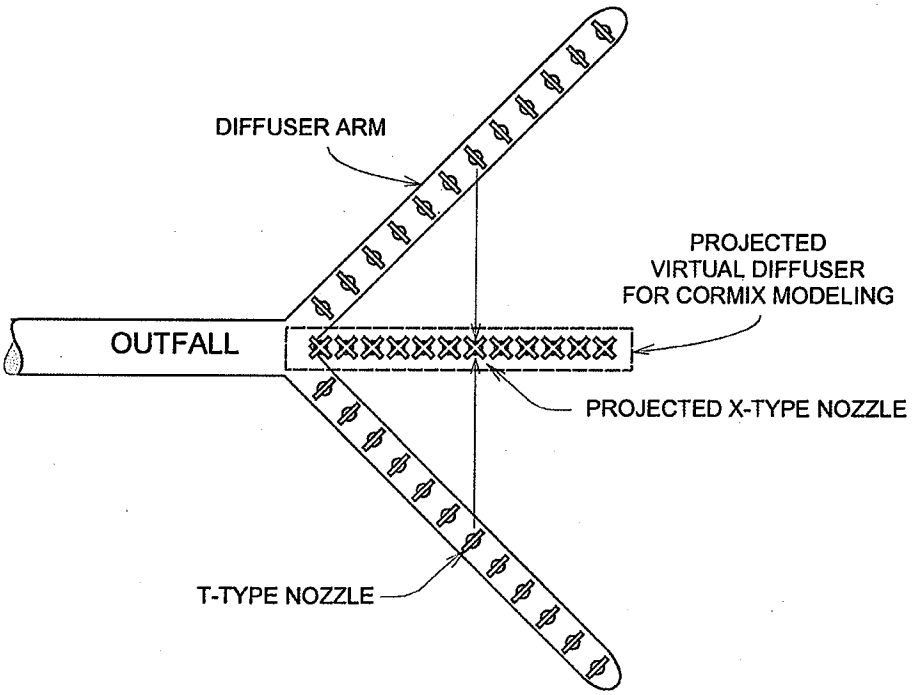

Schematic Design of Diffuser
Proposed Rehoboth Beach Ocean Outfall

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

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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

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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

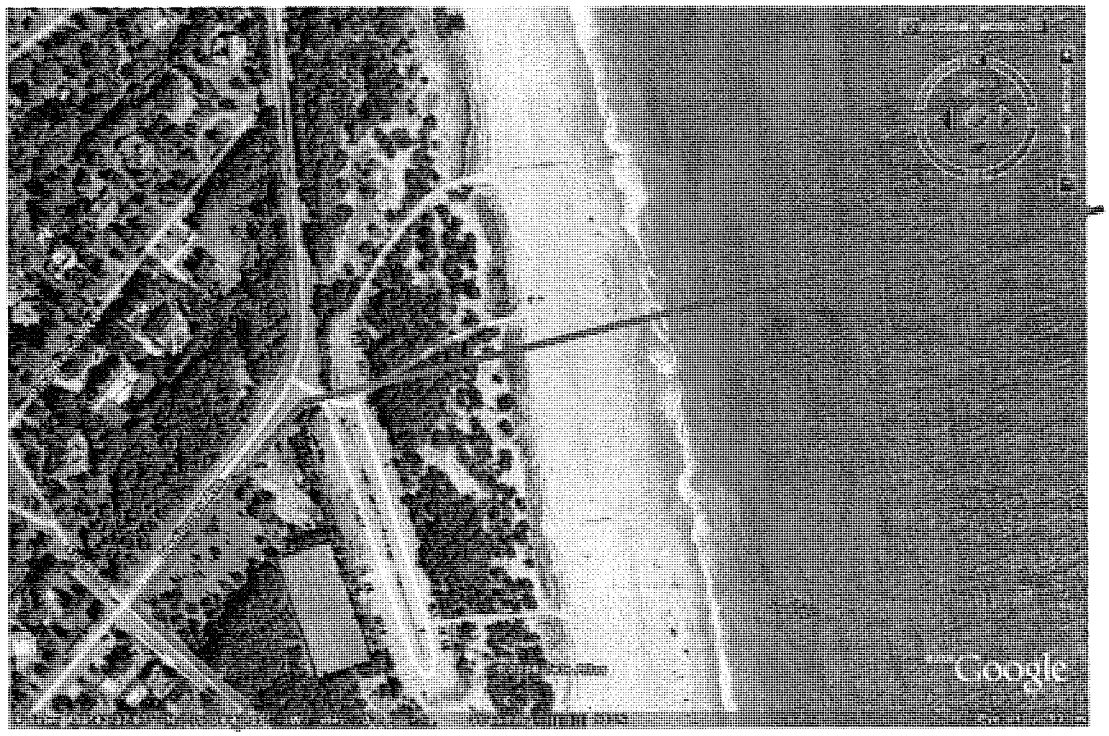
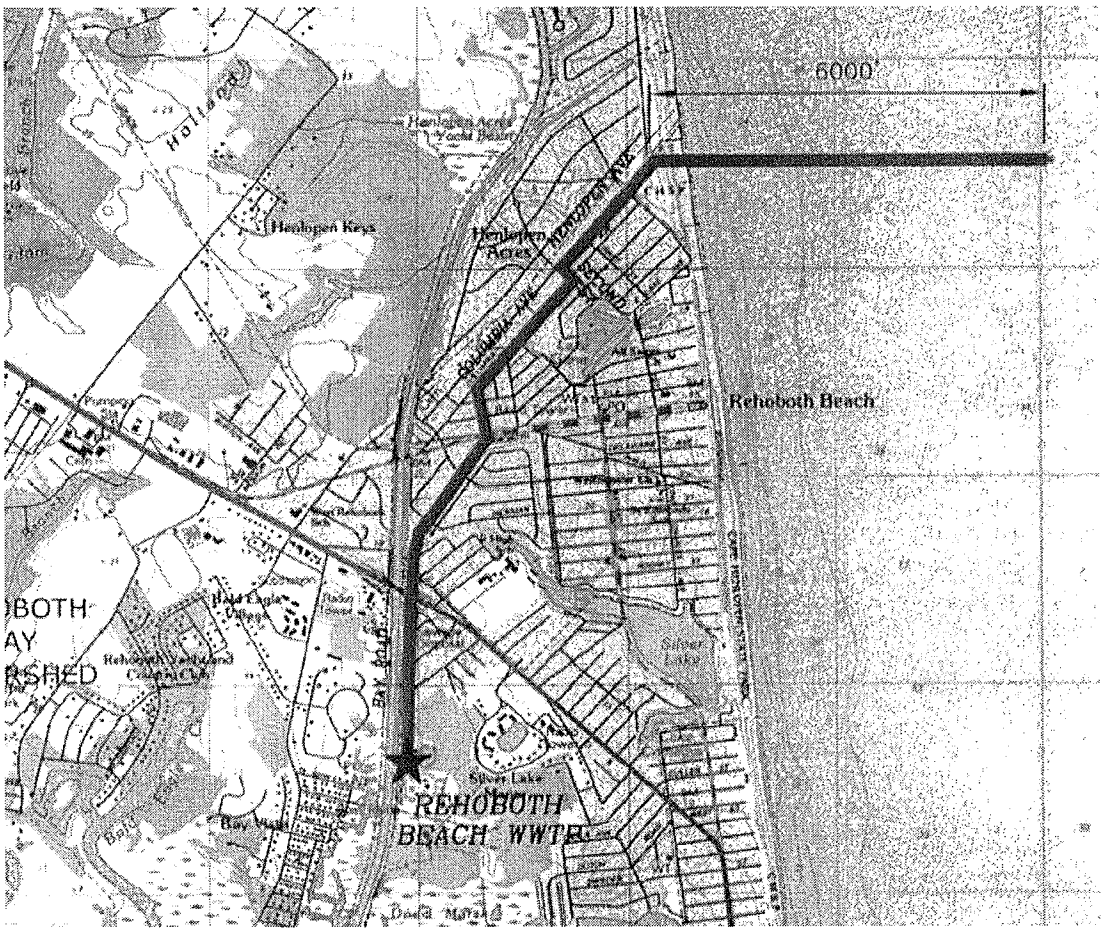


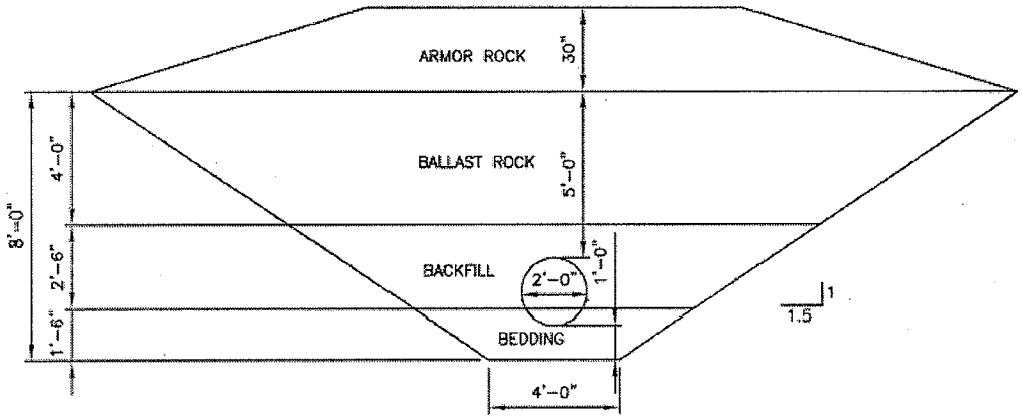
Figure 1-2 Plan of Proposed Pipeline and Outfall Route



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



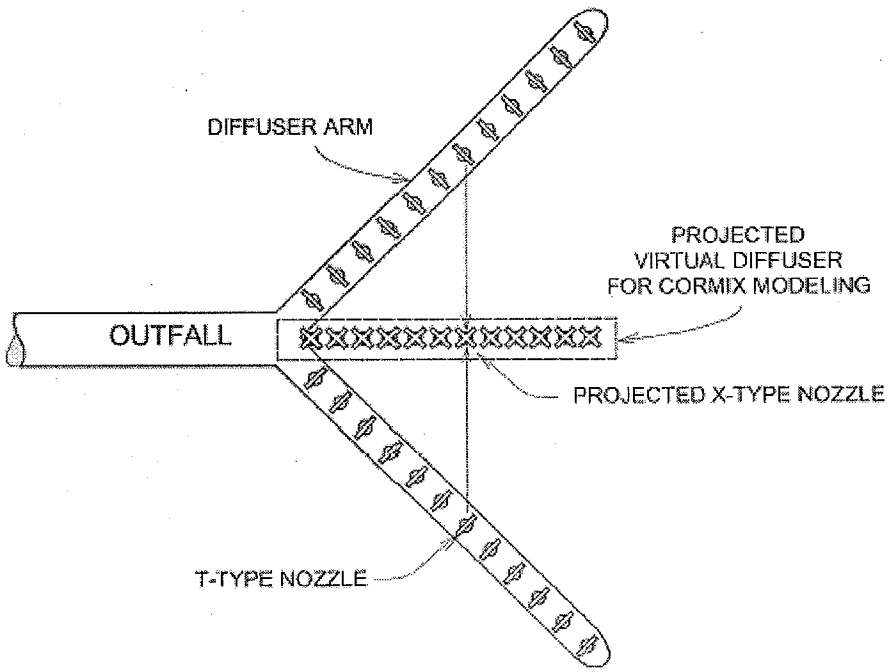
TYPICAL OCEAN OUTFALL
CROSS SECTION
SCALE: NTS

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

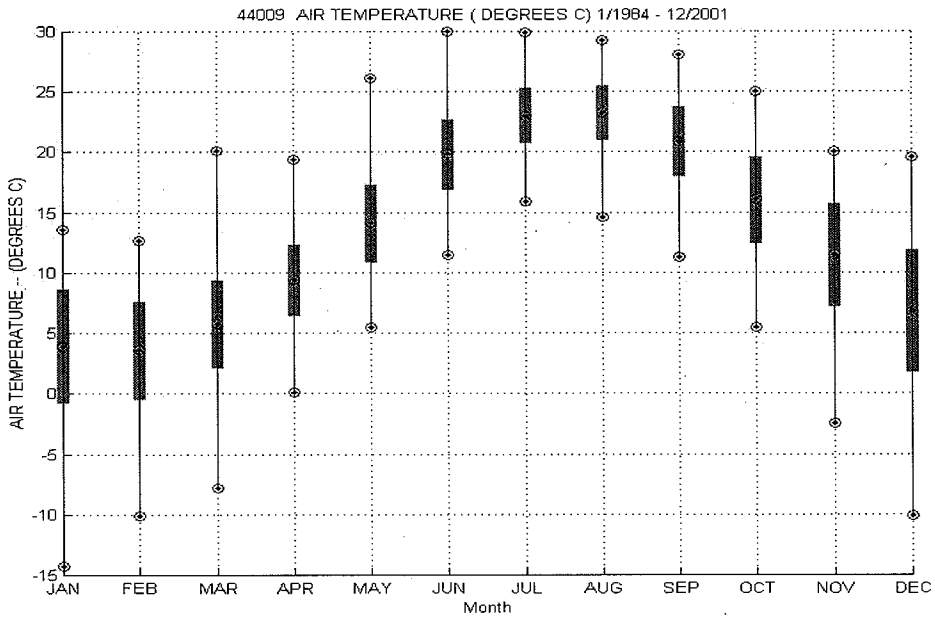


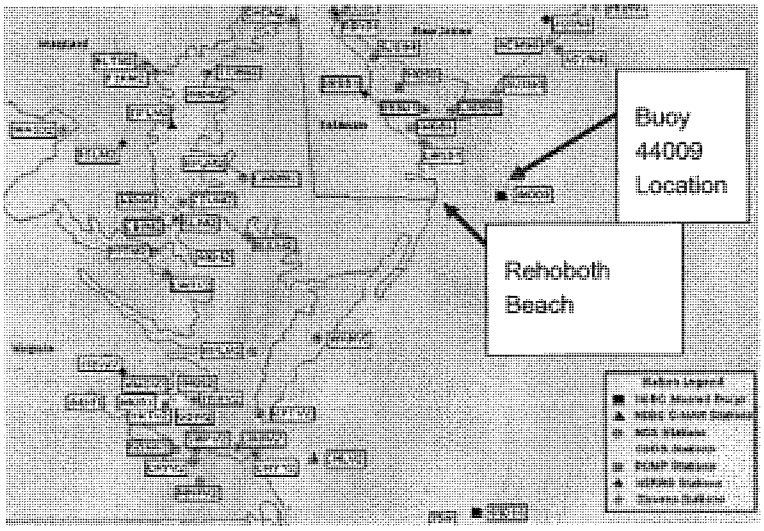
Figure 2-2 Rehoboth Beach Average Temperatures and Rainfall

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

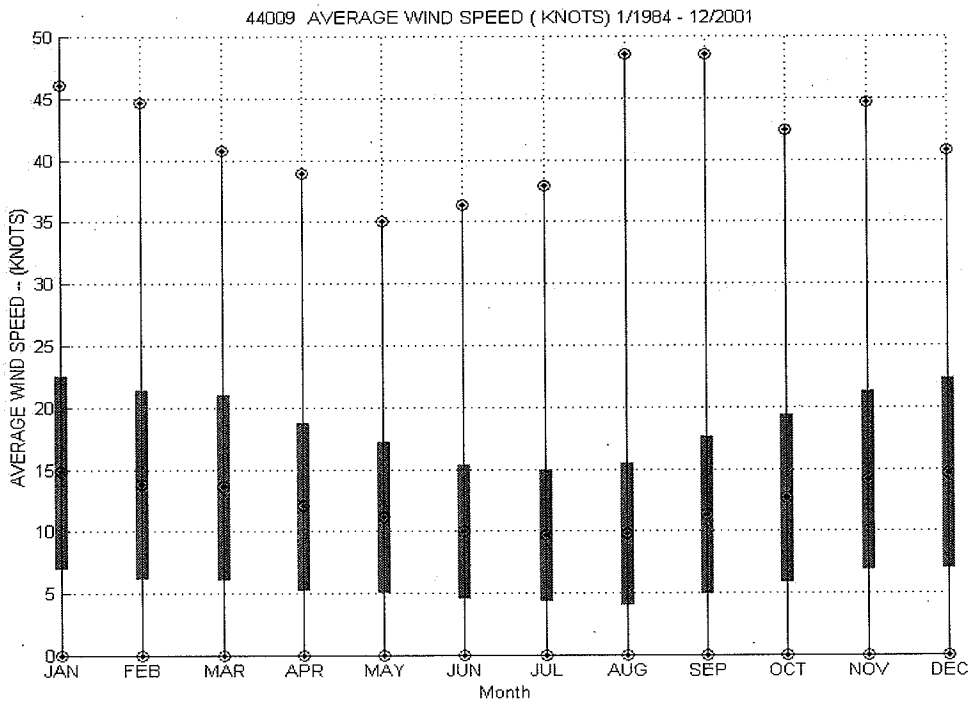
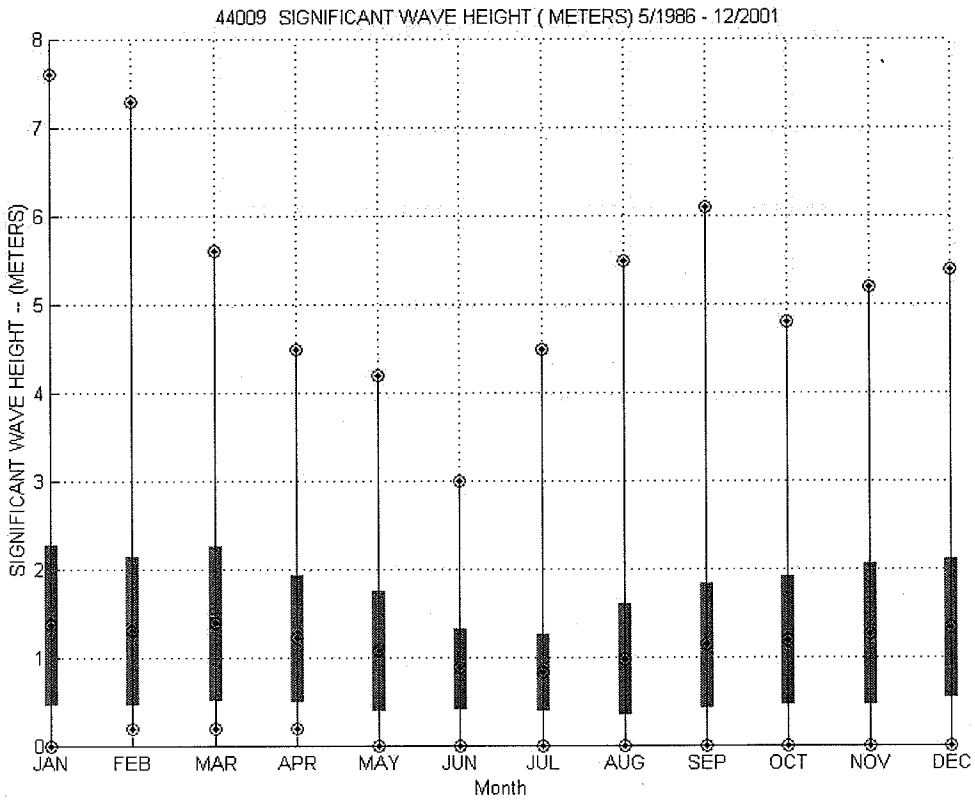


Figure 2-4 Rehoboth Beach Significant Wave Height by Month



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

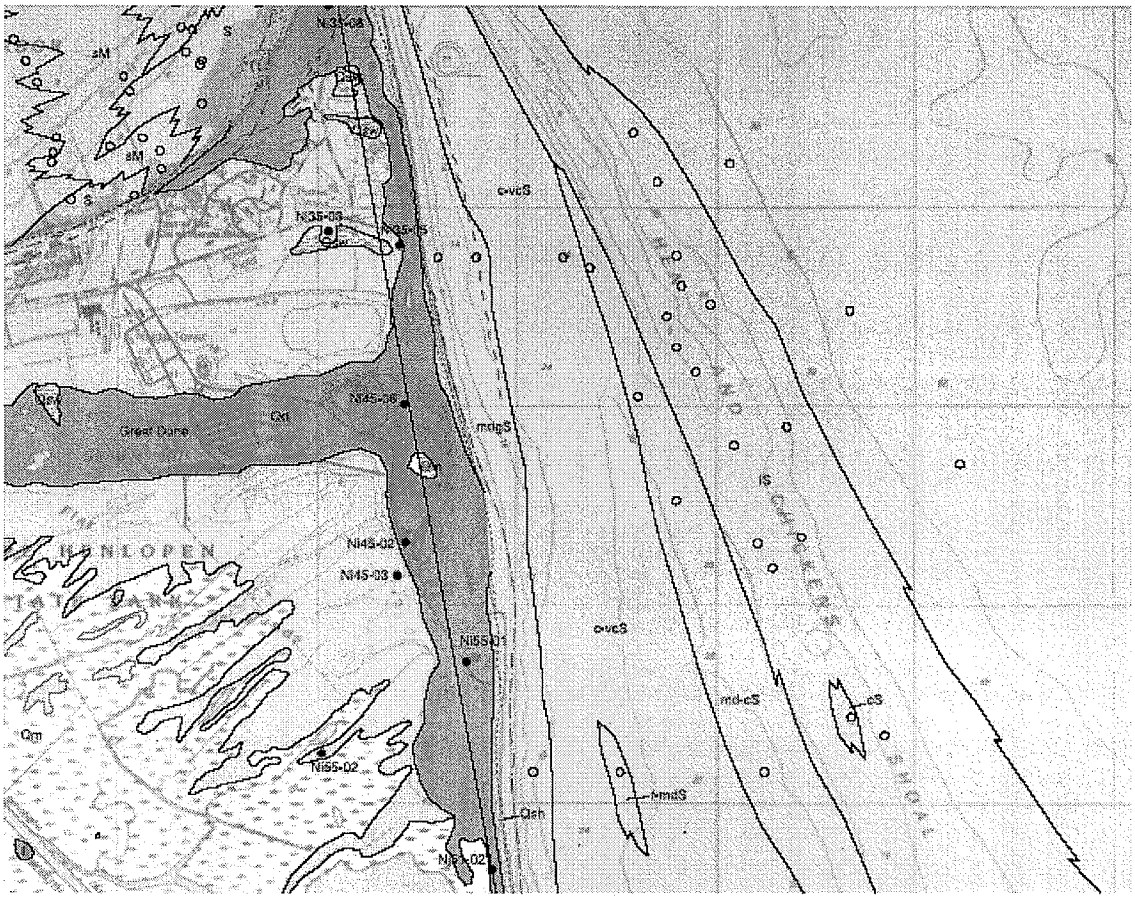
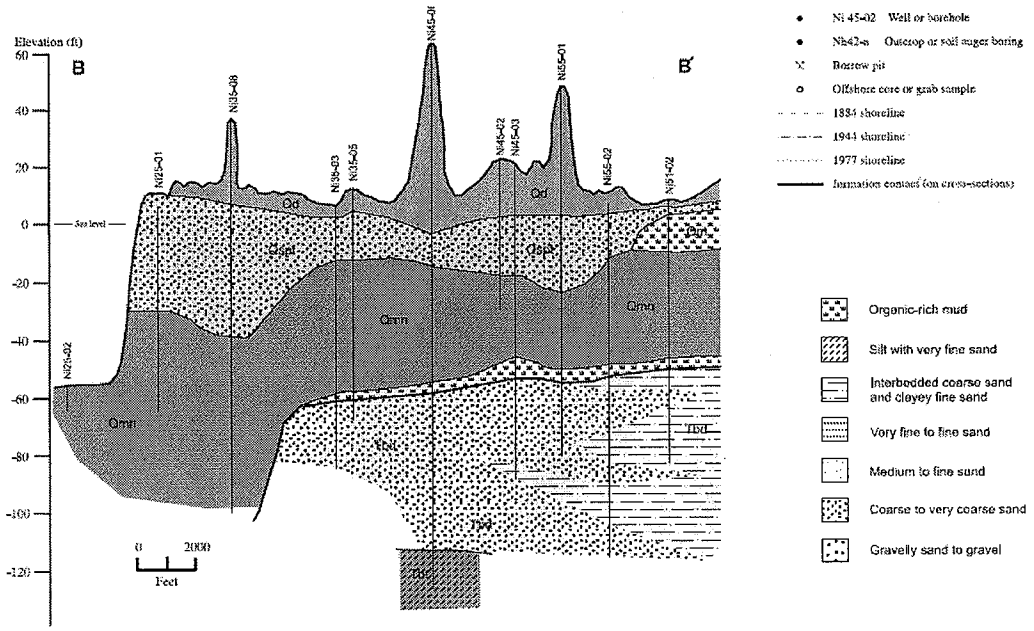


Figure 2-6 Rehoboth Beach Geological Profile



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

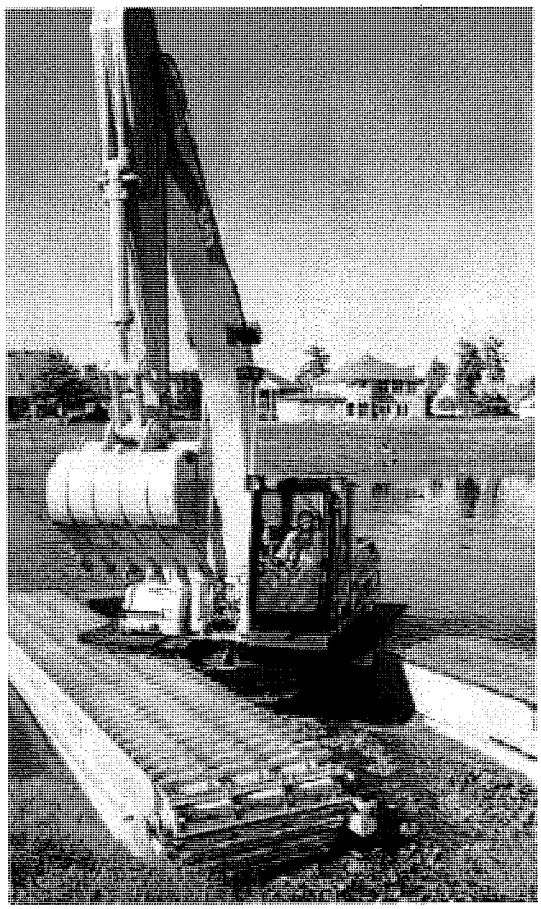


Figure 3-2 Cutter Suction Dredges

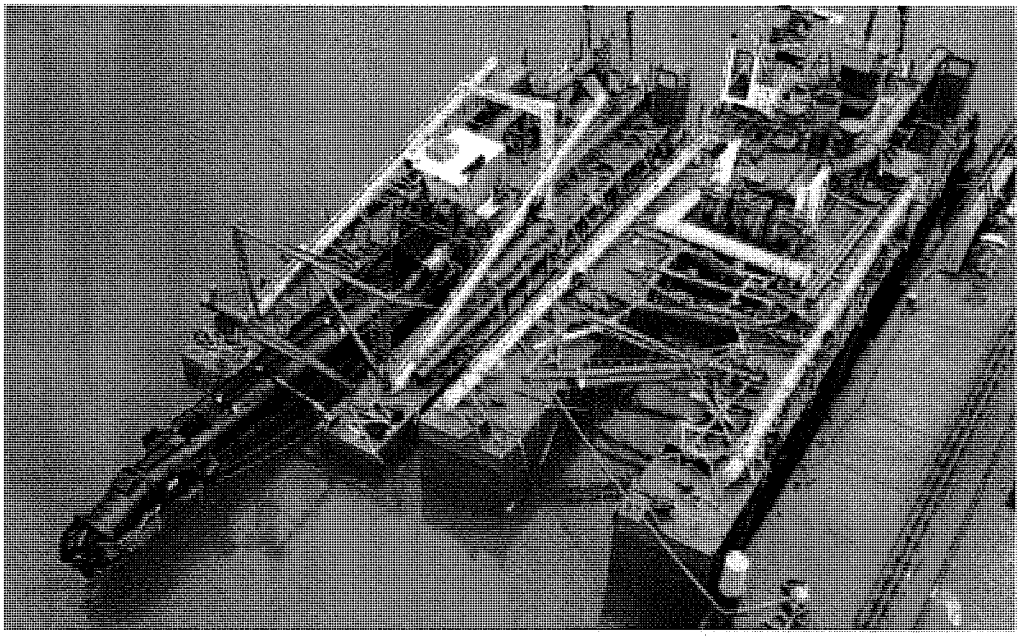
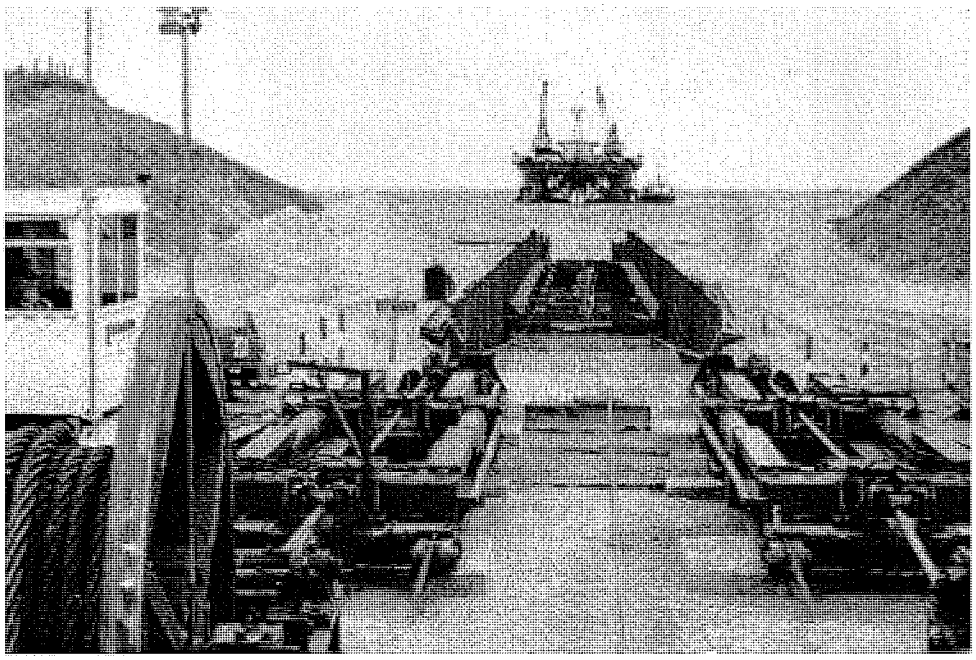


Figure 3-3 Sheet Piled Shore Crossing ready for Pipelay



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

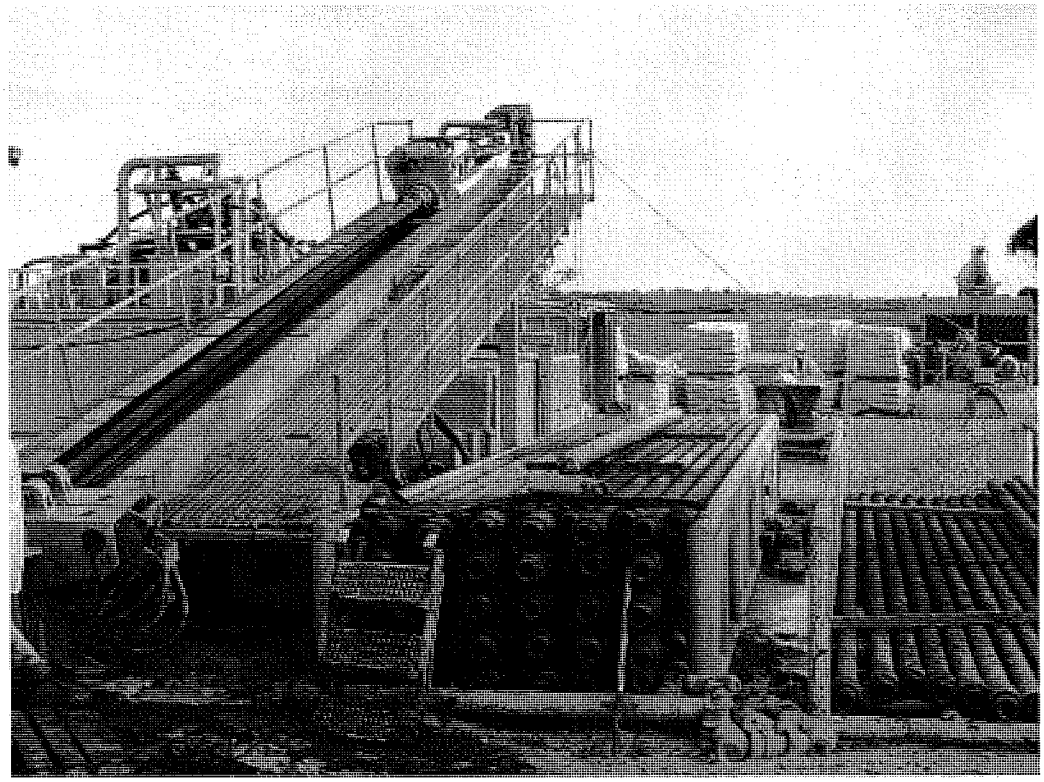


Figure 3-5 HDD Rig Site

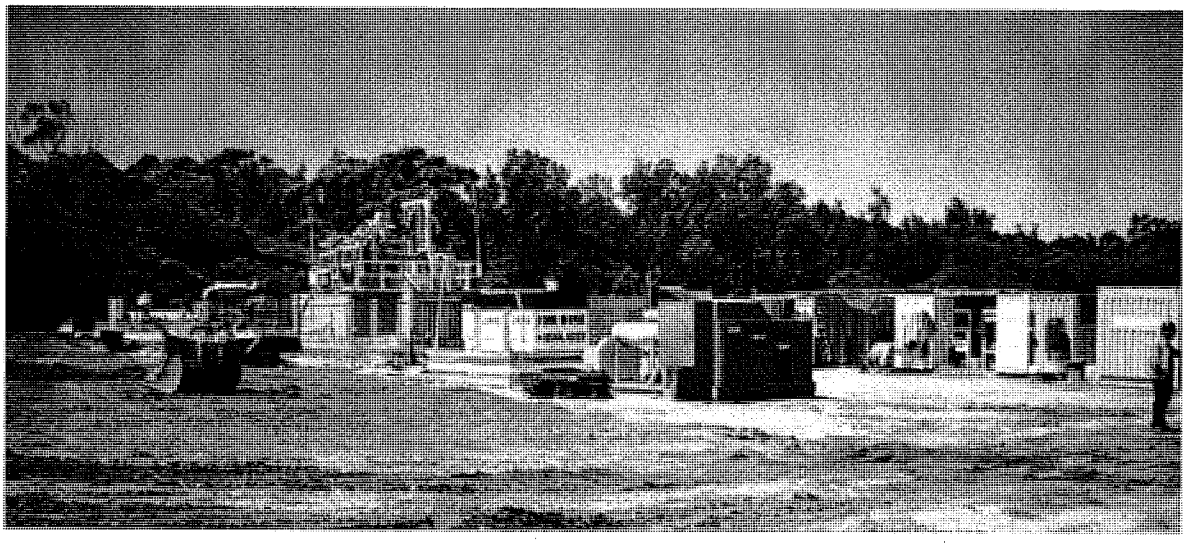
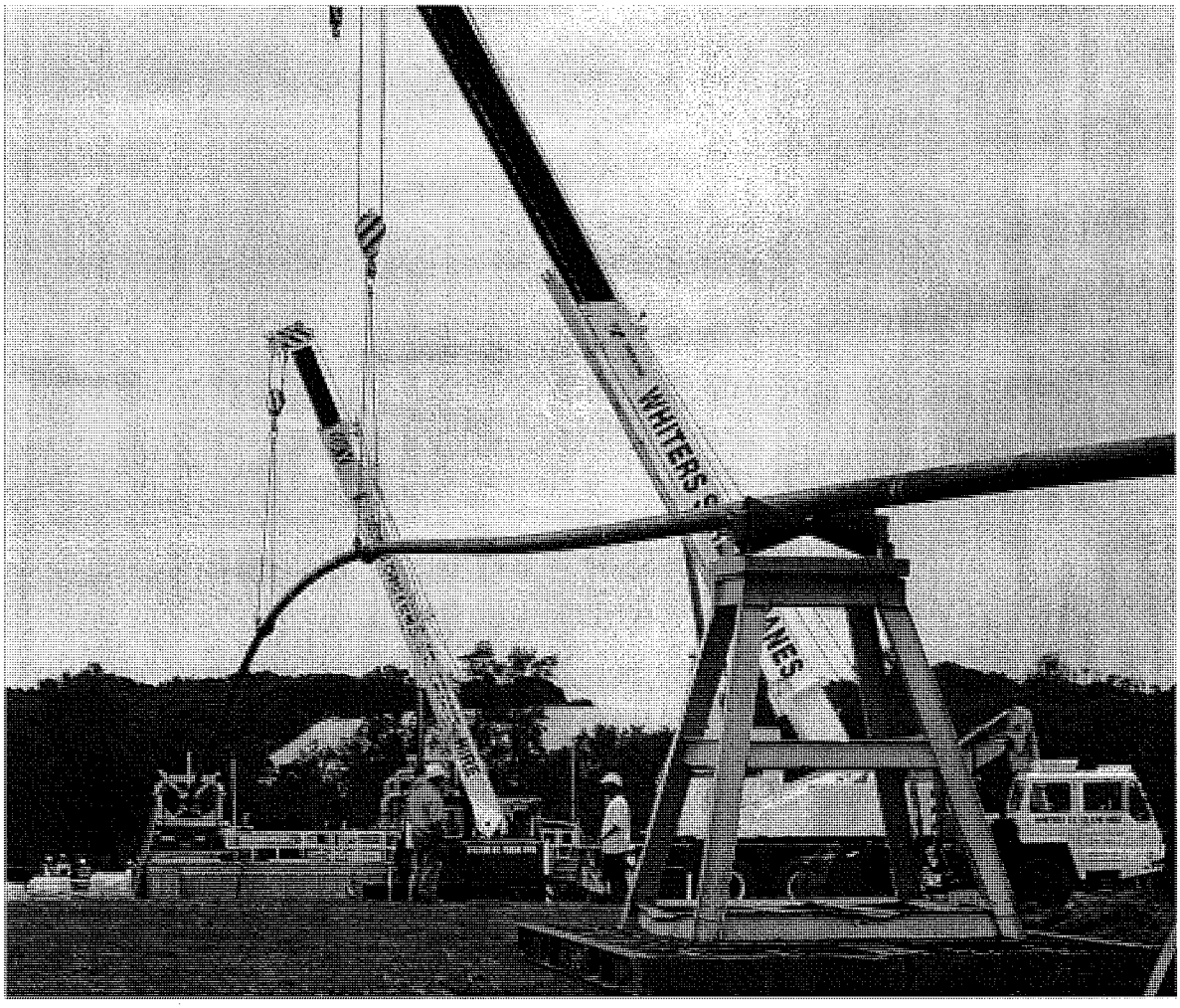


Figure 3-6 Pushing the Pipe into the HDD Hole



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

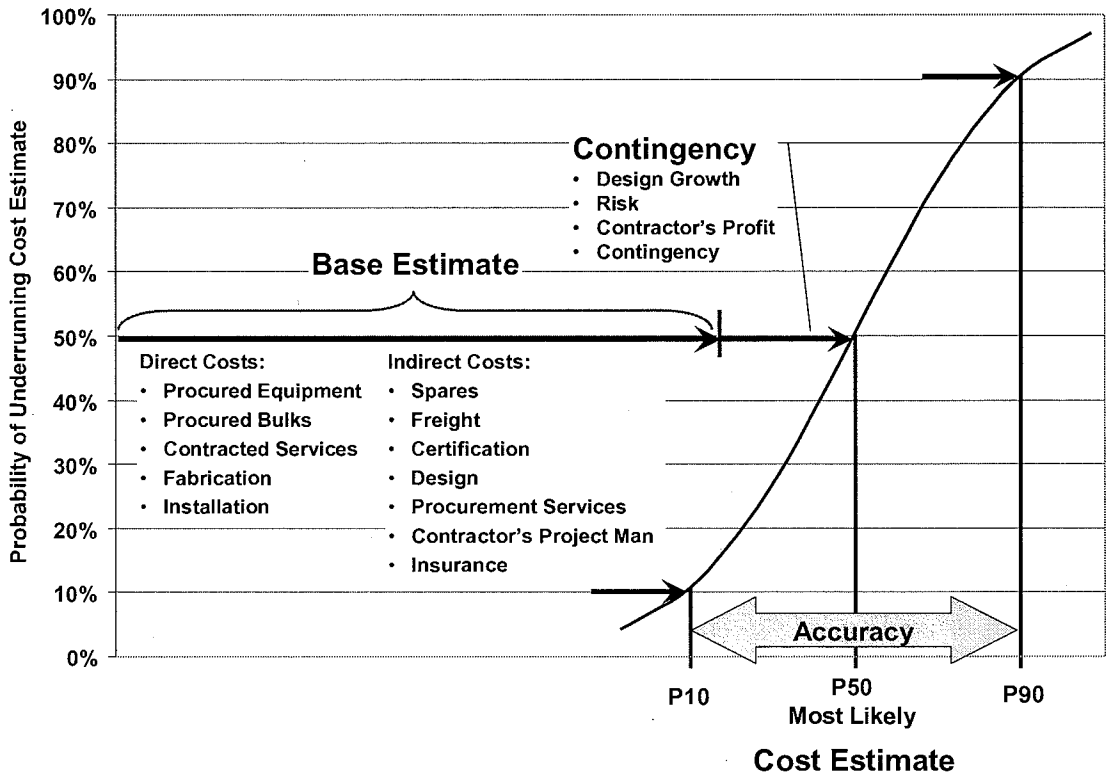
4.2 Estimate Accuracy and Contingency

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**

WorleyParsons
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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

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

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

WorleyParsons
resources & energy

Project Number 401010-00438
Date 22-Oct-08
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Check 0

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	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

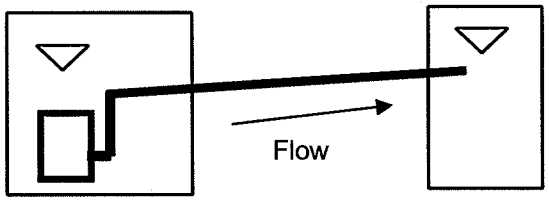
Date: Calc By:

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**

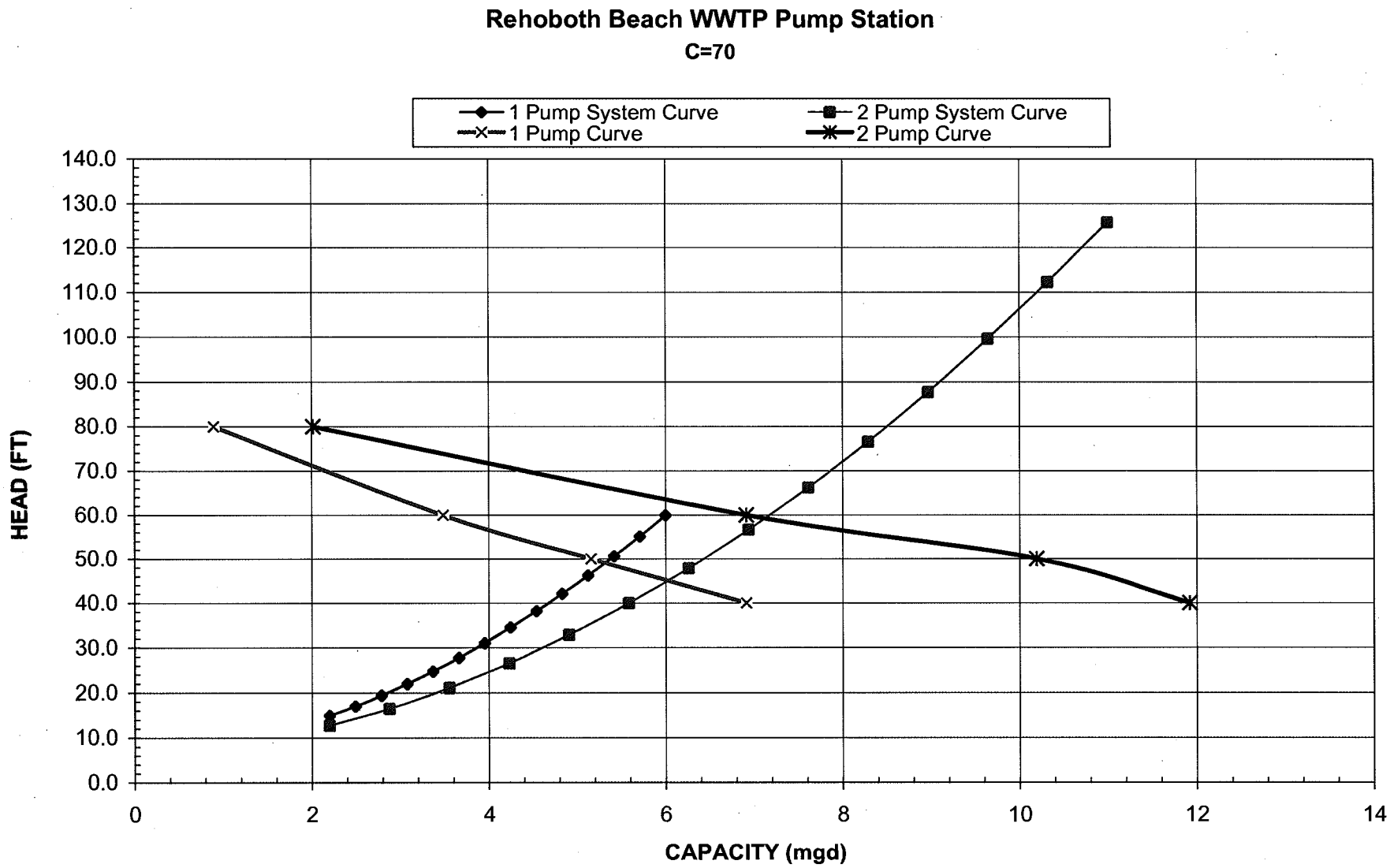
Pumping Station Hydraulics

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
1 Pump System Curve
2 Pump System Curve
1 Pump Curve
2 Pump Curve
HEAD (FT)
140.0
130.0
120.0
110.0
100.0
90.0
80.0
70.0
60.0
50.0
40.0
30.0
20.0
10.0
0.0
0
2
4
6
8
10
12
14
CAPACITY (mgd)

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

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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

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

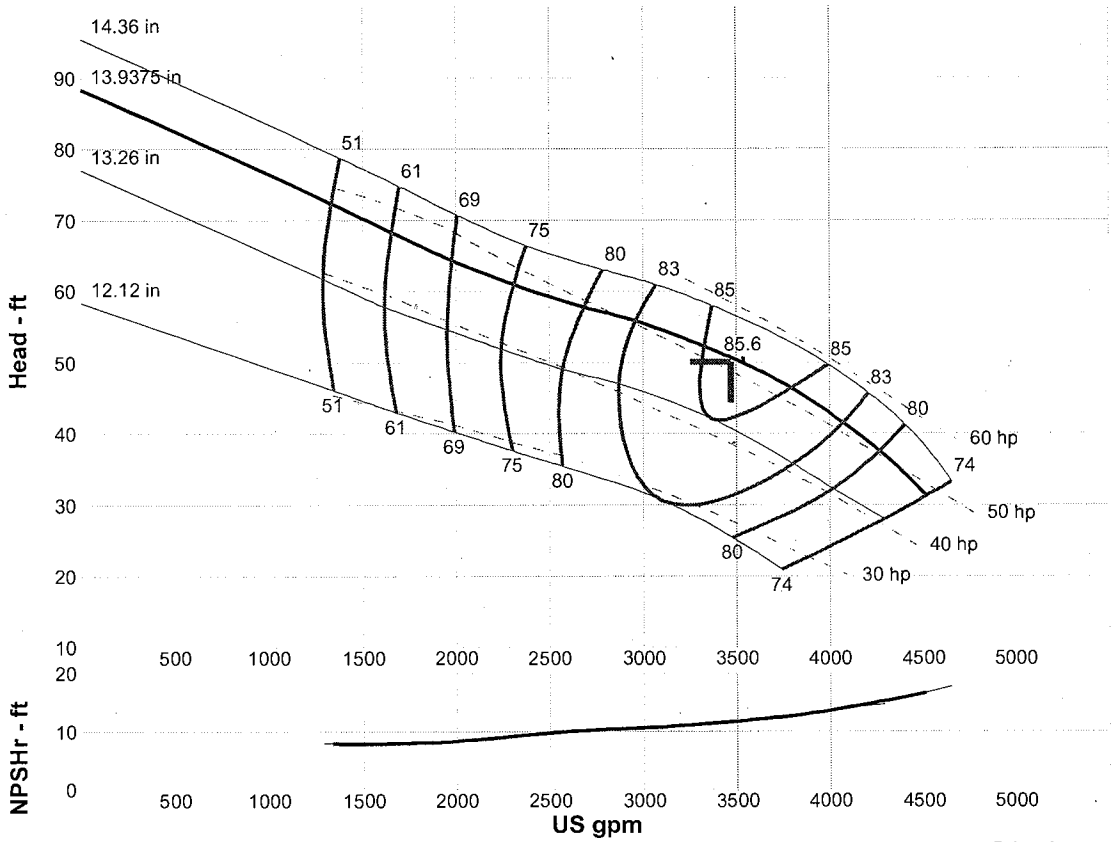
Sizing criteria: Max Power on Design Curve

Pump Limits:

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

Power: 431 hp
Eye area: ---

---- 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

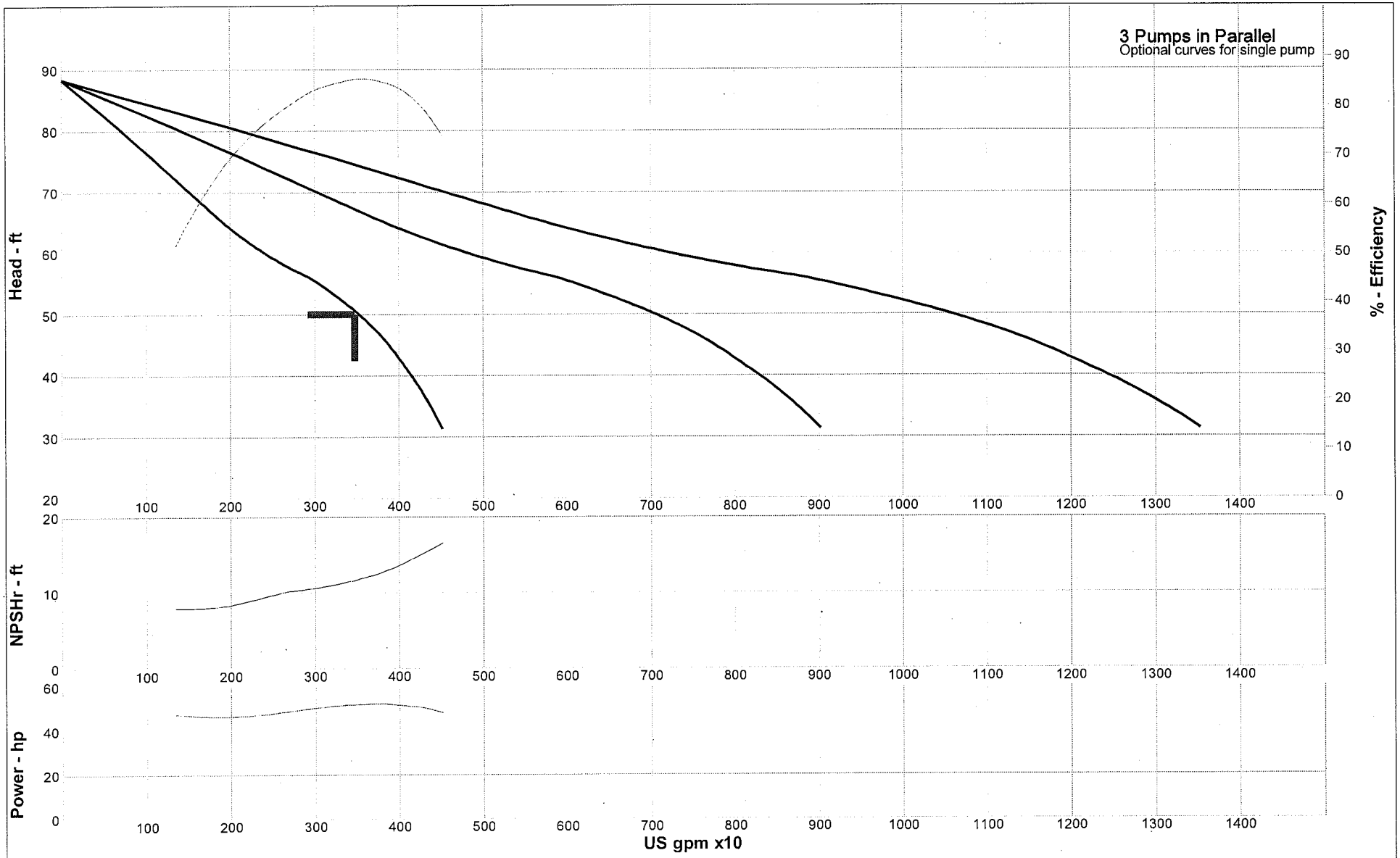


Curve efficiencies are typical. For guaranteed values, contact Fairbanks Morse or your local distributor. Las eficiencias en curvas son típicas. Para valores garantizados contacte a Fairbanks Morse o a su distribuidor local.

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



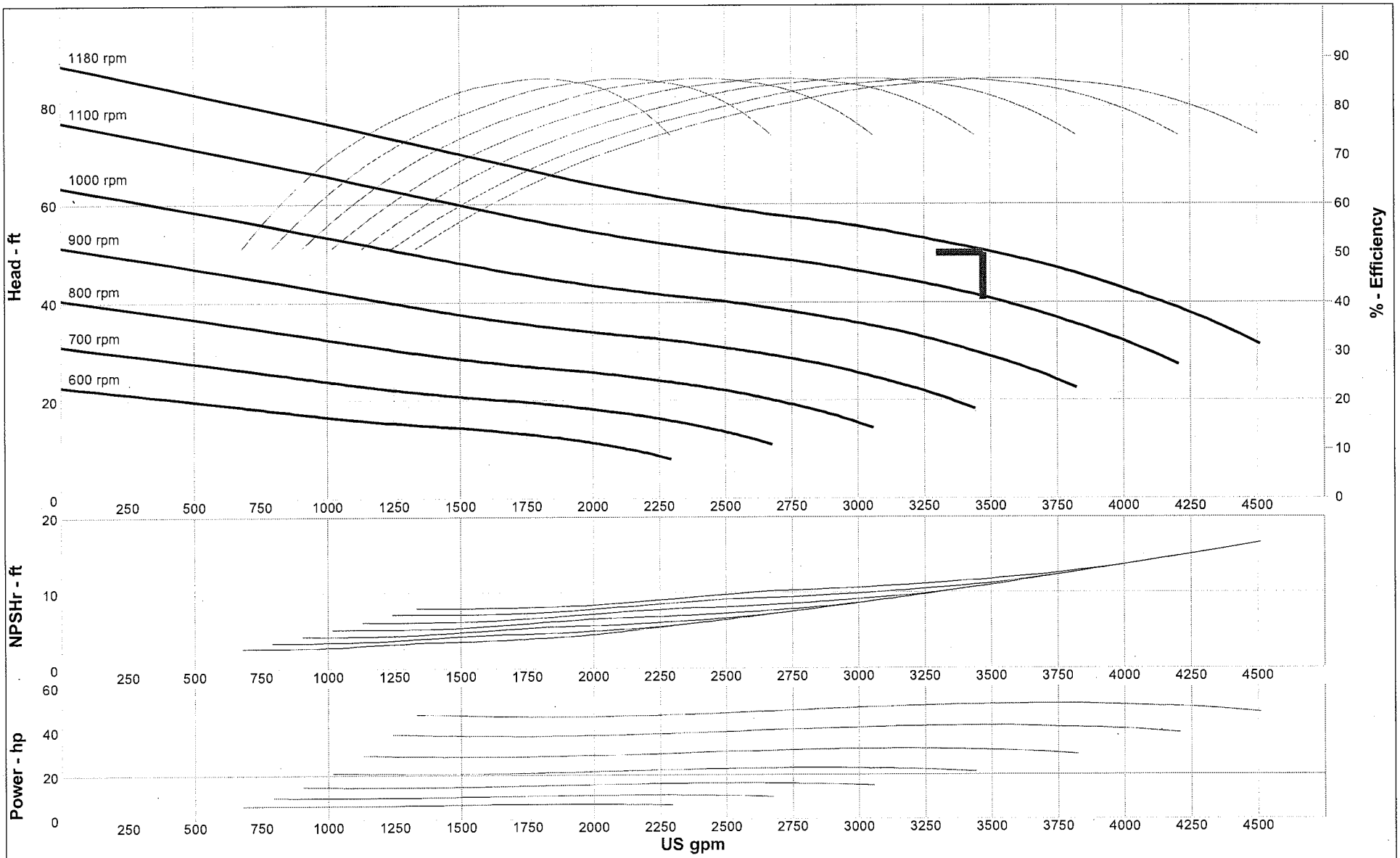
Curve efficiencies are typical. For guaranteed values, contact Fairbanks Morse or your local distributor. Las eficiencias en curvas son típicas. Para valores garantizados contacte a Fairbanks Morse o a su distribuidor local.

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

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

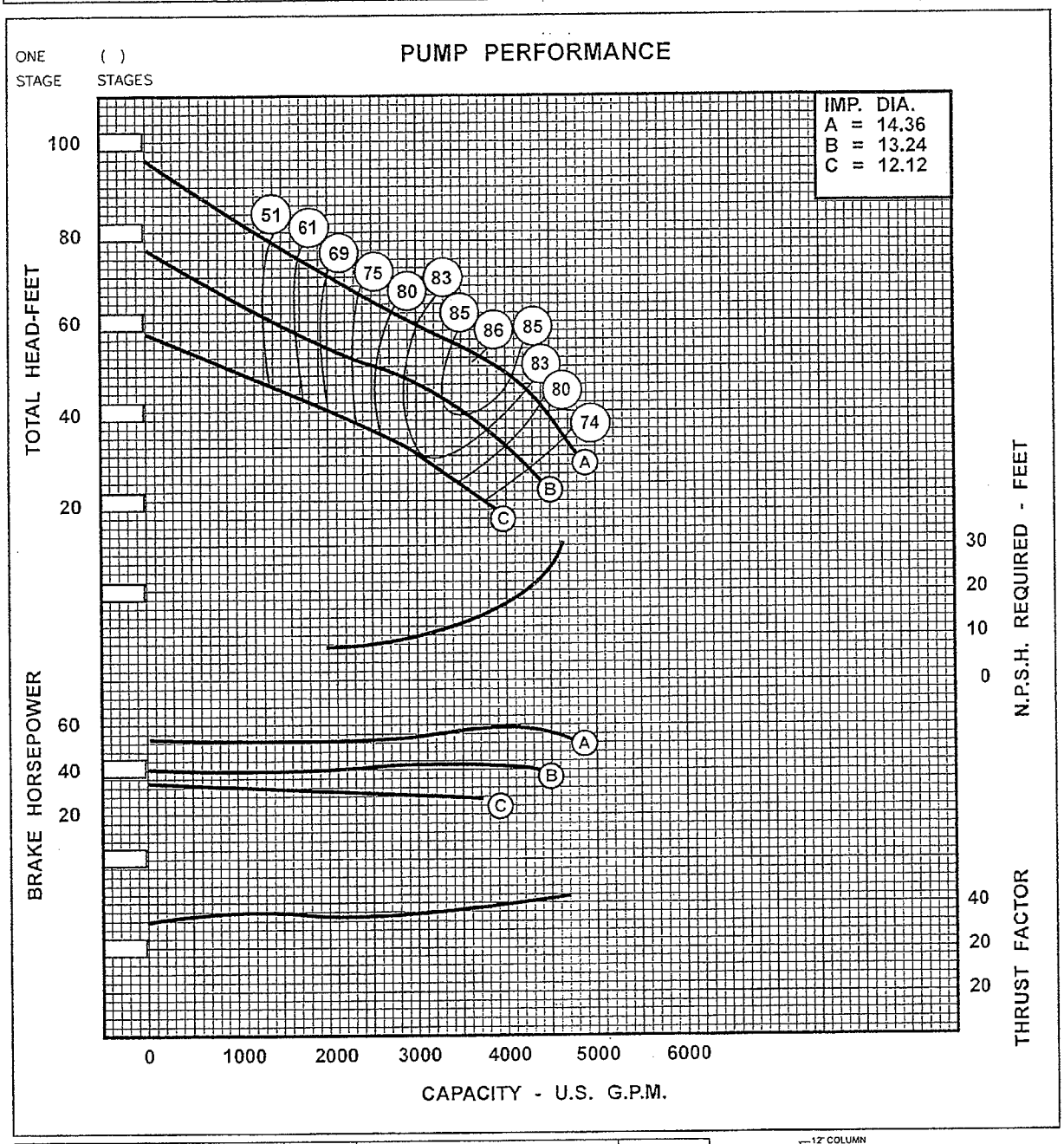
Fairbanks Morse
Pentair Water

Fairbanks Morse
Pentair Pump Group

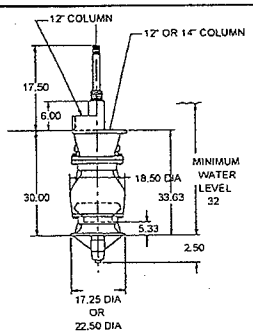
No. Stages	Eff. Change	MATERIAL	Eff. Change
1	0	IMP. - C.I.	-1
2		IMP. - NI-RI	-1
3		BOWL- BRZ.	-1
4		BOWL- NI-R.	-1

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.



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

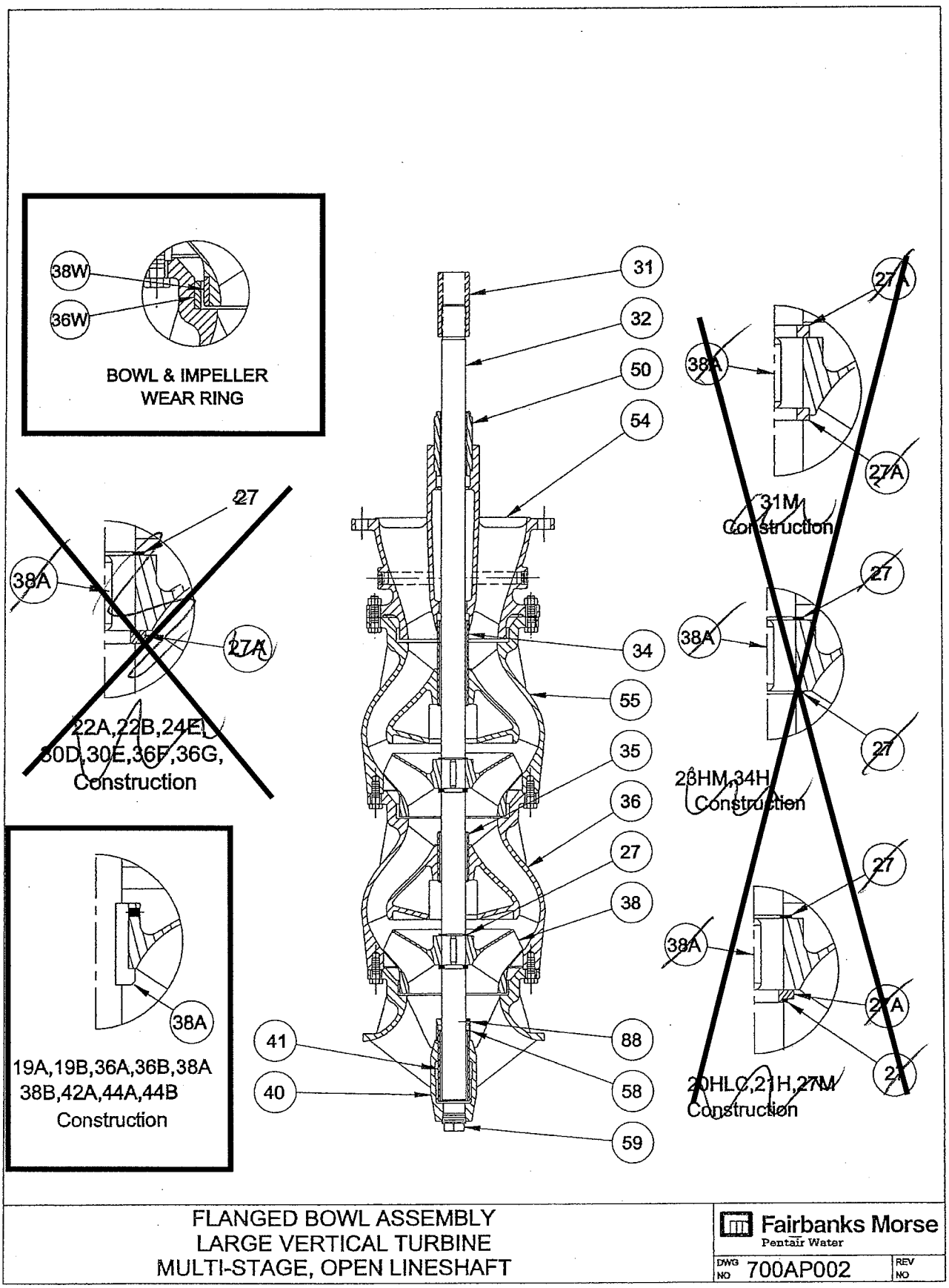
Shaft Size = 2-3/16 Inches

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.



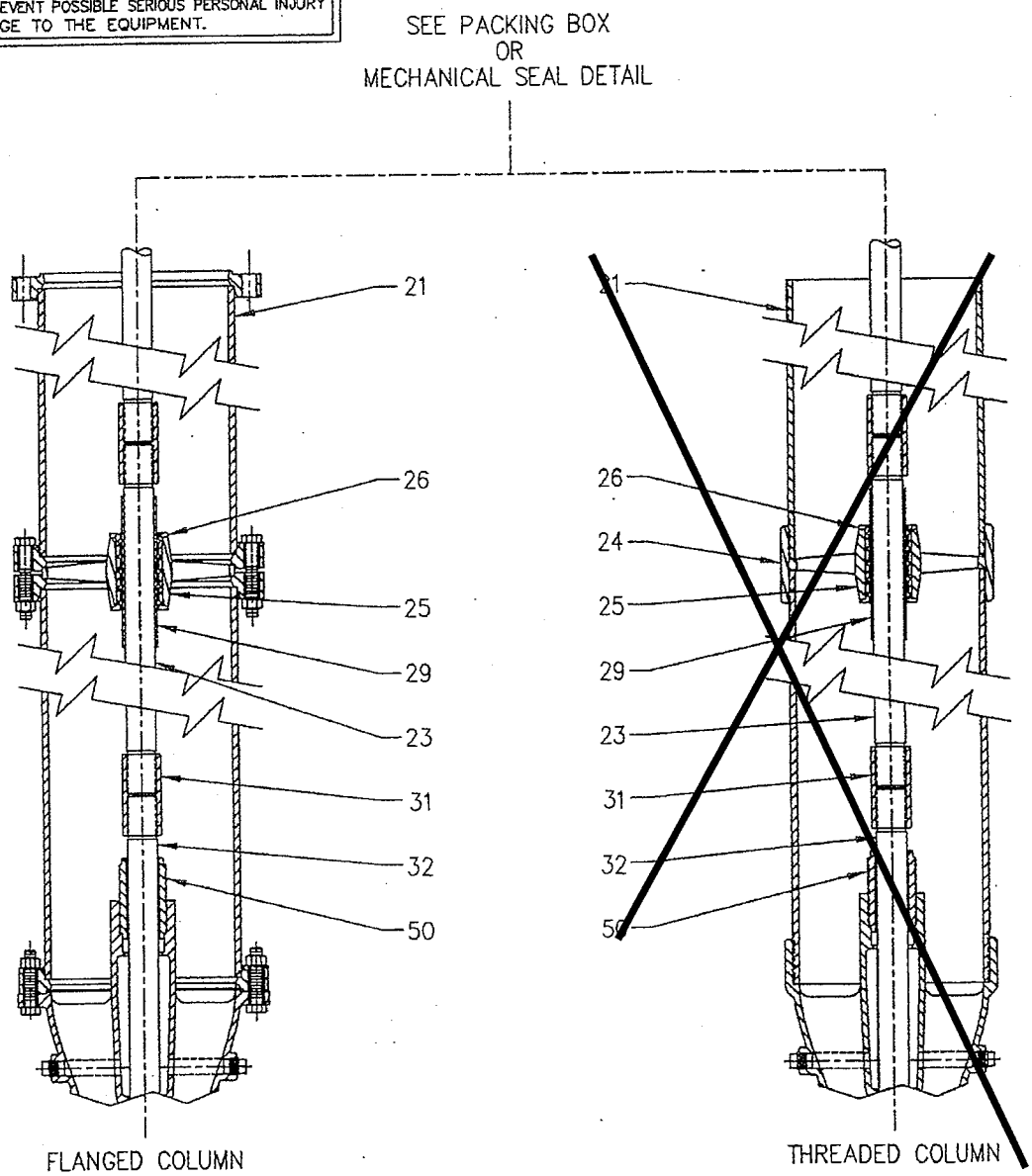
FLANGED BOWL ASSEMBLY
LARGE VERTICAL TURBINE
MULTI-STAGE, OPEN LINESHAFT

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.

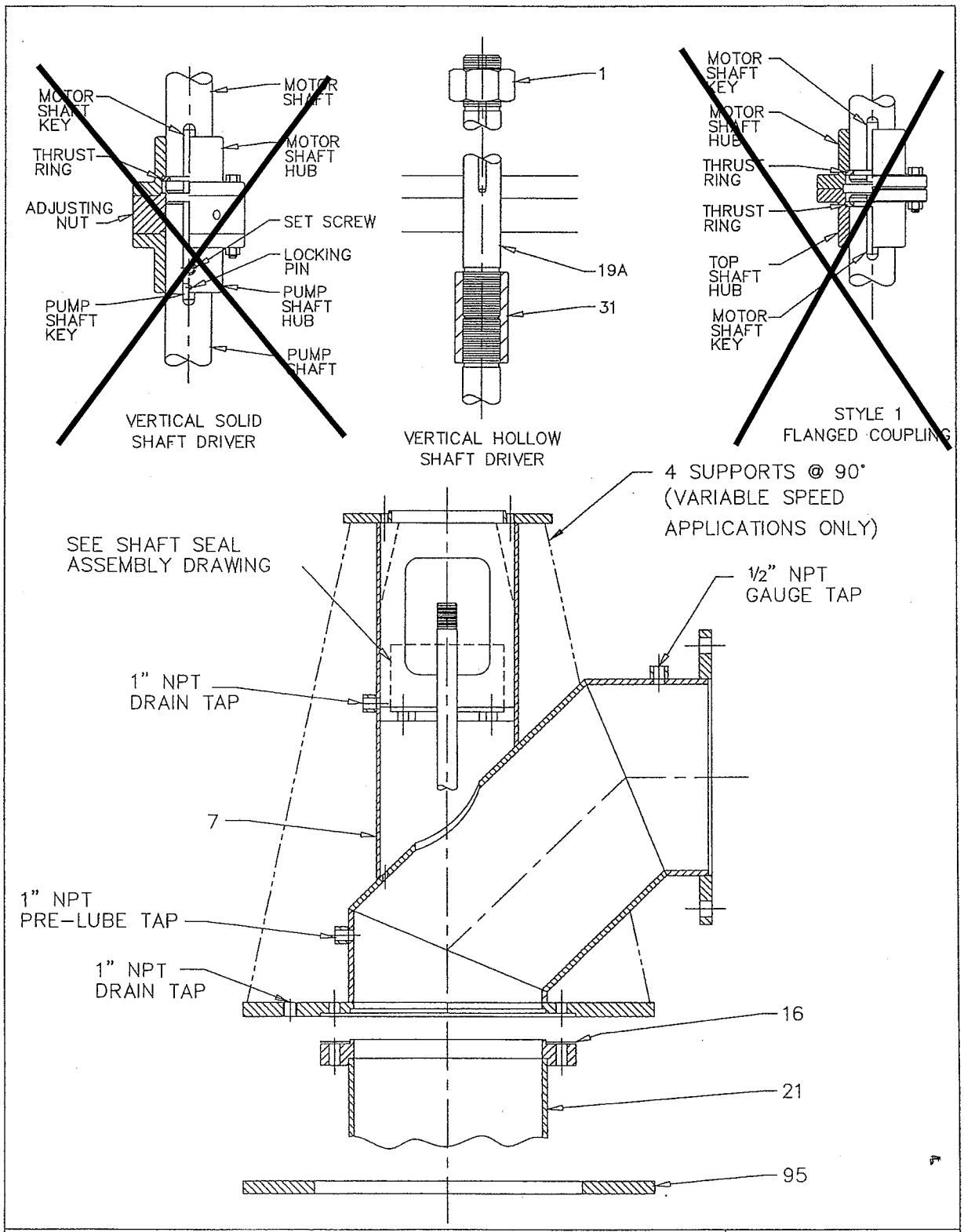


NOTES:
(1) COLUMN SECTIONS ARE TO BE LIFTED BY EYEBOLTS OR "COLUMN CLAMPS" (SUPPLIED BY OTHERS).
(2) COLUMN, AND SHAFT ASSEMBLIES SHOULD BE SECURED TOGETHER BY ROPE SLINGS OR OTHER SUITABLE MEANS.
(3) BEARING CENTERS (MAX)
TOP: 6.5'
INTER: 5'
COLUMN & SHAFT LENGTHS (MAX): 10'
SHAFT PROJECTION: 17.5"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

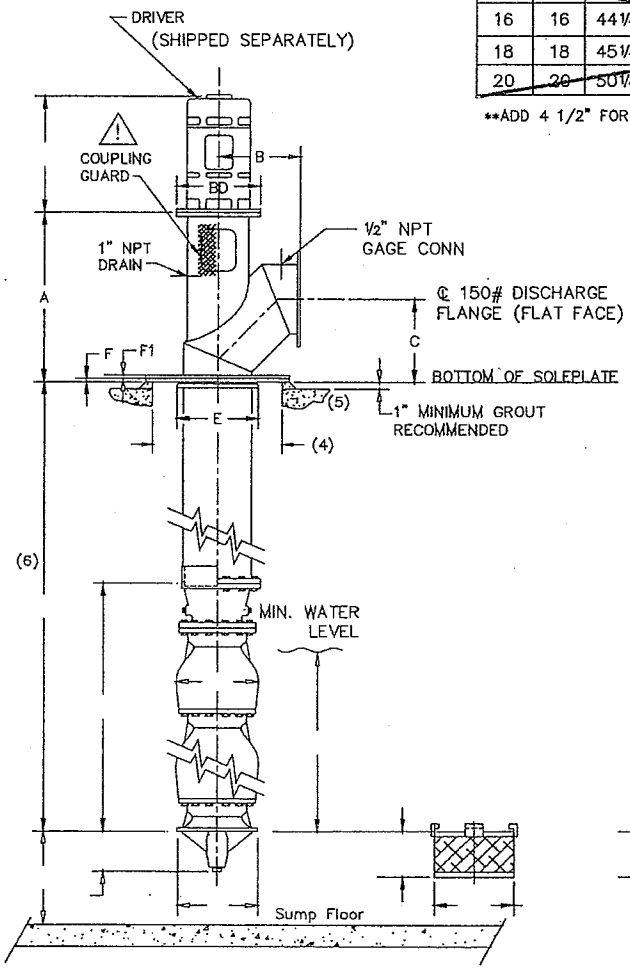
⚠ WARNING

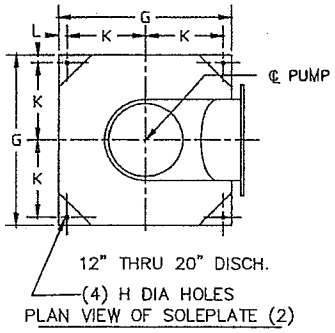
DO NOT OPERATE THIS MACHINE WITHOUT PROTECTIVE GUARD IN PLACE. ANY OPERATION OF THIS MACHINE WITHOUT PROTECTIVE GUARD CAN RESULT IN SEVERE BODILY INJURY.

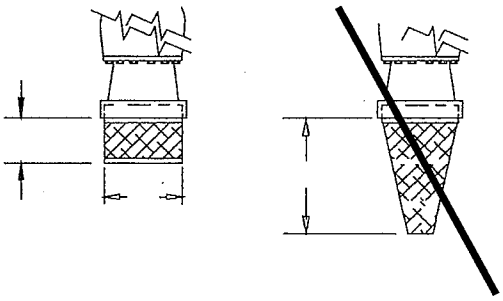
DISCHARGE HEAD DIMENSIONS

DISCH SIZE	COL SIZE	A** MTR BASE DIA (BD) 13	16 1/2	20	24 1/2	B	C	E	F	F1	G	H	K	L
12	12	37 1/8	37 1/8	37 1/8		15	16 1/2	16 1/4	1	1	31	7/8	13 1/2	2
14	14	40 1/4	40 1/4	40 1/4	43	17	18 1/2	17 1/2	1 1/2	1 1/2	34	1	15	2
16	16	44 1/4	44 1/4	44 1/4	47	20	21 1/2	19 1/2	1 1/2	1 1/2	36	1	16	2
18	18	45 1/4	45 1/4	45 1/4	48	20	21 1/2	22	1 1/2	1 1/2	38	1	17	2
20	20	50 1/4	50 1/4	50 1/4	53	24	25 1/2	23 3/4	1 1/2	1 1/2	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.

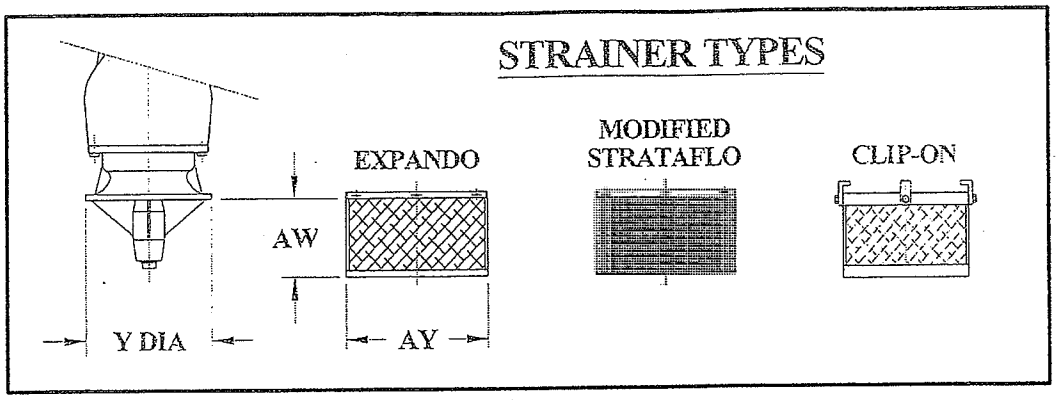
CUSTOMER				P.O.		
JOB NAME			SERVICE			
PUMP SIZE & MODEL	STAGES	GPM	TDH	RPM	ROT CCW	
MOTOR	HP	FRAME	PHASE	HERTZ	VOLTS	ENCL
CERTIFIED FOR		CERTIFIED BY		DATE		

Fairbanks Morse
Pentair Water

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

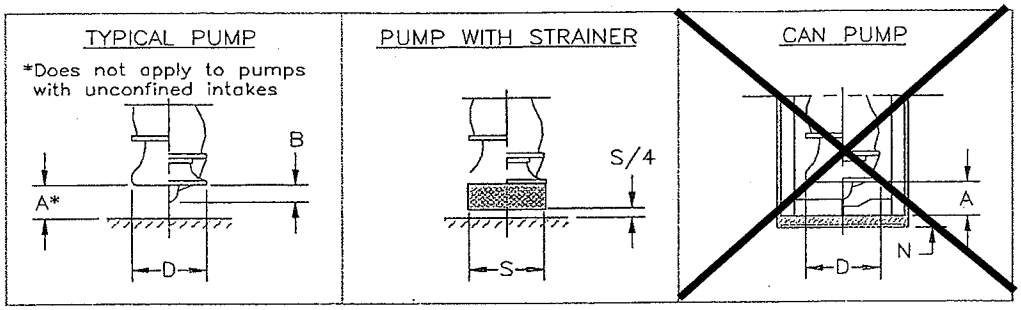
DWG. NO. 7000FS010 REV

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	3.75	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, 30E	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**

4034 Mint Way
Dallas, TX 75237
PH: 800.783.6756
214.337.8780
FAX: 214.333.2742
E-MAIL: sales@tigerflow.com
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

4034 Mint Way
Dallas, TX 75237
PH: 800.783.6756
214.337.8780
FAX: 214.333.2742
E-MAIL: sales@tigerflow.com
WEB SITE: www.tigerflow.com

Treated Wastewater Effluent:

A Reclaimable and Reusable Resource

For

Delaware Agriculture

IRRIGATION PRESERVATION TASK FORCE
HOUSE CONCURRENT RESOLUTION 67

FINAL REPORT AND RECOMMENDATIONS

INTRODUCTION AND BACKGROUND

During the 144th General Assembly House Concurrent Resolution No. 67 created the Irrigation Preservation Task Force. The Task Force was created to develop and submit legislation that will help to sustain Delaware agriculture through the use of reclaimed water. One of the benefits is the preservation of the ground waters of the State by allowing the farmer the voluntary use of treated wastewater effluent, the current standards for the source of which are established by the Department of Natural Resources and Environmental Control. Other benefits to agriculture include:

- Irrigation delivered directly to a farmer's field as needed.
- Reliable, continuous supply of reclaimed water lowers farm operations cost
- Makes water available during drought conditions
- Irrigated fields have a higher yield harvest per acre compared to non-irrigated fields
- Sustains small farms as a way of life
- Provides permanent jobs in agriculture
- Provides for uptake of nutrients and prevents runoff

There are economic, environmental and societal benefits to the practice of recycling treated water back to farmers through spray irrigation of reclaimed water. Delaware's policy on water and wastewater, while designed to serve a growing population with fresh water and wastewater capacity, needs to serve Delaware's agriculture as well. Water should not just be used once and thrown away. Reclaimed water can be recycled to farmlands to promote sustainable farming and return the water to the watershed for recharge of the aquifer.

The reclaimed wastewater resource comes from a diverse number of plants. Over 60 municipal and private wastewater treatment plants produce 10.8 billion gallons of reclaimed water, or 33,140 acre feet/year. Some of these facilities already have disposal areas for the reclaimed water. But many municipal and private treatment plants are out of treatment disposal capacity or will see their NPDES permits capped with no additional capacity for future expansion.. The remaining municipal and private plants either cannot discharge into surface waters or have their discharge limit capped. These plants could be the largest source of reclaimed water; approximately 8.3 billion gallons, or 25,460 acre feet annually. (source: DNREC list, all but Wilmington). The reclaimed water can be used by farmers if wastewater service providers have the incentive to pipe it to farmers' fields, and the farms have the ability to take the water.

The State Department of Agriculture, Task Force members, and Department of Natural Resources and Environmental Control (DNREC) support the reclamation of wastewater. There is widespread and increasing interest by the DNREC, municipalities, the agriculture community, and wastewater utilities for the use of reclaimed water for agricultural irrigation.

* For the purpose of this report Reclaimed Water is defined as water that has been recovered through the treatment of sanitary wastewater at a wastewater treatment facility. Reclaimed Water contains macronutrients, micronutrients, suspended solids, and small quantities of bacteria, salts and metals. In order to protect public health, wastewater must undergo significant levels of treatment and disinfection before it can be reclaimed and reused for agricultural purposes.

Additionally,

The purpose of this report is to educate decision makers and other interested parties about the advantages of using reclaimed water for the irrigation of agricultural lands; address the charge to us as stated in HCR 67; and submit our findings and recommendations for further consideration by the General Assembly. The Task Force was asked to submit this report to the General Assembly by January 15, 2009.

TASK FORCE FINDINGS

Wastewater can be made available for agricultural reuse in two (2) ways. In voluntary reuse treated wastewater lines are extended from treatment facilities to farming operations and the reclaimed water is made available on an "as needed" basis to the farming operation to irrigate crops consistent with existing farming practices. In these situations the farming operation benefits from a pressurized supply of available water, and thereby reducing the need to pump groundwater or surface water supplies. This alternative has many of the same benefits to the farmer and environment as the following Leased Land option, but does not generate a specific wastewater disposal capacity for the wastewater entity.

As an alternative agricultural reuse option, certain wastewater entities have designed a special economic package for Delaware farm families. The wastewater entity offers to lease the farming acres while still allowing farmers to farm the land, preserve the land, and conduct and hunting or recreation activity on the land that is compatible with the lease. The wastewater entity has proposed that the farmer retain ownership, but put the land to work under an irrigation lease. If the farmer would agree to take the reclaimed water as irrigation flow, then the private utility would deliver the water to the field and pay the farmer to take it. Leases with farmers to apply treated reclaimed water need to be flexible enough to provide predictable financial returns for farmers while at the same time providing long term certainty (30-plus years) for the wastewater treatment entities. The land lease proposition has several benefits to the farmer:

Benefits to the Farmer

1. Irrigation lease provides farmers with affixed return on their equity in land
2. Reduces fuel costs to pump the water to the fields
3. Reduces some fertilizer costs through "fertigation" providing nutrients in the reclaimed water
4. Increases crop yield through the continuous flow of reliable, reclaimed water
5. Renders the fields drought resistant through reliable flow of reclaimed water
6. Provides more efficient and consistent uptake and use of nutrients
7. Provides additional incentives to preserve farmland
8. Lease option provides supplemental income to agricultural operation

Benefits to the Environment & the Public

The use of reclaimed water for agricultural purposes benefits the environment and the public while reducing government spending.

Environment

- Returns reclaimed water to the watershed for crop production

- Reduces aquifer withdrawal by the amount of reclaimed water applied
- Recharges groundwater aquifers
- Assures perpetual open space for farming and recreation (hunting)
- After nutrient uptake, less nutrients lost to surface waters and other environmentally sensitive areas
- Preserves open space for multiple uses
- Reduces the amount of commercial fertilizers imported into the watershed

Government

- Centralization of reclaimed water infrastructure directs and controls growth
- Reduces infrastructure costs to rate payers and taxpayers
- Enables the elimination of faulty residential wastewater systems
- Enables cooperation between public and private entities
- Promotes more efficient use of state's water resources
- Provides another option for municipalities to comply with pollution control strategies

Advantages & Disadvantages

Interest in receiving reclaimed irrigation water is high among farmers. The Task Force discussed certain advantages and disadvantages with the use of treated wastewater for agricultural irrigation:

Pros Include:

1. Consistent reliable source of additional irrigation water
2. Increases and stabilizes farmers' yield per acre and balances nutrient loads
3. Reduces fuel cost to pump water from wells
4. Reduces fertilizer cost through "fertigation"
5. Low cost source of irrigation water for Delaware farmers
6. Economical and acceptable environmental way to recycle reclaimed water
7. Reclaimed water is available to farmers during drought conditions
8. Returns water to the watershed
9. Recharges valuable groundwater for other uses
10. Provides permanent jobs in agriculture

Cons Include:

1. Wastewater that is not treated or managed correctly can create potential public health and safety problems (DNREC must regulate the source of reclaimed water).
2. Wastewater continuously generated throughout the year, while the demand for irrigation water is seasonal (requires that source of reclaimed water must have storage capacity or other discharge options).
3. Municipality or private utility must make investment in land (purchase or lease) and equipment (spray irrigation equipment).
4. Treated reclaimed water from each municipal treatment facility and wastewater utility has its own chemical make up (DNREC must scrutinize municipal and private permits for

wastewater disposal). When this wastewater is used for agricultural irrigation, care must be given to protect the health of the public and the soil and consistent with approved nutrient plans.

Regulations

Current regulations allow for the application of reclaimed water onto farmers' fields through a DNREC public permit process. Guidance and Regulations Governing the Land Treatment of Wastes (Regulations) are currently under review by DNREC and will by undergoing revisions within the next 18-24 months.

This regulatory review process will allow the opportunity to update and address any limitations or prohibitions in the current regulations to more readily allow farmers the ability to utilize reclaimed wastewater.

Recommendations

1. The task force recommends that the State of Delaware explore ways provide incentives including utilizing existing funding sources that are available to any wastewater entity that will cease discharging effluent into surface waters and instead divert reclaimed wastewater to farmers' fields.

2. The task force recommends that all wastewater entities recycling reclaimed water to agricultural lands be required to do so under an agronomic plan.
3. The task force recommends that wastewater entities that enter into lease agreements with farmers to recycle reclaimed water on farmland provide reasonable economic lease terms dictated by the market that will enable farmers to get a reasonable return on the equity in their agricultural lands.
4. The task force recommends that the findings of the task force be utilized to benefit all agricultural lands including farmlands that are under agricultural preservation.
5. The task force recommends that any and all state and DNREC regulations regarding the recycling of reclaimed water to farmland be implemented upon the wastewater entity, and not the farmer.

Rehoboth Beach

Update on Ocean Outfall Alternative

May 15, 2009

Total Water Management Solutions. Wastewater.

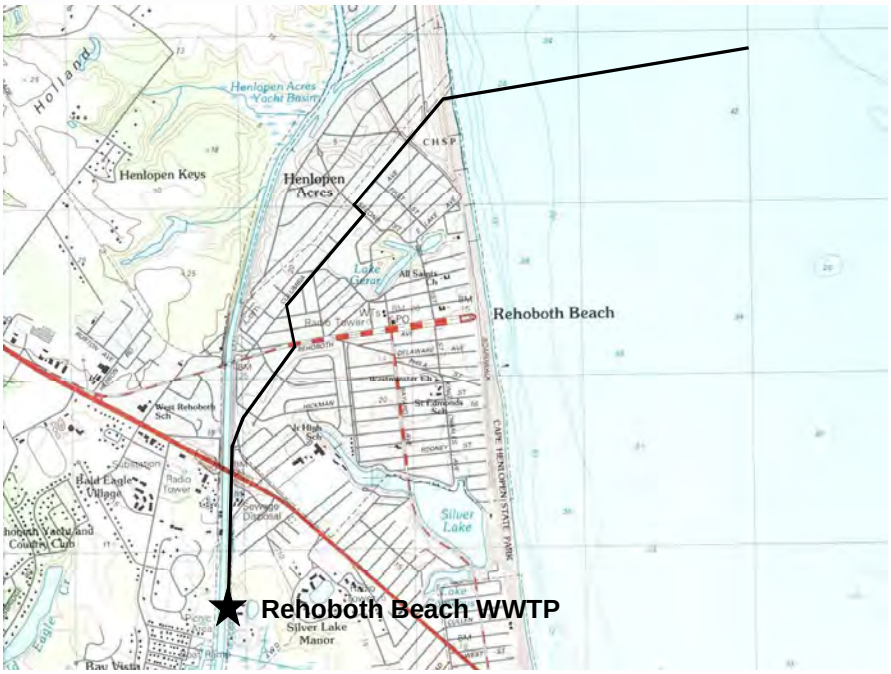
GHD

STEARNS & WHELER
CLIENTS | PEOPLE | PERFORMANCE

Agenda

- Location of outfall
- Force main alignment
- Construction Alternatives
- Permitting issues
- WWTP upgrade
- Estimated costs

Ocean Outfall
Force Main and Outfall



Force main alignment

WWTP Access Road

1B Bridge

Force main alignment

State Road

Rehoboth Ave

Force main alignment

Henlopen Ave

Parking Lot Entrance

Force main alignment

Parking Lot

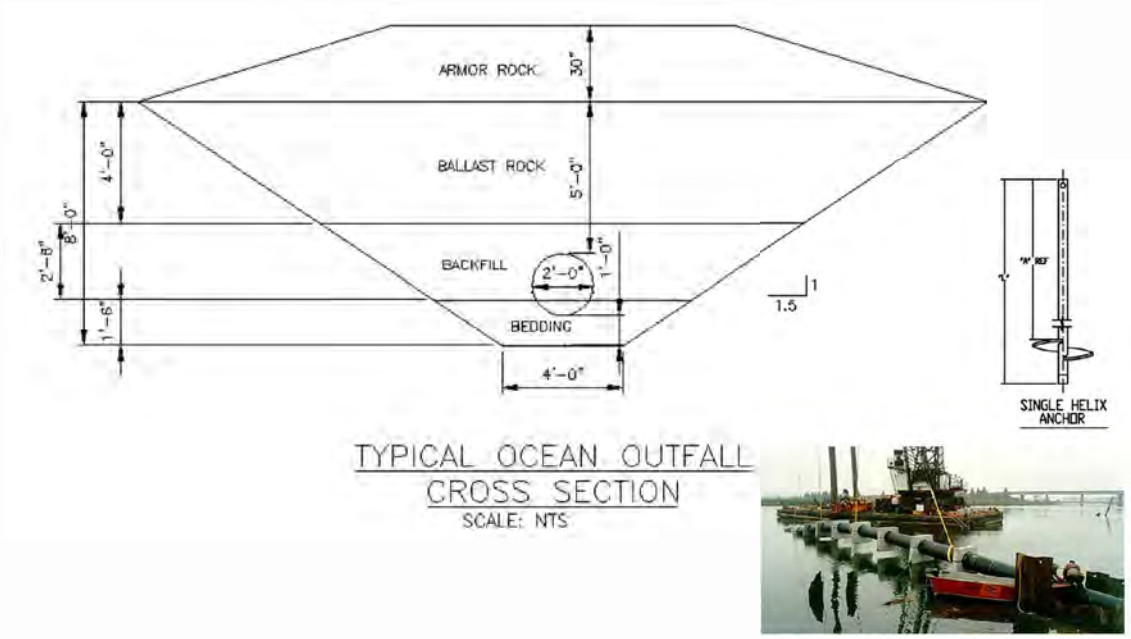
Dune Entrance

Force main alignment

Beach Entrance

Beach

Ocean Outfall
Cross Section



Construction Techniques

- Excavate / Directional Drill

- Concrete encased steel pipe / HDPE

Construction Techniques

Excavated and Buried Pipe

- Establish construction area at shore
- Establish pipe spooling area
- Sheet pile through surf zone
- Excavate
- Dredge to diffuser
- Lay bedding material
- Pull pipe / weld sections
- Backfill and armor pipe
- Install diffuser
- Remove sheet piling and restore area

Construction Techniques

Excavated and Buried Pipe

Sheeted shore crossing

Cutter Suction Dredge

Construction Techniques
Horizontal Directional Drilling (HDD)

- Establish construction area behind dunes in parking area
- Establish pipe spooling area
- Drill pilot hole and ream to larger diameter
- Push pipe from shore side / weld sections
- Dredge for diffuser section
- Install diffuser using divers
- Restore area

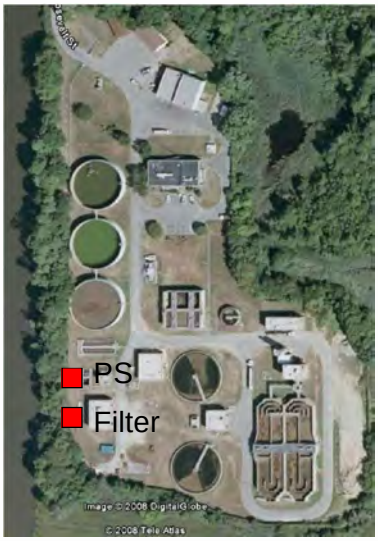
Construction Techniques
Horizontal Directional Drilling (HDD)

HDD Rig

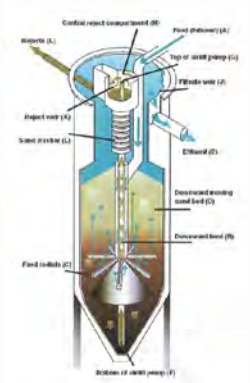
Pushing pipe

WWTP Upgrade
Ocean Outfall

Rehoboth Beach WWTP



Upgrades
New effluent filters
Pump station
MCC Improvements



Permit

BOD 19 mg/L

TSS 15 mg/L

Primary Contact Recreation Marine Waters

	Enterococcus (colonies/100mL) Single Value	Geometric Mean
Public Health	104	35
Existing Permit	--	10

Estimated Costs (million $)
Ocean Outfall

	HDPE Excavated Buried	HDPE Directional Drill	Steel Pipe Excavated Partial Bury
Engineers Estimate	25.9		
Weeks Marine	16.7		
WorleyParsons	16.5	17.4	10.1
Average		19.7	

Estimated Costs (million $)

Ocean Outfall

WWTP Improvements	3.7
PS and FM	3.9
Ocean Outfall	19.7
Total	27.3 *

* Capital including contingency

Typical Annual Residential User Charge

Typical Annual Water Usage

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 Resident	gal/day	**150**

Typical Annual Charge = $ 326.00

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**

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 %

Estimated User Charge

Rehoboth Beach

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**

Permitting Issues

Federal

- USCOE
  - NP-7 / IP-7
  - Section 403 / 404 (dredging / excavation)
  - Marine Protection, Research and Sanctuaries Act
  - Rivers and Harbors Act
- EPA
  - NPDES
  - Beach Protection Act
- US Fish & Wildlife
- US Marine Fisheries

State

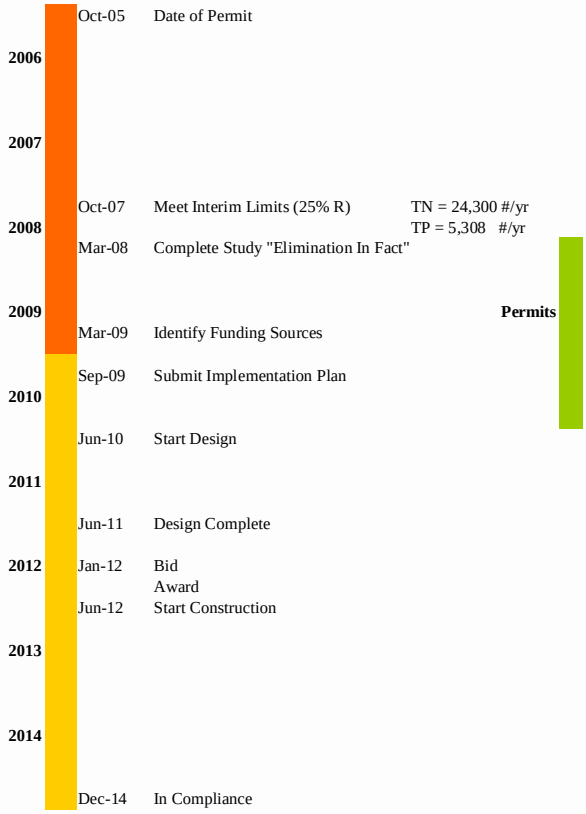
- DNREC
  - NPDES
  - ERES Waters
- Coastal Zone Management
  - Coastal Zone Act
  - Beach Preservation Act
  - Underwater Lands Act
  - Wetlands Act
- Delaware State Historic Preservation
- Soil & Water Conservation

Permitting Issues

Environmental Impact Assessment

- Baseline Studies
- Water quality impacts
- Public health impacts
- Dilution modeling

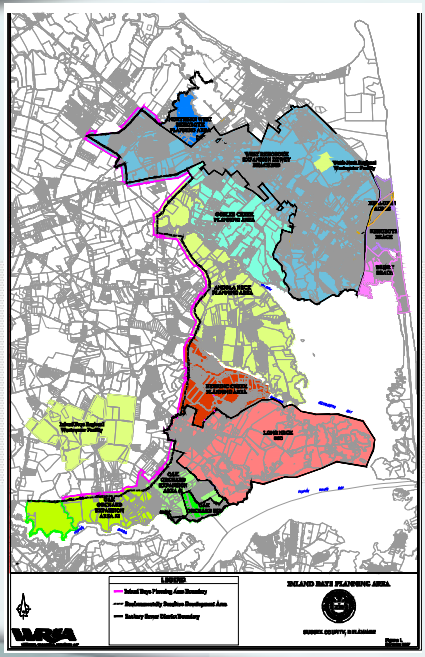
Schedule



Questions ?

Stearns & Wheler, LLC
Environmental Engineers and Scientists

Sussex County Council



A Regional Planning Report to Assess a Joint Sussex County/City of Rehoboth Land Application Project

August 18, 2009

Design Criteria

Planning Period: Year 2009 →2030

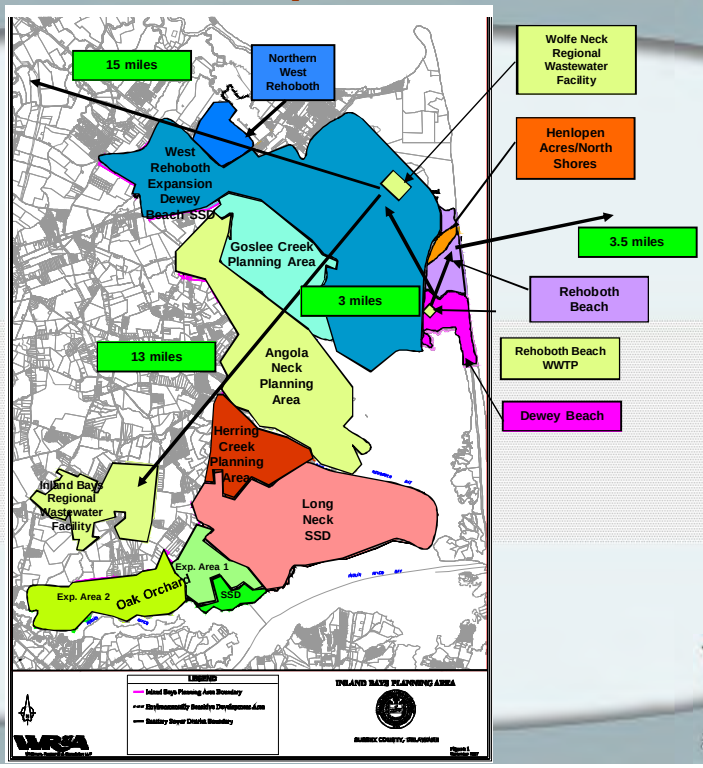
West Rehoboth Expansion Flows: 4.4 million gallons per day (mgd) (1.)
Inland Bays Service Area Flows: 2.9 mgd
Rehoboth Beach Flows: 2.5 mgd (2.)

Total Treatment and Disposal Capacity Required: 9.8 mgd

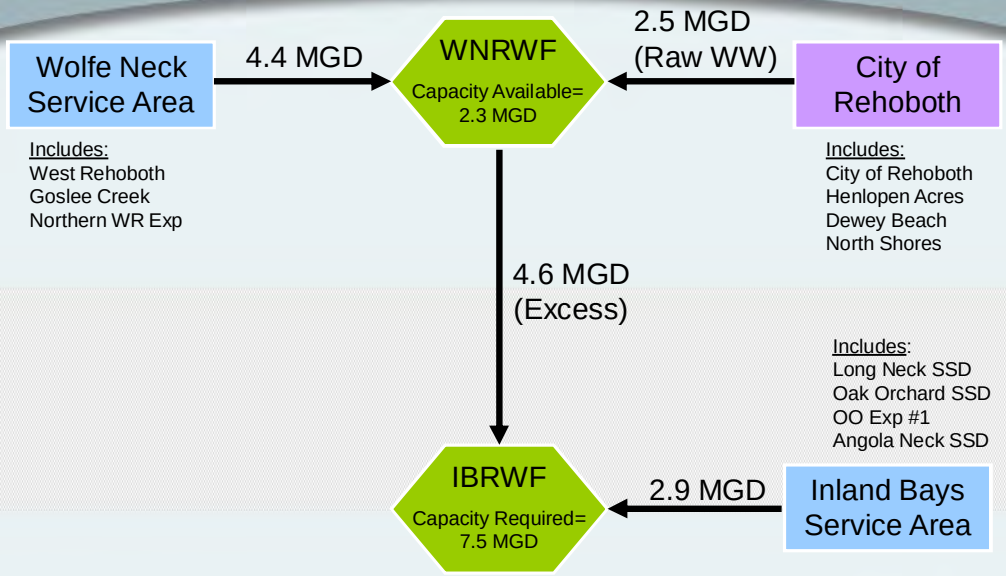
Note:
(1.) All flows are maximum month average daily flows.
(2.) Rehoboth Beach Flows include Dewey Beach, Henlopen Acres & North Shores.

North Coastal Planning Area Treatment and Disposal Alternatives

- **Wolfe Neck Regional Wastewater Treatment Facility (WNRWF)**
- **Inland Bays Regional Wastewater Treatment Facility (IBRWF)**
- **City of Rehoboth Beach Wastewater Treatment Plant (RBWWTP)**

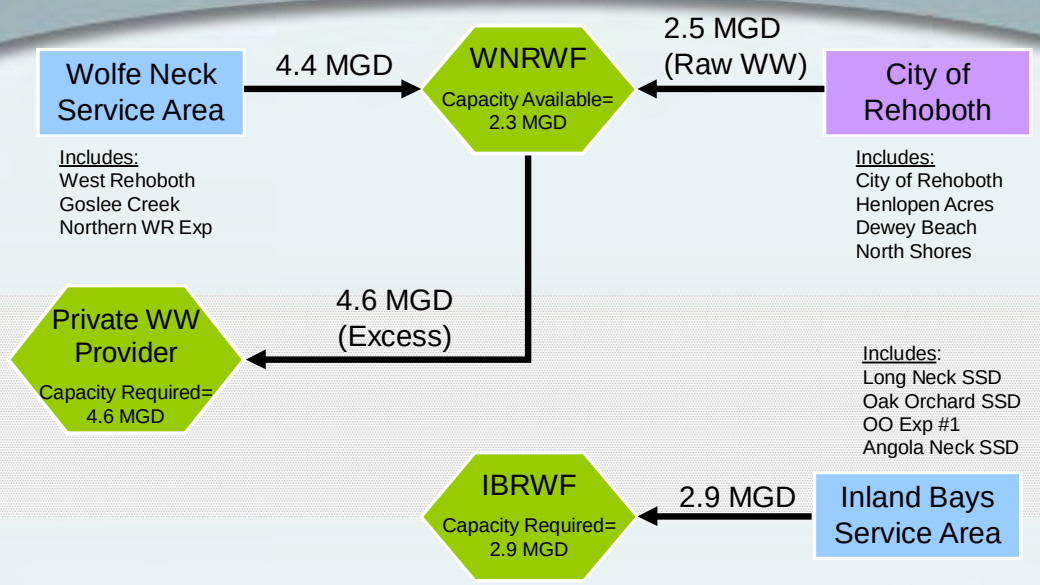


Alternative #1A- Raw Wastewater to WNRWF with Treatment at the IBRWF



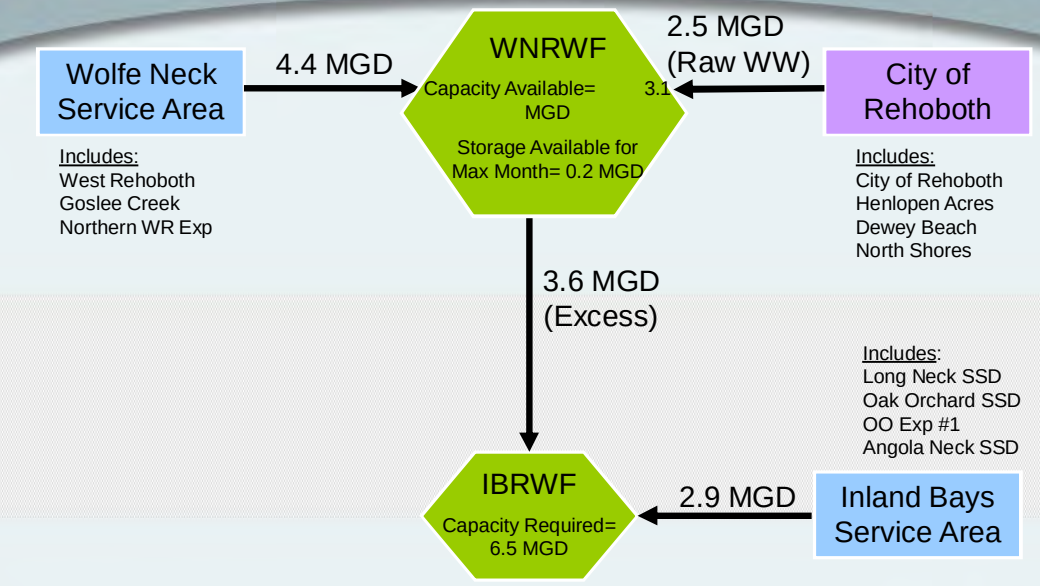
Note: All flow rates refer to year 2030 Max Month treatment and disposal requirements.

Alternative #1B- Raw Wastewater to WNRWF with Treatment at a Private Provider



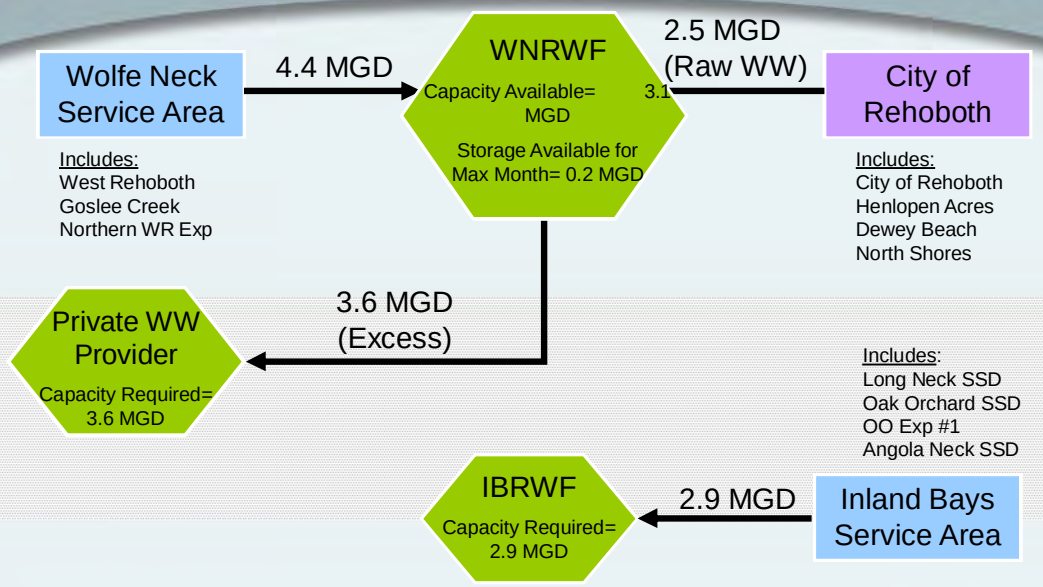
Note: All flow rates refer to year 2030 Max Month treatment and disposal requirements.

Alternative #2A- Treated Effluent to WNRWF with Treatment at the IBRWF



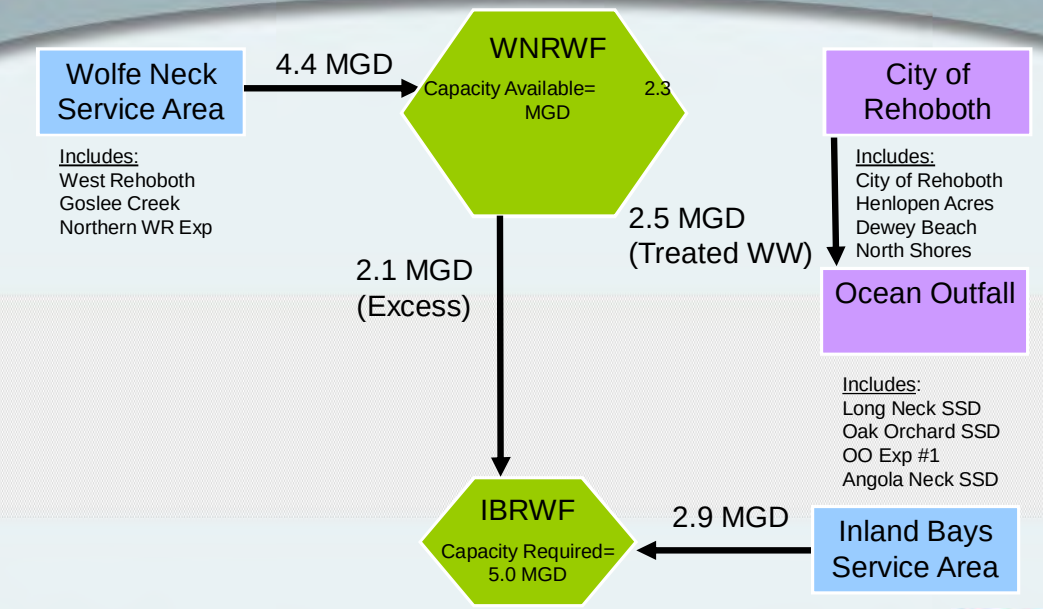
Note: All flow rates refer to year 2030 Max Month treatment and disposal requirements.

Alternative #2B- Treated Effluent to WNRWF with Treatment at a Private Service Provider



Note: All flow rates refer to year 2030 Max Month treatment and disposal requirements.

Alternative #3- Separate Treatment and Disposal



Note: All flow rates refer to year 2030 Max Month treatment and disposal requirements.

Summary of Costs

Alternative	Description	Total Capital Cost	Sussex County Capital Cost	City of Rehoboth Beach Capital Cost	City of Rehoboth Beach Annual Capital Costs	City of Rehoboth Beach Annual O&M Costs
#1A	Raw Wastewater Pumped to WNRWF with Disposal at IBRWF	$112 M	$44 M	$68 M	$2.9 M	$1.5 M
#1B	Raw Wastewater Pumped to WNRWF with Disposal at Private Service Provider	$99 M	$50 M	$49 M	$2.1 M	$3.3 M
#2A	Treated Effluent Pumped to WNRWF with Disposal at IBRWF	$99 M	$49 M	$50 M	$2.2 M	$1.5 M
#2B	Treated Effluent Pumped to WNRWF with Disposal at Private Service Provider	$99 M	$67 M	$32 M	$1.4 M	$3.8 M
#3	Rehoboth Pumps to Ocean Outfall Alternative with County Pumping to IBRWF	$99 M	$64 M	$35 M	$1.5 M	$1.1 m

Preliminary User Rates

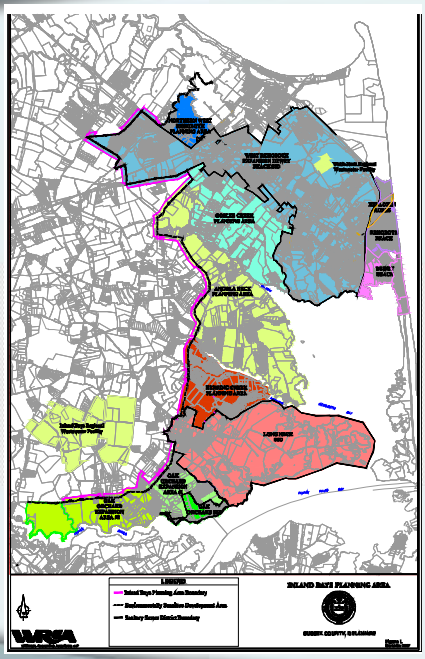
		Dewey Beach Estimated Rates		Henlopen Acres Estimated Rates		City of Rehoboth Beach Estimated Rates	
Alternative	Description	Existing Rate	New Rate	Existing Rate	New Rate	Existing Rate	New Rate
#2A	Treated Effluent Pumped to WNRWF with Disposal at IBRWF	$350	$745	$588	$1,398	$325	$968
#2B	Treated Effluent Pumped to WNRWF with Disposal at Private Service Provider	$350	$1,182	$588	$1,691	$325	$1,374
#3	Rehoboth Pumps to Ocean Outfall Alternative with County Pumping to IBRWF	$350	$565	$588	$1,096	$325	$680

Sussex County Council

City of Rehoboth

Beach Comments

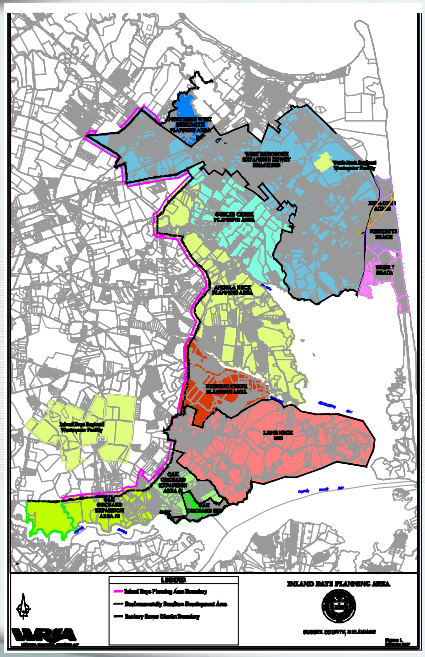
Sussex County Council



Questions?

August 18, 2009

Sussex County Council

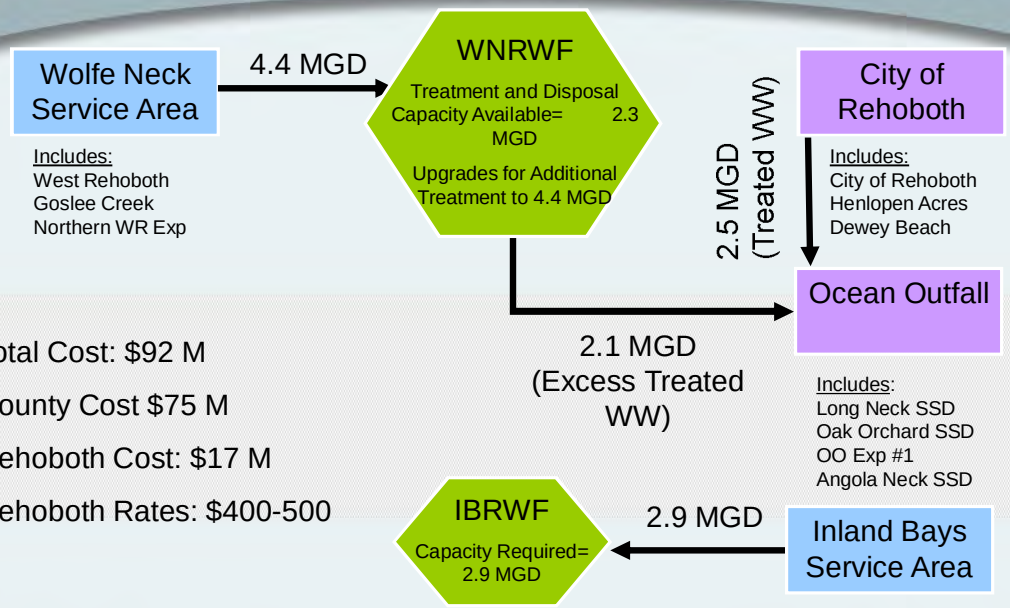


Where do we go from here?

August 18, 2009

Alternative #4- Combined Ocean Outfall

(Not part of August 2009 County/Rehoboth Study. Slide inserted for informational purposes for August 18, 2009 presentation to Sussex County Council. Slide was part of presentation to Sussex County Council in June 2008)



Total Cost: $92 M

County Cost $75 M

Rehoboth Cost: $17 M

Rehoboth Rates: $400-500

Note: All flow rates refer to year 2030 Max Month treatment and disposal requirements.

Previous County Council Motions

(Not part of August 2009 County/Rehoboth Study. Slide inserted for informational purposes for August 18, 2009 presentation to Sussex County Council.
Alternative #3 of June 3, 2008 does not refer to Alternative #3 of August 2009 Joint Study.
Italics emphasis added.)

<u>County Council Motion, June 3, 2008</u>

A Motion was made by Mr. Dukes, seconded by Mr. Phillips, to support spray irrigation (Alternative No. 3 – Joint Sussex County/Rehoboth *Spray Irrigation*).
Motion Adopted: 4 Yeas, 1 Nay.

<u>County Council Motion, December 16, 2008</u>

A Motion was made by Mr. Dukes, seconded by Mr. Phillips, to authorize County staff to issue an RFP (for cost alternatives for wastewater treatment and disposal services for the Wolfe Neck Treatment Facility and City of Rehoboth).
Motion Adopted: 4 Yeas, 1 Nay.

Stearns & Wheler, LLC

SUSSEX COUNTY ENGINEERING DEPARTMENT
Sussex County, Delaware

A Regional Planning Report to Assess a Joint Sussex County/City of Rehoboth Land Application Project

October 2009 – FINAL DRAFT

WHITMAN, REQUARDT & ASSOCIATES, LLP

in association with

STEARNS & WHELER LLC
Environmental Engineers and Scientists

A REGIONAL PLANNING REPORT TO ASSESS A JOINT SUSSEX COUNTY/CITY OF REHOBOTH LAND APPLICATION PROJECT

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C North Coastal EDU Data and Projections

D Rehoboth to Wolfe Neck Conveyance Cost Estimates

E Wolfe Neck Conveyance Cost Estimates

F Inland Bays Regional Wastewater Facility Cost Estimates

G Sussex County/City of Rehoboth Cost Sharing Model

EX EXECUTIVE SUMMARY

EX-1 BACKGROUND

The City of Rehoboth Beach currently owns and operates the Rehoboth Beach Sewage Treatment Plant (RBSTP), which treats and disposes of wastewater into the Lewes-Rehoboth Canal. The Delaware Department of Natural Resources and Environmental Control (DNREC) and the City of Rehoboth have entered into a Consent Order to eliminate this discharge into the Lewes-Rehoboth Canal by 2014. The RBSTP currently serves the City of Rehoboth as well as the following County areas:

- Dewey Beach
- Henlopen Acres
- North Shores

Sussex County currently owns and operates both the Wolfe Neck Regional Wastewater Facility (WNRWF), and the Inland Bays Regional Wastewater Facility (IBRWF). These are both spray irrigation facilities. The WNRWF currently serves the West Rehoboth Expansion of the Dewey Beach Sanitary Sewer District. The IBRWF currently serves the Long Neck and Oak Orchard Sanitary Sewer Districts. Future service is being planned for various other planning areas within the overall Inland Bays Planning Area. The location of the RBSTP, WNRWF, IBRWF and the various districts and planning areas within the overall Inland Bays Planning Area are indicated on Figure EX-1.

EX-2 PURPOSE

The purpose of this report is to review options for a joint Sussex County/City of Rehoboth Beach Land Application Project in which the City of Rehoboth will send either raw wastewater or treated effluent to the County for treatment and disposal via land application at either the WNRWF or the IBRWF or some combination thereof.

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COASTAL HIGHWAY

HENLOPEN ACRES/NORTH SHORES

REHOBOTH BEACH

DEWEY BEACH

Rehoboth Beach Sewage Treatment Plant

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MULLBERRY KNOLL ROAD

JOHN J. WILLIAMS HIGHWAY

CEDAR GROVE ROAD

ROBINSONVILLE ROAD

KENDALE ROAD

GOSLEE CREEK PLANNING AREA

ANGOLA NECK PLANNING AREA

ANGOLA NECK SANITARY SEWER DISTRICT

DAM ROAD

BEAVER

HOLLYMOUNT ROAD

INDIAN

PHILLIPS BRANCH ROAD

MISSION ROAD

CANNON ROAD

HERRING CREEK PLANNING AREA

CUPOLA CREEK

REHOBOTH BAY

Inland Bays Regional Wastewater Facility

LONG NECK SSD

LONG NECK PLANNING AREA

OAK ORCHARD SSD EXPANSION AREA #1

OAK ORCHARD EXPANSION AREA #2

OAK ORCHARD SSD

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LEGEND

- Inland Bays Planning Area Boundary
- Environmentally Sensitive Development Area
- Sanitary Sewer District Boundary

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SUSSEX COUNTY, DELAWARE

Figure EX-1

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Alternatives implementing the use of a Private Wastewater Provider (PWWP) or combined ocean outfall have also been examined.

EX-3 ALTERNATIVES EVALUATED

There are seven possible alternatives being considered by the County to handle the wastewater in the NCPA and from the City of Rehoboth Beach. The possible solutions can be grouped into four general treatment and disposal alternatives:

- **Alternative 1A/1B:** The RBSTP shuts down and sends all of its raw wastewater to the WNRWF, which will treat as much wastewater as possible and send the excess to another facility to be treated. The excess wastewater will be treated by the County owned and operated Inland Bays Regional Wastewater Facility (Alt 1A) or a private wastewater provider (Alt 1B).

- **Alternative 2A/2B**: The RBSTP remains in service and sends its treated effluent to the WNRWF for disposal via spray irrigation. A reduced amount of WNRWF influent wastewater from its service area will continue to be treated at that facility, with all excess being sent to either to the Inland Bays Regional Wastewater Facility (Alt 2A) or a private wastewater provider (Alt 2B).

- **Alternative 3**: The RBSTP remains in service and discharges treated effluent via an ocean outfall. In this scenario, the County will continue treating and disposing wastewater via land application at its existing facilities. The WNRWF will remain in service and continue treating and disposing wastewater from its service area. Any excess flow to the WNRWF above the capacity of the facility will be sent to the IBRWF for treatment and disposal.

- **Alternative 4/4B**: The RBSTP remains in service and discharges treated effluent via an ocean outfall. The County continues to treat wastewater via land

application at the WNRWF. The WNRWF will expand and upgrade its treatment capacity. Treated wastewater that exceeds the WNRWF disposal capacity will be pumped to the Rehoboth ocean outfall for disposal. Alternative 4 is based on 2030 maximum month flows. For cost sharing purposes, Alternative 4B is based on buildout maximum month flows.

EX-4 COST SHARING MODEL

A cost sharing model was developed for each alternative. This model was developed by estimating the initial capital costs, the project costs and contingencies, contract service costs associated with the private wastewater provider option and the long term operation and maintenance costs for each of the alternatives. Table EX-1 on the following page provides a summary of the resulting County/Rehoboth Costs, as well as the anticipated Rehoboth User Rates for each alternative. Table EX-2 provides the anticipated impacts to the County users.

Table EX-2 : Impacts of Alternatives on County Rates

	Dewey Beach User Rates		Henlopen Acres User Rates		City of Rehoboth Beach User Rates	
Alternative	Existing Rate	New Rate (1)	Existing Rate	New Rate (1)	Existing Rate	New Rate (2)
#2A	$350	$770	$588	$1,460	$325	$1,010
#2B	$350	$1,210	$588	$1,750	$325	$1,420
#3	$350	$540	$588	$1,030	$325	$630
#4	$350	(3)	$588	(3)	$325	$550
#4B	$350	(3)	$588	(3)	$325	$550

Notes:
(1) New rates have been rounded to the nearest $10 and are based on a 40 year loan at 5%,
(2) New rates have been rounded to the nearest $10 and are based on a 20 year loan at 4.4%,
(3) Not evaluated to date

Table EX-1: Impacts of Alternatives on City of Rehoboth User Rates (1) (2)

Alt.	Description	Total Project Cost ($ M)	County Cost Share ($ M)	Rehoboth Cost Share ($ M)	Annual Capital Cost - Rehoboth	Annual Maintenance Cost- Rehoboth	**Rehoboth User Rates**
#1A	Raw Wastewater Pumped to WNRWF with Disposal at IBRWF	$112	$44	$68	$2,900,000	$1,500,000	$1,160
#1B	Raw Wastewater Pumped to WNRWF with Disposal at Private Service Provider	$100	$50	$50	$2,100,000	$3,300,000	$1,430
#2A	Treated Effluent Pumped to WNRWF with Disposal at IBRWF	$103	$48	$54	$2,300,000	$1,500,000	$1,010
#2B	Treated Effluent Pumped to WNRWF with Disposal at Private Service Provider	$91	$54	$37	$1,600,000	$3,800,000	$1,420
#3	Rehoboth Pumps to Ocean Outfall Alternative with County Pumping to IBRWF	$94	$64	$30	$1,300,000	$1,100,000	$630
#4	Rehoboth and County Pump to Common Outfall with County Continuing to use IBRWF for Southern Service Area (2030 Max. Month)	$87	$64	$23	$1,000,000	$1,100,000	$550
#4B	Rehoboth and County Pump to Common Outfall with County Continuing to use IBRWF for Southern Service Area (Buildout Max Month)	$87	$68	$19	$800,000	$1,100,000	$500

Notes:
(1) All annual capital costs, maintenance costs, and users rates are based on 4.4% for 20 years.
(2) All total project costs, annual costs and user rates are rounded to the nearest $1M, $0.1M, and $10 respectively.

EX-5 EVALUATION OF ALTERNATIVES

It was not the intent of this study to recommend one specific alternative, but rather provide the information which could be used as a part of the overall decision process. There are other non-economic, public perception, and regulatory issues that could influence the final outcome. Rather the intent is to provide a basic summary of pros and cons for each alternative, primarily on a cost basis. Based on the analysis performed the following observations can be made regarding potential City of Rehoboth costs:

- A public/private partnership with a PWWP (Alt 1B or 2 B) does not appear to be cost effective as compared to other alternatives.
- Alternative 2A (Treated Effluent) is the most cost effective spray irrigation alternative.
- Both ocean outfall alternatives and appear to be more cost effective than the spray alternatives, with the combined City/County outfall (Alt 4/4B) being the most cost effective.

For the County, the costs of for a combined ocean outfall (Alternative 4/4B) verses conveyance and treatment/disposal at the IBRWF (Alternative 3) are essentially equal. Factors that should be considered include:

- Alternative 4 would appear to be lower operation and maintenance for energy and force main maintenance issues.
- The County has already made a capital investment in land at the IBRWF. Depending on future flows per equivalent dwelling unit (EDU). If Alternative 4/4B is implemented, the County may have excess land, which could potentially be used to provide sewer service to new areas or partner with other entities.

- Alternative 4/4B would likely be a more reliable treatment option. Factors such as weather and variable soil conditions introduce higher uncertainties for spray irrigation.
- Alternative 4/4B would provide the County with multiple methods of disposal (land disposal and ocean discharge).
- Future upgrades beyond the current 20 year planning period will likely be higher for Alternative 3 as compare to Alternative 4/4B.

1. INTRODUCTION

1.1 BACKGROUND

The City of Rehoboth Beach currently owns and operates the Rehoboth Beach Sewage Treatment Plant (RBSTP), which treats and disposes of wastewater into the Lewes-Rehoboth Canal. The Delaware Department of Natural Resources and Environmental Control (DNREC) and the City of Rehoboth have entered into a Consent Order to eliminate this discharge into the Lewes-Rehoboth Canal by 2014. The RBSTP currently serves the City of Rehoboth as well as the following County areas:

- Dewey Beach
- Henlopen Acres
- North Shores

Sussex County currently owns and operates both the Wolfe Neck Regional Wastewater Facility (WNRWF), and the Inland Bays Regional Wastewater Facility (IBRWF). These facilities treat and dispose of wastewater from the following existing Sanitary Sewer Districts within the Inland Bays Planning Area via land application:

- West Rehoboth Expansion of the Dewey Beach Sanitary Sewer District
- Long Neck Sanitary Sewer District
- Oak Orchard Sanitary Sewer District

Immediate service (within the next 2 years) is being planned for the following areas within the Inland Bays Planning Area:

- Oak Orchard Expansion Area #1
- Angola Neck Sanitary Sewer District

Future service is being planned for the following planning areas within the overall Inland Bays Planning Area:

- Herring Creek
- Angola Neck
- Northern West Rehoboth
- Long Neck
- Oak Orchard Expansion Area #2
- Goslee Creek

The location of the RBSTP, WNRWF, IBRWF and the various districts and planning areas within the overall Inland Bays Planning Area are indicated on Figure 1.1-1.

1.2 PURPOSE OF REPORT

The purpose of this report is to review options for a joint Sussex County/City of Rehoboth Beach Land Application Project in which the City of Rehoboth will send either raw wastewater or treated effluent to the County for treatment and disposal via land application at either the WNRWF or the IBRWF or some combination thereof. Alternatives implementing the use of a Private Wastewater Provider (PWWP) or combined ocean outfall have also been examined. This report is being coordinated with a separate report being performed by the City of Rehoboth entitled "The Rehoboth Beach Wastewater Treatment Plant Alternative Discharge Cost Evaluation", herein referred to as the "Rehoboth Beach Alternative Discharge Evaluation".

1.3 SCOPE OF WORK

This report will address the following issues:

1) Analysis of the operating data for the RBSTP over the past three years (2006 though 2008).

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REHOBOTH BAY

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LONG NECK SSD

LONG NECK PLANNING AREA

OAK ORCHARD SSD EXPANSION AREA #1

OAK ORCHARD EXPANSION AREA #2

OAK ORCHARD SSD

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LEGEND

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- Environmentally Sensitive Development Area
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Figure 1.1-1
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2) Estimate of future wastewater flows and loads from the RBSTP, including an estimate of the flow rate to be pumped to the WNRWF for treatment and disposal.
3) Assessment of the conveyance system required to convey flows from the RBSTP to the WNRWF, including pumping station and force main sizes, force main alignments, as well as preliminary costs.
4) Assessment of the improvements necessary at the WNRWF to accept flow from the RBSTP, including preliminary costs.
5) Assessment of the conveyance system required to convey flows from the WNRWF to the IBRWF, including pumping station and force main sizes, force main alignments, as well as preliminary costs.
6) Analysis of spray irrigation disposal capacities at both the WNRWF and IBRWF, including a timeline for future expansion at IBRWF, as well as estimated costs to perform additional hydrogeological and soils tests required.
7) Assessment of the impacts on future plant expansions at the WNRWF and IBRWF based on accepting flow from the RBSTP.
8) Development of a cost-sharing model to determine impact costs to each entity.
9) Analysis of private wastewater options in order to compare capital costs for the use of a private wastewater provider.

2. REHOBOTH BEACH FLOWS AND LOADS

The following chapter provides an overview of the existing Rehoboth Beach Sewage Treatment Plant (RBSTP), reviews historical flowrates and provides future flow and nutrient loading projections.

2.1 FACILITY SUMMARY

The RBSTP is owned and operated by the City of Rehoboth Beach. The facility is located at 20543 Roosevelt Street, on the bank of the Lewes-Rehoboth Canal.

The facility features an oxidation ditch system to achieve biological nutrient removal and is disinfected via a chlorine contact tank; final effluent is discharged into the Lewes-Rehoboth Canal. In addition to the City of Rehoboth Beach, the treatment plant services County customers from the areas of Dewey Beach, Henlopen Acres, and North Shores. The treatment facility was designed to treat a maximum month flow of 3.4 mgd. The City has an agreement with Sussex County to allocate 1.1 mgd of this for the Dewey Beach Sanitary Sewer District (DBSSD) and 0.075 mgd for the Henlopen Acres Sanitary Sewer District (HASSD) on a maximum weekly average basis.

The RBSTP operates under State Permit No. WPCC 3084D/74, which is effective until September 20, 2010. The permit stipulates daily average and daily maximum effluent concentration limits for BOD_5, TSS and enterococcus coliform. A summary of the permitted parameters is shown in Table 2.1-1.

Table 2.1-1: RBSTP Permit Summary

Parameter	Value
BOD_5	19 mg/L Daily Average 29 mg/L Daily Maximum
TSS	15 mg/L Daily Average 23 mg/L Daily Maximum
Enterococcus Coliform	10 colonies/ 100 mL
Total Residual Chlorine	None Detectable
pH	6.0 Minimum 9.0 Maximum

Note:
1. State Permit No. WPCC 3084D/74, Expiration Date: September 20, 2010.

In addition to the effluent limits listed in Table 2.1-1, the permit indicates that the total nitrogen (TN) discharged shall not exceed 24,300 lbs/yr and the total phosphorus (TP) discharges shall not exceed 5,308 lbs/yr. These loading rates are equivalent to a TN

concentration of 2.35 mg/L and a TP concentration of 0.51 mg/L at the maximum month design capacity.

The 2.35 mg/L TN concentration is below the commonly accepted limit of technology; it is part of the consent order in effect until the RBSTP is required to stop discharging into the Lewes- Rehoboth Canal. The Delaware DNREC recently established Total Maximum Daily Loads (TMDLs) for the Inland Bays. The TMDL is described in the Delaware Pollution Control Strategy titled, "Regulations of the Pollution Control Watersheds, Delaware," dated November 2008. As part of these TMDLs, the RBSTP must stop discharging to the Lewes-Rehoboth Canal by December 31, 2014. These TMDLs will no longer apply when the RBSTP stops discharging into the canal and conveys flow for spray irrigation disposal or to an ocean outfall.

Available flow and loading data for the RBSTP were analyzed to asses the current influent conditions and estimate future loads. Influent flows are assumed to be equal to effluent flows because no influent data were available. Population projections and wastewater characteristics were used to estimate wastewater flows and loads which served as the basis for design in evaluating operational alternatives.

For this study, the years from 2005 through 2008 were evaluated. 2005 was included as a representation of a high flow year, either from population flux or weather patterns. Plant data are included in Appendix A.

2.2 CURRENT FLOWS

The wastewater treated at the RBSTP comes primarily from domestic and commercial sources (e.g., retail stores and restaurants). Wastewater is conveyed to the treatment facility by four force mains; two from the City of Rehoboth Beach and two directly from the DBSSD. Wastewater from HASSD and North Shores are conveyed to the RBSTP through the City of Rehoboth Beach's collection and conveyance system. Despite

treating wastewater from three other districts, the City of Rehoboth Beach contributes the majority of the wastewater. Figure 2.2-1 shows the total flow for the RBSTP, Figure 2.2-2 shows the flows of the individual contributing entities.

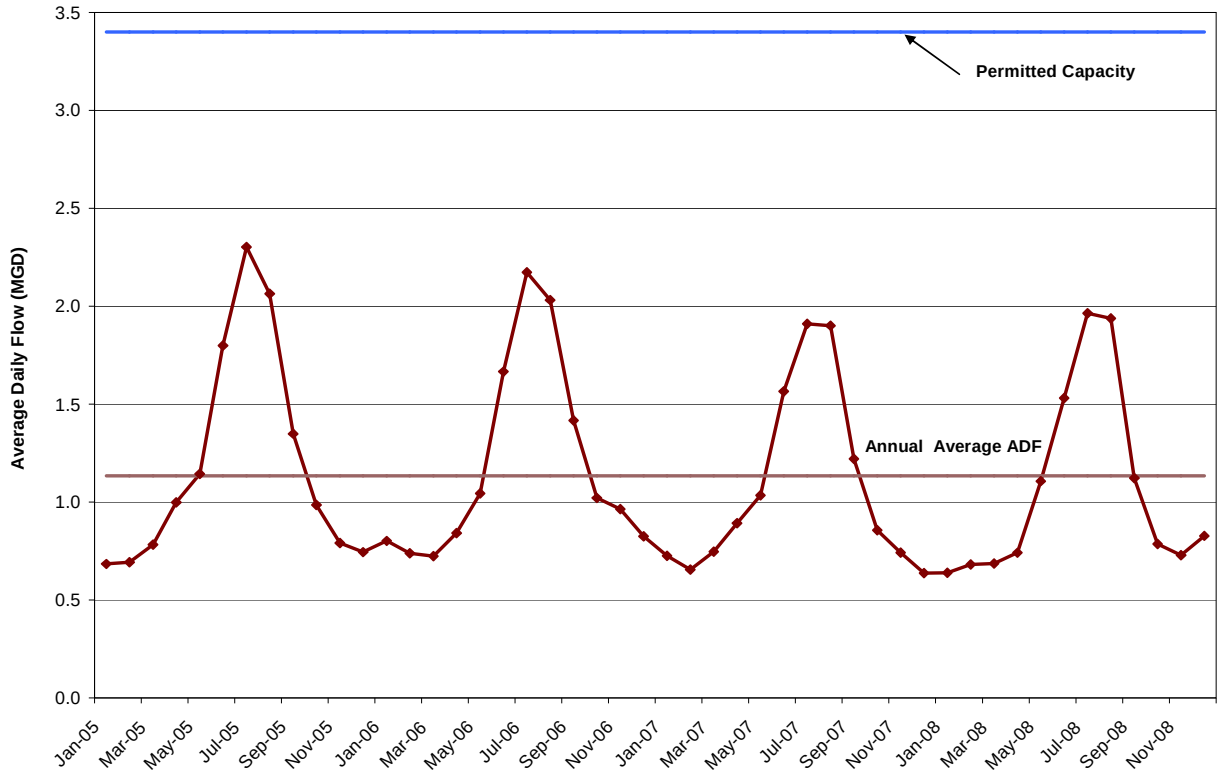


Figure 2.2-1 RBSTP Monthly Average Influent Flow (2005-2008)

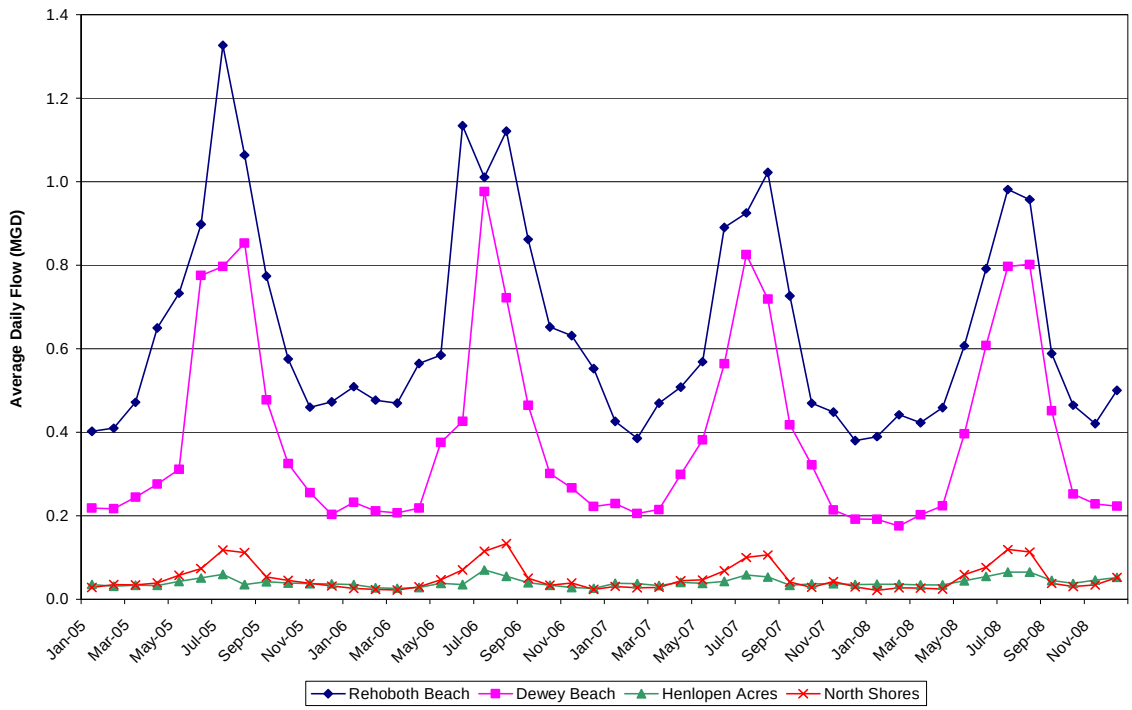


Figure 2.2-2: Individual Monthly Average Flows from Contributing Entities (2005-2008)

The maximum month ADF over the period of analysis was 2.3 mgd and occurred in July 2005. Monthly flow data dating back to 1988 was examined and the July 2005 flow was exceeded only once over this period (July 2000). Table 2.2-1 shows the average flow contribution for each of the contributing entities.

Table 2.2-1: Average Flows from Contributing Entities

Entity	Four Year Average Flow(1) (mgd)	Max Month Average Flow(2) (mgd)	Contributing EDUs	Max Month gpd/ EDU
City of RB	0.65	1.3	Not Available	N/A
DBSSD	0.39	0.80	3,612	224
HASSD	0.04	0.06	205	298
North Shores	0.05	0.12	Not Available	N/A
Total	1.1	2.3	Not Available	N/A

Notes:
1. The period of study includes 2005 through 2008.
2. July 2005 flows were shown. This was the maximum month flow over the 4 year period of review.

As shown in Table 2.2-1, the City of Rehoboth Beach currently contributes about 57% of the flow to the RBSTP.

Each year, there has been more than twice as much influent wastewater flow during the summer (defined as June, July and August) as compared to the winter (defined as December, January and February). Table 2.2-2 summarizes the seasonal flows; Table 2.2-3 summarizes the seasonal flow ratios.

Table 2.2-2: RBSTP Seasonal Monthly Influent Flowrates

Year	Max Month ADF (mgd)	Summer ADF (mgd)	Winter ADF (mgd)	Annual ADF (mgd)
2005	2.3	2.1	0.69	1.2
2006	2.2	2.0	0.77	1.2
2007	1.9	1.8	0.73	1.1
2008	2.0	1.8	0.65	1.1
Average	**2.1**	**1.9**	**0.72**	**1.1**

Note:
1. Winter is defined as December, January, February; summer is defined as June, July, August.

Table 2.2-3: RBSTP Seasonal Flow Ratios

Year	Summer / Winter Ratio	Max Month / Annual Ratio	Max Month / Summer Month Ratio
2005	3.0	1.9	1.1
2006	2.5	1.8	1.1
2007	2.4	1.8	1.1
2008	2.8	1.8	1.1
Average	**2.7**	**1.8**	**1.1**

Note:
1. Winter is defined as December, January, February; summer is defined as June, July, August.

The seasonal nature of the flow is attributed to the service area's close proximity to popular vacation coastline. The majority of the residents live in the area only during the summer months and on weekends in the spring and fall. As a result, significantly larger average wastewater flows are received during the summer months compared to the rest of the year. Due to the seasonal nature of this community, the summer average and summer

maximum flows were examined to determine the current operating state of the facility and to estimate future operating conditions.

2.3 PROJECTED FLOWS

Equivalent dwelling units (EDUs) were used for this analysis instead of the total number of customers because it converts different types of customers (single-family residential, multi-unit residential, institutional, commercial, and industrial) into the equivalent number of single-family residential users. The EDUs were only available for two of the four contributing entities (DBSSD and HASSD). The maximum month flow contribution for the DBSSD and HASSD was 224 gpd/EDU and 298 gpd/EDU, respectively. For planning purposes, 225 gpd/EDU was used to project flow contributions from future EDUs added to the sewage collection system.

To develop growth projections, EDU data from 2003-2008 was analyzed for Dewey Beach and Henlopen Acres. These areas gained a total of 69 EDUs over the time span, approximately 14 EDUs per year. The EDUs added per year was proportionally scaled up to include the entire RBSTP service area. By this method, the annual rate of growth is 0.39%. Table 2.3-1 summarizes the calculations and methodology for future projections; detailed calculations are in Appendix A. Table 2.3-2 summarizes the influent flow projections for 2030 and the ultimate buildout.

Table 2.3-1: Growth Projection Methodology

Growth Determination	
EDUs Gained from HA	5
EDUs Gained From DB	64
Total EDUs Gained 2003-2008	69
EDUs Gained/Year	14
HA & DB Average Annual Flows (MG/yr)	158
Total RBSTP Average Annual Flows (MG/yr)	414
Percent Contribution of HA & DB to RBSTP (%)	38%
Estimated EDUs Gained by RBSTP per Year (Proportional)	37

Notes:

1. Data used for calculations provided by the Sussex County Engineering Department (SCED) and City of Rehoboth Beach.

Table 2.3-2: RBSTP Projected Wastewater Influent Flows

Design Period	Max Month ADF (mgd)	Summer ADF (mgd)(3)	Winter ADF (mgd)(4)	Annual ADF (mgd)
Current	2.30(1)	1.91	0.72	1.10
Year 2030	2.50(2)	2.30	0.93	1.40
Ultimate Design	3.40	3.10	1.30	1.90

Notes:
1. Current Max Month ADF based on July 2005 observed flow.
2. Year 2030 max month ADF based on current max month ADF + 37 EDU/year multiplied by 225 gpd/ EDU.
3. Summer ADF based on applying observed 1.10 average ratio of max month to average summer ADFs from Table 2.2-2 to projected max month ADF.
4. Winter ADF based on applying observed 2.7 average ratio of summer to winter ADFs from Table 2.2-2 to projected summer ADF.

2.4 INFLUENT LOADS

The RBSTP does not regularly sample influent wastewater for pollutants. Because of this, it is not recommended that facility modifications be designed based on the influent wastewater characteristics provided by the treatment plant. Instead, it is recommended that more typical influent wastewater characteristics published in the Metcalf & Eddy Wastewater Engineering design manual be used as the basis for design modifications. The average and maximum month concentrations the design will be based on are summarized in Table 2.4-1.

Table 2.4-1: Influent Concentrations Based on Typical Wastewater Strength

Parameter	Average Month (mg/L)	Maximum Month (mg/L)
BOD_5	190	250
TSS	210	270
TKN	40	52
NH_4-N	25	33
TP	7	9

Notes:
1. Average month characteristics are based on medium strength wastewater characterization as presented in Metcalf and Eddy, 4th Edition Table 3-15.

2. The maximum month to average month constituent loading ratio is expected to be about 1.3:1 (Metcalf & Eddy, Figure 3-8, 4th Edition).

Using the Metcalf & Eddy assumptions for wastewater concentrations, the current and projected influent loadings are summarized in Table 2.4-2.

Table 2.4-2: Design Current & Projected Influent Loads

Design Period	BOD_5 (lbs/day)		TSS (lbs/day)		TKN (lbs/day)		NH_4-N (lbs/day)		TP (lbs/day)	
	Avg.	Max.	Avg.	Max.	Avg.	Max.	Avg.	Max.	Avg.	Max.
Current (2005-2008)	3,700	4,800	4,000	5,200	770	1,000	480	630	130	170
2030 Projected	4,000	5,200	4,400	5,600	830	1,100	520	690	150	190
Ultimate Flow	5,400	7,100	6,000	7,700	1,100	1,500	710	940	200	260

Notes:
1. Average loading based on average concentrations shown in Table 2.4-1 at current max month ADF of 2.3 mgd from Table 2.3-2.
2. Maximum loading rate based on maximum concentrations shown in Table 2.4-1 at current max month ADF of 2.3 mgd from Table 2.3-1.

2.5 CURRENT EFFLUENT PERFORMANCE

The RBSTP is subject to permit limits for conventional pollutants as well as nutrients. The RBSTP has consistently produced a final effluent with concentrations well below the permit requirements. A summary of the reported values for effluent monitored pollutants is presented in Table 2.5-1. Table 2.5-2 summarizes the effluent performance of both conventional and nutrient pollutants for the study period. The seasonal performance of the plant for conventional pollutants is shown in Figure 2.5-1. Complete performance data are provided in Appendix A.

Table 2.5-1: Comparison of Actual Effluent Performance to Permit Limits

Parameter	Permit Limit	Current Value(1)
BOD_5 – Daily Average	19 mg/L	1.7 mg/L
BOD_5 – Daily Maximum	29 mg/L	4.3 mg/L
TSS – Daily Average	15 mg/L	3.2 mg/L
TSS – Daily Maximum	23 mg/L	11.0 mg/L

Notes:
1. Data were provided by the City of Rehoboth Beach. Reported values are a flow weighted average over the period of study (2005-2008).

Table 2.5-2: Current Effluent Performance

Year	BOD_5 (mg/L)	TSS (mg/L)	TN (mg/L)	TP (mg/L)
2005	1.7	3.4	6.0	0.50
2006	1.4	2.8	4.4	0.34
2007	1.6	3.6	5.1	0.38
2008	2.0	3.0	6.0	0.39
Average	1.7	3.2	5.4	0.44

Notes:

1. Data were provided by the City of Rehoboth Beach. Reported values are an annual flow weighted average.

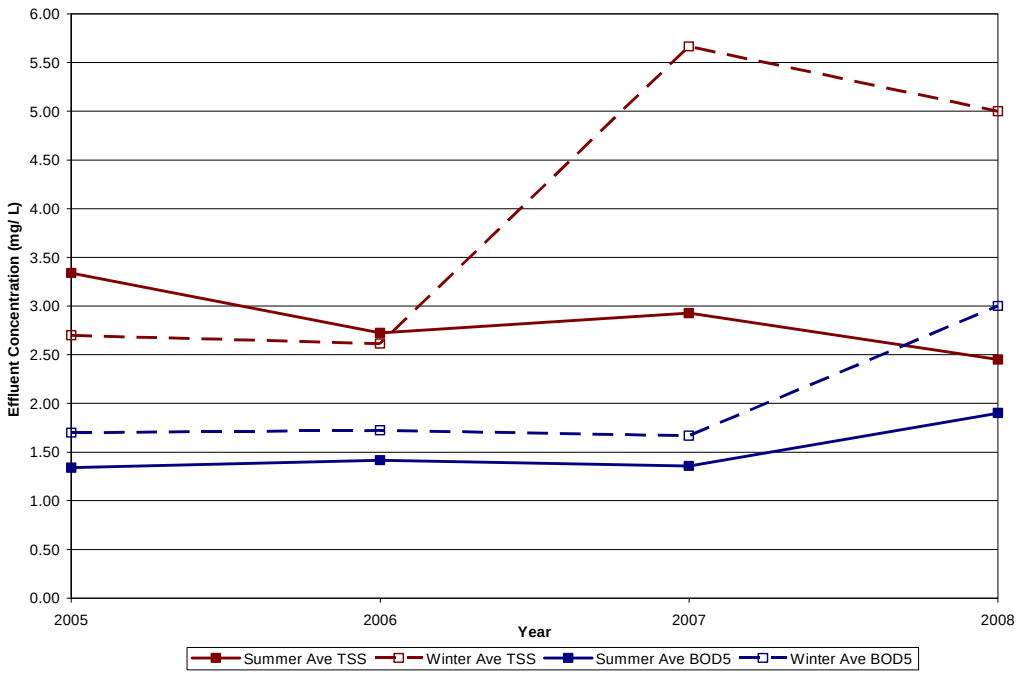


Figure 2.5-1: Seasonal BOD_5 and TSS Effluent Performance (2005-2008)

The effluent BOD_5 concentration is consistently higher in the winter than in the summer; approximately 25% higher in the winter from 2005-2008. While not as consistent, the effluent TSS concentration is generally higher in the winter as well; approximately 29% higher in the winter for the same period. Since the average daily influent flowrate is significantly lower in the winter, it follows that the temperature has a greater impact on the process than the amount of flow.

For total nitrogen and total phosphorus, the facility is required to meet annual loading limits of 24,300 lbs and 5,308 lbs, respectively. The RBSTP has also consistently met these TMDL requirements. The nutrient performance is summarized as annual loading in Table 2.5-3 and seasonal concentrations in Figure 2.5-2.

Table 2.5-3: Effluent Nutrient Performance

Year	Total Nitrogen (lbs/yr)	Total Phosphorus (lbs/yr)
2005	22,000	1,800
2006	15,900	1,400
2007	16,600	1,300
2008	19,400	1,500
Average	18,500	1,500

Notes:
1. Data were provided by the City of Rehoboth Beach.

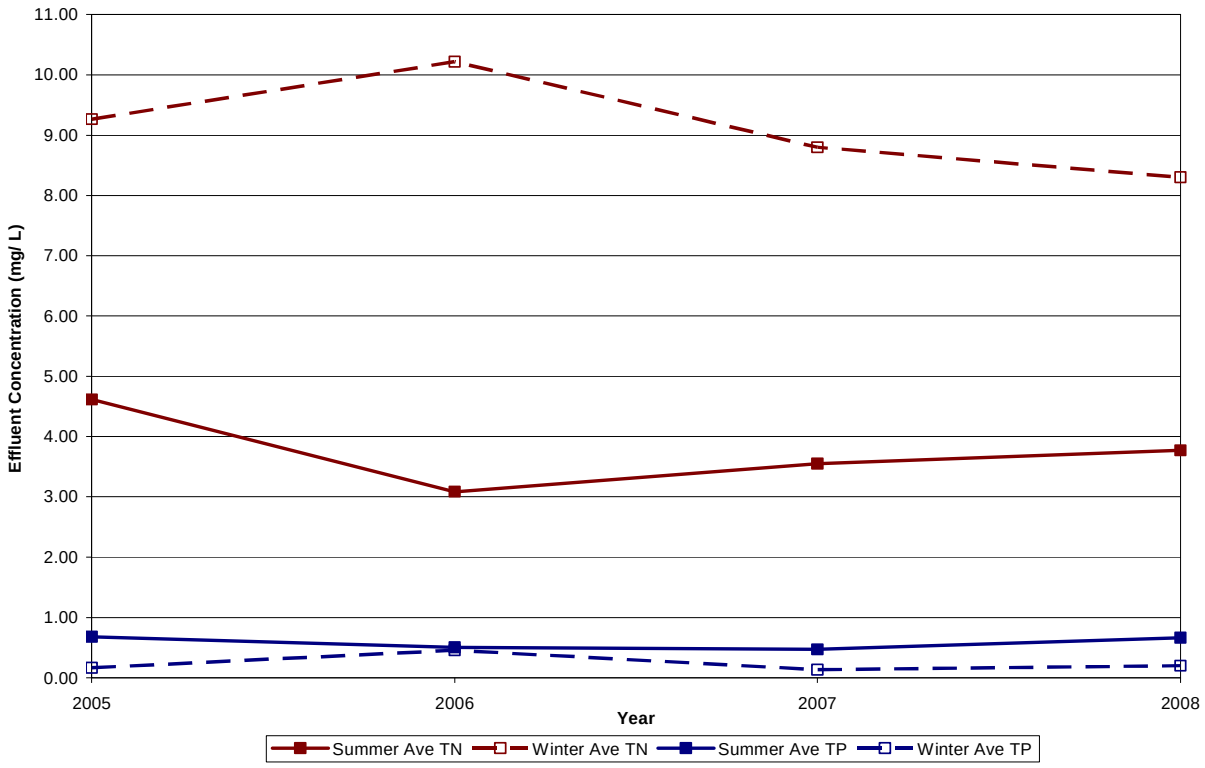


Figure 2.5-2: Seasonal TN and TP Effluent Performance (2005-2008)

Similarly to BOD_5 and TSS, the effluent TN concentration is consistently higher in the winter. This is most likely due to the sensitivity of nitrification to low temperatures. Conversely, the effluent TP concentration is lower during the winter. The process for phosphorus removal is less impacted by low temperatures than nitrogen removal and benefits from a lower flow rate.

2.6 PROJECTED EFFLUENT LOADING

Based on population and flow growth projections, future effluent performance and effluent annual loading were estimated. The RBSTP is expected to continue to perform well at its rated capacity of 3.4 mgd. For planning purposes, effluent concentrations for BOD_5 and TSS are estimated to increase slightly to 8.0 mg/ L and 4.0 mg/L, respectively, at projected 2030 flows. For the land application alternative evaluated in this report, effluent TN and TP concentrations from the RBSTP are estimated to increase under ultimate flows to 10 mg/L and 1.0 mg/L, respectively. Table 2.6-1 summarizes future performance estimations.

Table 2.6-1: Projected Effluent Concentrations and Loading

Design Period	Average Daily Flows (mgd)		Total Nitrogen		Total Phosphorus		BOD_5		TSS	
	Max Month	Annual	Conc. (mg/L)	Annual Loading (lbs/yr)	Conc. (mg/L)	Annual Loading (lbs/yr)	Conc. (mg/L)	Annual Loading (lbs/yr)	Conc. (mg/L)	Annual Loading (lbs/yr)
Current (2005-2008)	2.30	1.10	5.4	18,500	0.4	1,500	1.7	5,900	3.2	10,900
2030 Projected	2.50	1.35	8.0	33,000	1.0	4,100	2.5	10,300	4.0	16,500
Ultimate Flow (Permitted Capacity)	3.40	1.85	10.0	56,000	1.0	5,600	4.0	22,500	6.0	34,000

3. WEST REHOBOTH FLOWS & LOADS

The following chapter provides an overview of the existing Wolfe Neck Regional Wastewater Facility (WNRWF), reviews historical flowrates and provides future flow and nutrient loading projections.

3.1 FACILITY SUMMARY

The West Rehoboth Beach Expansion (WRE) of the Dewey Beach Sanitary Sewer District (DBSSD) is served by the WNRWF. The facility is located at the east end of County Road 270, approximately 1.2 miles east of Route 1 on the former Dodd farm parcel.

The WNRWF includes a headworks, partially mixed aerated treatment lagoons, an effluent storage lagoon, chlorine disinfection, and an effluent spray irrigation system. The facility has a spray irrigation permit (State Permit No. LTS 5005-95-05) issued by DNREC, which allows land application of treated effluent to spray fields.

The facility is permitted to accept up to 4.0 mgd as a monthly average influent flow from May through September and 2.23 mgd as a monthly average influent flow from October through April. The permit states that the average monthly quantity of effluent discharged to the spray irrigation fields shall not exceed 3.1 mgd. The permit also indicates that the weekly effluent applied to the spray irrigation fields shall not exceed 2.6 inches per week for the months of June and September, 2.75 inches per week for the months of July and August, and 2.5 inches per week from October 1 to May 31 with a maximum field application rate of 0.25 inches per hour. A 24-hour rest period is required between applications. The permit prohibits the application of wastewater during periods of rainfall, snowfall and when the ground is frozen. Monitoring requirements include frequency of sampling and sampling procedures for specific groundwater and soil parameters.

The permit stipulates daily average and daily maximum effluent concentration limits for BOD_5, TSS and fecal coliform. A summary of these effluent concentrations is provided in Table 3.1-1.

Table 3.1-1: Key Permit Requirements for Sprayed Effluent (1)

Parameter	Value
BOD_5	50 mg/L Daily Average
TSS	90 mg/L Daily Average
Fecal Coliform	200 colonies/100 mL Daily Average
Total Residual Chlorine	1.0 mg/L Minimum 4.0 mg/L Maximum
pH	5.0 Minimum 9.0 Maximum

Note:
1. State Permit No. LTS 5005-95-05, Expiration Date: October 13, 2010.

In addition to the effluent limits listed in Table 3.1-1, the permit indicates that the total nitrogen load applied to any field shall not exceed 396 lbs/yr/acre, including any supplemental fertilizer. Based on the 319 irrigated acres currently utilized at the permitted capacity of 3.1 mgd, this loading rate is equivalent to an effluent concentration of 13.4 mg/L TN, assuming no supplemental fertilizers are applied.

Available flow and loading data for the WNRWF were analyzed to asses the current influent conditions and estimate future loads. Population projections and wastewater characteristics were used to estimate wastewater flows and loads, which served as the basis for design in evaluating operational alternatives.

For this study, the years from 2005 through 2008 were evaluated. Plant data are included in Appendix B.

3.2 CURRENT FLOWS

Like the RBSTP, wastewater comes primarily from domestic and commercial sources. Pump Station Nos. 196 and 210 supply wastewater directly to the headworks through a common 30-inch forcemain. Currently, approximately 98% of the influent flow comes from Pump Station No. 210. The pumps at this station are controlled by variable frequency drives (VFDs). To serve the developing Hawkeye/Cadbury subdivision and surrounding areas, the County plans to increase the capacity of Pump Station No. 196 by directly connecting a new force main from this pump station to the WNRWF headworks. Table 3.2-1 summarizes the pump station characteristics; Figure 3.2-1 shows the influent wastewater flow rate over the period studied.

Table 3.2-1: Collection System Pump Stations Currently Connected Directly to the WNRWF

Pump Station	No.	Hp	Pump Capacity (gpm)	Pump Capacity (mgd)
PS No. 210 (Main PS) (1)	3	90	7,000	10.0
PS No. 196 (Wolfe Point Regional PS) (2)	2	88	1,896	2.7
Total			8,896	12.7

Notes:

1. Based on 2 units in service. The combined flow shown is based on August 2005 field testing by County staff. Note that the field-measured capacity was greater than the design combined pumping capacity of 6,500 gpm shown on the 1994 as-built drawings of PS 210, prepared by GMB. Pump capacity per unit is 4,400 gpm per Flygt Pumps test report, Nov. 11, 1995.
2. Based on 1 unit in service. Pump capacity taken from Flygt Pumps test report, Jan. 1, 2002.

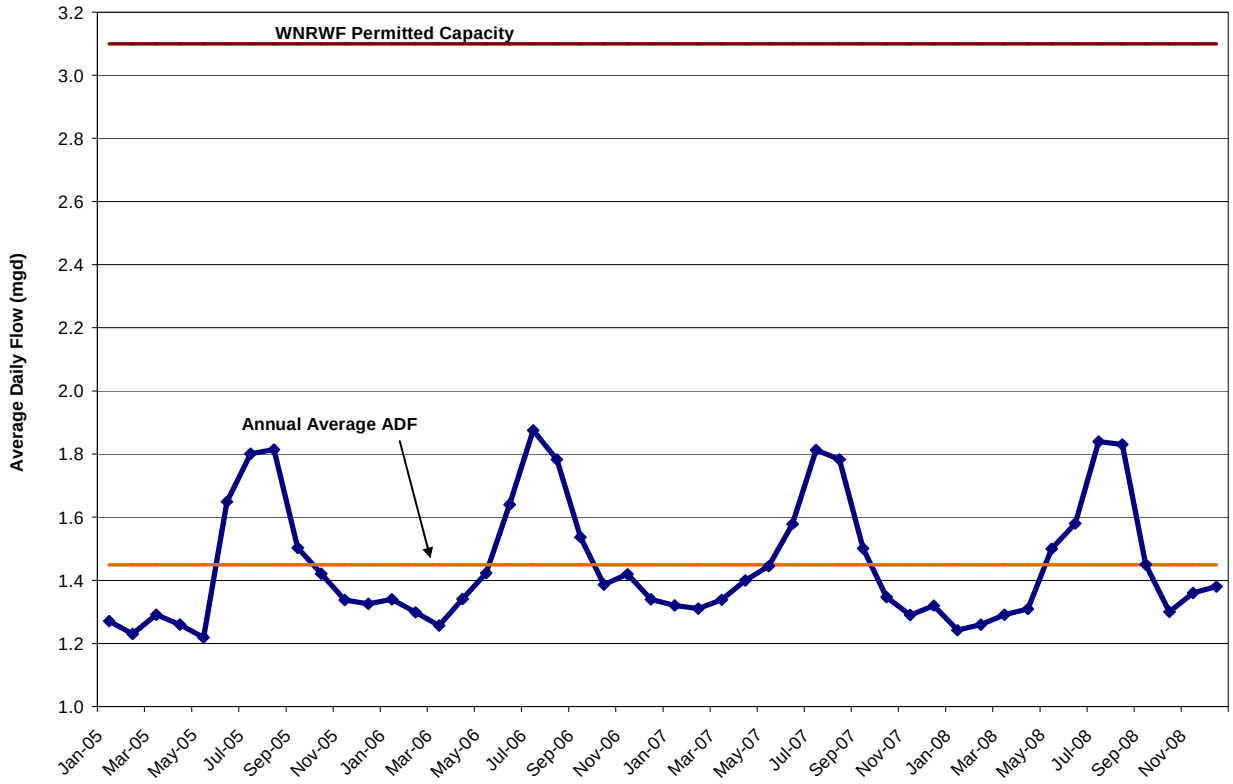


Figure 3.2-1: Influent Wastewater 2005-2008

The maximum month ADF over the period of analysis was 1.9 mgd in July 2006. Monthly flow data going back to 1999 were analyzed and July 2006 had the greatest flow rate of the entire data set. During July 2006 15,934 EDUs were connected to the WNRWF, resulting in a monthly average flow contribution of 119 gpd/ EDU.

Historically, the maximum month flow contributions from EDUs in the West Rehoboth service area has been higher (maximum of 149 gpd/ EDU in 2001), but this figure has dropped in recent years. The drop in maximum month flow per EDU may be related to the large number of constructed by unoccupied or under-occupied housing units built during the recent housing boom in the region. This trend is shown in Table 3.2-2.

Table 3.2-2: WNRWF Maximum Monthly Flow Data

Year	Summer Max Month ADF (mgd) (1,2)	Month Maximum Flow Occurred	Total Number of EDUs in Sewer Service Area(3,4)	Summer Max Month ADF per EDU (gpd/EDU)
2000	1.4	July	10,150	135
2001	1.7	July	11,472	149
2002	1.6	July, August	12,133	131
2003	1.8	July	13,155	136
2004	1.8	August	14,412	123
2005	1.8	August	15,272	119
2006	1.9	July	15,934	118
2007	1.8	July	16,775	108
2008	1.8	July	17,272	107
Average				125
Maximum				149

Notes:
1. Influent data for years 2000 to 2008 are from WNRWF Monthly Reports and the Sussex County Engineering Department.
2. Summer was defined as June, July, and August.
3. The contributing sewer service area is in the WRE of the DBSSD.
4. The total number of EDUs in the sewer service area is at mid-year (July 1). This data was provided by the Sussex County Engineering Department from billing records.

From 2005-2008, the summer (defined as June, July and August) has approximately 35% more wastewater influent than the winter (defined as December, January and February). Table 3.2-3 shows the seasonal flowrates; Table 3.2-4 summarizes the seasonal flow ratios.

Table 3.2-3: WNRWF Seasonal Monthly Influent Flowrates

Year	Summer ADF (mgd)	Winter ADF (mgd)	Annual ADF (mgd)	Max Month ADF (mgd)
2005	1.8	1.3	1.5	1.8
2006	1.8	1.3	1.5	1.9
2007	1.7	1.3	1.4	1.8
2008	1.8	1.3	1.5	1.8
Average	1.8	1.3	1.5	1.8

Note:
1. Winter is defined as December, January, February; summer is defined as June, July, August.

Table 3.2-4: WNRWF Seasonal Flow Ratios

Year	Summer/ Winter Ratio	Max Month/ Annual Ratio	Max Month / Summer Ratio
2005	1.4	1.2	1.0
2006	1.3	1.3	1.1
2007	1.3	1.3	1.1
2008	1.4	1.3	1.1
Average	1.4	1.3	1.0

Note:
1. Winter is defined as December, January, February; summer is defined as June, July, August.

Like the RBSTP, the seasonal nature of the flow to the WNRWF is attributed to its close proximity to a popular vacation coastline. The same living patterns (high population in summer, low in winter) apply to this location and cause the corresponding flux in wastewater flows. Because of these trends, both the summer average and summer maximum flows were estimated to determine the current operating state of the facility and to estimate future operating conditions.

3.3 PROJECTED FLOWS

Similar to the RBSTP, EDUs were used for this analysis. EDUs convert all different types of customers into the equivalent number of single-family residential users. For future planning projections, a contribution of 150 gpd/ EDU was used for both existing and future connections.

Historical growth rates in sewered districts typically range from 3-5%. While due to current economic conditions growth has been on the higher end from 2003 to 2008, the WRE is expected to grow at slower rate than in recent history. 3% is a more typical long term growth rate in sewered areas. To project future growth, a constant rate of 3% of the estimated existing 17,121 EDUs, approximately 513 EDUs, was added each year. This annual increase of 513 EDUs was applied through the planning period of 2030. For Goslee Creek, 100 EDUs was assumed to connect in 2025 and increase at a rate of 100 EDUs/ year. Table 3.3-1 summarizes the projected wastewater influent flows. More

detailed projected flows for the entire Inland Bays Planning Area are provided in Appendix C.

Table 3.3-1: WNRWF Projected Wastewater Influent Flows

Year	Contributing EDUs	Max Month ADF (mgd)	Summer Month ADF (mgd)(3)	Winter Month ADF (mgd)(4)	Annual ADF (mgd)(5)
Current	18,600	1.9(1)	1.8	1.3	1.5
Year 2030	29,000	4.4 (2)	4.2	3.1	3.5
Ultimate Design	47,800	7.2	6.9	5.1	5.7

Notes:
1. Current max month ADF based on July 2006 observed flow.
2. Year 2030 max month ADF based on an annual increase of 513 EDUs/yr for the WRE and 100 EDUs/ yr for Goslee Creek starting in 2025. Total EDUs are multiplied by 150 gpd/ EDU.
3. Summer ADF based on applying observed 1.1 average ratio of max month to average summer ADFs from Table 3.2-3 to projected max month ADF.
4. Winter ADF based on applying observed 1.4 average ratio of summer to winter ADFs from Table 3.2-3 to projected summer ADF.
5. Annual ADF based on applying observed 1.3 average ratio of max month to annual ADFs from Table 3.2-3 to max month ADF.

3.4 CURRENT INFLUENT LOADING

The WNRWF regularly monitors influent wastewater characteristics. For this study, the monthly averages from 2005-2008 were analyzed. The average and maximum monthly concentrations are summarized in Table 3.4-1. Table 3.4-2 shows the associated monthly loading rates.

Table 3.4-1: Current WNRWF Wastewater Influent Characteristics

Parameter	Average Month Concentration (mg/L)	Max Month Concentration(3) (mg/L)
BOD5	255	332
TSS(1)	255	332
TKN	52	68
NH3-N(2)	30	40
Org-N(2)	24	31

Notes:
1. Data adjusted to closer reflect expected values. Original data suspected to be low, perhaps due to settling of samples.
2. NH_3-N and Org-N concentrations based on data from 2007-2008.

3. Due to incomplete data set, the maximum month concentration is based on a 1.3:1 maximum to average ratio (Metcalf & Eddy, Figure 3-8, 4th Edition).
4. Max month concentrations are shown at average monthly flow, but maximum month can occur at any flowrate.

Table 3.4-2: Current WNRWF Influent Loading

Parameter	Average Monthly Loading (lbs/mo)	Max Month Loading (lbs/mo)
BOD_5	3,100	4,000
TSS	3,100	4,000
TKN	660	820
NH3-N	360	480
Org-N	290	380

Notes:
1. Loading values based on observed values from 2005 to 2008.

3.5 PROJECTED INFLUENT LOADING

It is assumed that the current wastewater strength will not change dramatically. Based on this assumption, the projected influent loading is based on the current influent concentrations at the projected flows, as shown in Table 3.5-1.

Table 3.5-1: Projected Influent Loading

Design Period	BOD_5 (lbs/d)		TSS (lbs/d)		TKN (lbs/d)		NH3-N (lbs/d)		Org-N (lbs/d)	
	Avg.	Max.	Avg.	Max.	Avg.	Max.	Avg.	Max.	Avg.	Max.
Current(1)	4,000	5,200	4,000	5,200	820	1,100	480	620	380	490
Permitted Capacity	6,600	8,600	1,400	1,800	1,400	1,800	790	1,000	630	800
2030 Projected	9,400	12,000	9,400	12,000	1,900	2,500	1,100	1,500	900	190
Ultimate Flow	15,000	20,000	15,000	20,000	3,100	4,100	1,800	2,400	1,500	260

Notes:
1. Loading values based on concentrations shown in Table 3.4-1 and the max month ADF of 1.9 mgd.

3.6 CURRENT EFFLUENT PERFORMANCE

The operators at the WNRWF have been able to meet the DNREC-permitted discharge limits by a wide margin. The facility is required to submit monthly Spray Effluent Monitoring Reports in order to demonstrate record of discharge limit compliance. Data was provided by the County for 2005 through 2008. A summary of the average values

reported over this four-year period is presented in Table 3.6-1. Figure 3.6-1 shows the seasonal BOD_5 and TSS effluent performance as a plot. Complete performance data are provided in Appendix B.

Table 3.6-1: Comparison of Actual Effluent Performance to Permit Limits

Parameter	Permit Limit	Current Value(1)
BOD_5	50 mg/L Daily Average	14.8 mg/L
TSS	90 mg/L Daily Average	17.0 mg/L
pH	5.0 Minimum	8.0
	9.0 Maximum	

Notes:
1. Data provided by the SCED. Average of monthly averages from 2005-2008.

Table 3.6-2: Current Effluent Performance

Year	BOD_5 (mg/L)	TSS (mg/L)	TN (mg/L)	TP (mg/L)
2005	Not Available	Not Available	20.3	Not Available
2006	15.7	21.8	18.8	5.8
2007	13.3	13.7	20.7	7.0
2008	15.5	15.5	19.0	7.2
Average	14.8	17.0	19.9	6.6
Percent Removal(2)	94%	93%	75%(3)	5%(4)

Notes:
1. Data provided by the SCED. Average of monthly averages.
2. Percent removal based on influent concentrations listed in Table 3.4-2.
3. Total Nitrogen removal based on assumed influent TN as influent TKN multiplied by 3/2.
4. Phosphorus removal based on assumed TP influent concentration of 7 mg/ L for medium strength wastewater (Metcalf & Eddy, Figure 3-8, 4th Edition).

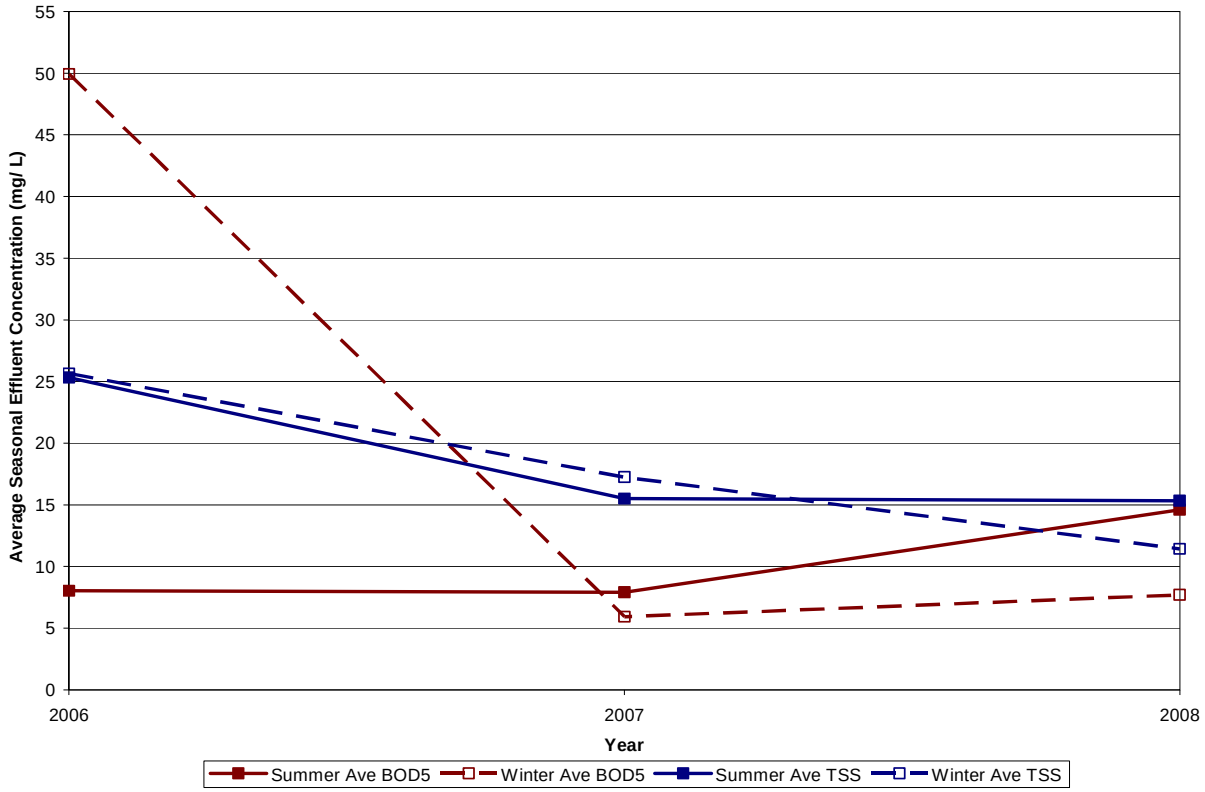


Figure 3.6-1: Seasonal BOD_5 and TSS Effluent Performance (2006-2008)

While always under permit limits, the effluent performance of the WNRWF varied over the period of study. Both BOD_5 and TSS initially had better performance during summer. During 2007, the effluent discharge of these pollutants began to be lower during winter, and remained that way through 2008.

To meet its spray irrigation requirements, the facility cannot exceed 396 lbs/ ac/ year of total nitrogen. The WNRWF has consistently met these requirements. A summary of this information is presented in Table 3.6-3; seasonal effluent concentrations are shown in Figure 3.6-2. Complete effluent nitrogen data are available in Appendix B.

Table 3.6-3: Effluent Nitrogen Performance

Year	TN (lbs/ac/yr)
2005	290
2006	240
2007	290
2008	260
Average	270

Notes:
1. Data provided by the SCED. Loading rates based on effluent loadings divided by the acres in service.

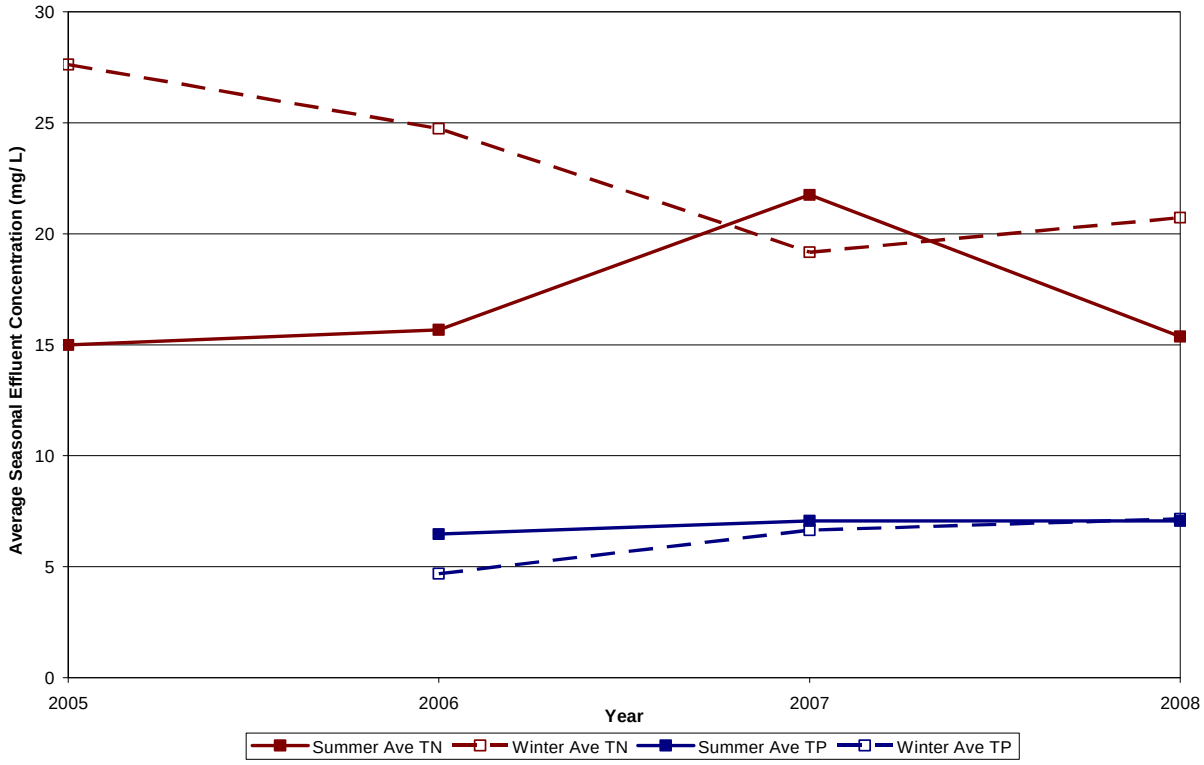


Figure 3.6-2: Seasonal TN and TP Effluent Performance (2005 – 2008)

As with BOD_5 and TSS, the TN performance varied throughout the period of study. Like BOD_5, the TN effluent is higher during the beginning of the period of study compared to 2008. The effluent TP concentration remained relatively constant from 2005-2008, with little seasonal variation.

3.7 PROJECTED EFFLUENT PERFORMANCE

To estimate future performance, it was assumed that effluent concentrations of BOD_5, TSS, and TN increase in proportion to flow. This approximately translates into doubling the current effluent concentrations since the current annual average daily flow of 1.5 mgd is approximately 50% of the permitted capacity of 3.1 mgd. Future TP effluent concentrations were increased to 7 mg/L because performance is expected to decrease, but the effluent concentrations cannot exceed influent concentrations. Development of these calculations is further discussed in Chapter 7.

Table 3.7-2: WNWRF Projected Effluent Performance

Design Period	Flow	Total Nitrogen		Total Phosphorus		BOD_5		TSS	
	Annual ADF (mgd)	Conc. (mg/L)	Annual Loading (lbs/yr)	Conc. (mg/L)	Annual Loading (lbs/yr)	Conc. (mg/L)	Annual Loading (lbs/yr)	Conc. (mg/L)	Annual Loading (lbs/yr)
Current	1.5	20.0	91,000	6.6	30,000	15.0	68,00	17.0	78,000
Permitted Capacity	3.1	41.0	390,000	7.0	66,000	31.0	330,000	35.0	330,000

Notes:

1. Projected concentrations are based on a 2.1:1 ratio. This ratio was derived by assuming a linear relationship between performance and flow.

4. WASTEWATER TREATMENT AND DISPOSAL ALTERNATIVES

4.1 INTRODUCTION

There are four possible options being considered by the County to handle the wastewater in the NCPA and from the City of Rehoboth Beach. The possible solutions can be grouped into four general treatment and disposal alternatives:

- **Alternative 1:** The RBSTP shuts down and sends all of its raw wastewater to the WNRWF, which will treat as much wastewater as possible and send the excess to another facility to be treated. The excess wastewater will be treated by the County owned and operated Inland Bays Regional Wastewater Facility (IBRWF).

- **Alternative 2**: The RBSTP remains in service and sends its treated effluent to the WNRWF for disposal via spray irrigation. A reduced amount of WNRWF influent wastewater from its service area will continue to be treated at that facility, with all excess being sent to either the IBRWF or a private contractor for treatment and disposal.

- **Alternative 3**: The RBSTP remains in service and discharges treated effluent via an ocean outfall. In this scenario, the County will continue treating and disposing wastewater via land application at its existing facilities. The WNRWF will remain in service and continue treating and disposing wastewater from its service area. Any excess flow to the WNRWF above the capacity of the facility will be sent to the IBRWF for treatment and disposal.

- **Alternative 4**: The RBSTP remains in service and discharges treated effluent via an ocean outfall. The County continues to treat wastewater via land application at the WNRWF. The WNRWF will expand and upgrade its treatment capacity.

Treated wastewater that exceeds the WNRWF disposal capacity will be pumped to the Rehoboth ocean outfall for disposal.

4.2 PRIVATE WASTEWATER TREATMENT PROVIDER

In addition to the four previous alternatives, the County has received a proposal from a Private Wastewater Provider (PWWP) to convey wastewater in excess of the available capacity at the County's WNRWF to a privately owned location for treatment and disposal.

Figure 4.2.1 details the infrastructure proposed by the PWWP to convey excess wastewater from the WNRWF to the privately owned location. A transfer pumping station will be required at the WNRWF to accept flow in excess of the plant's capacity. This pumping station will pump through a 24-inch force main, approximately 82,000 LF to the treatment and disposal lands. The PWWP has proposed a booster pumping station at the intersection of Coastal Highway and Cave Neck Road in order to accept flow from outside the County's planning area. This pump station has been removed from this evaluation since this station would provide capacity for flows not being contributed by the County. The use of a PWWP only impacts Alternatives 1 and 2.

4.3 ALTERNATIVE 1

In Alternative 1, the RBSTP is taken out-of-service and all raw wastewater currently conveyed to that treatment plant is pumped directly to the WNRWF by a new Rehoboth Beach Wastewater Pumping Station (RBWWPS). The raw wastewater would enter a new WNRWF headworks where it will mix with influent wastewater from the Wolfe Neck Service Area. Because the mixed influent will exceed the treatment and disposal capacity of the WNRWF, the total influent wastewater will be split between being treated at this facility and being sent elsewhere via the proposed

Wolfe Neck Transfer Pump Station (WNTPS). Figure 4.3-1 is a schematic showing how the influent wastewater would be transferred between the RBSTP, WNRWF, and third treatment facility.

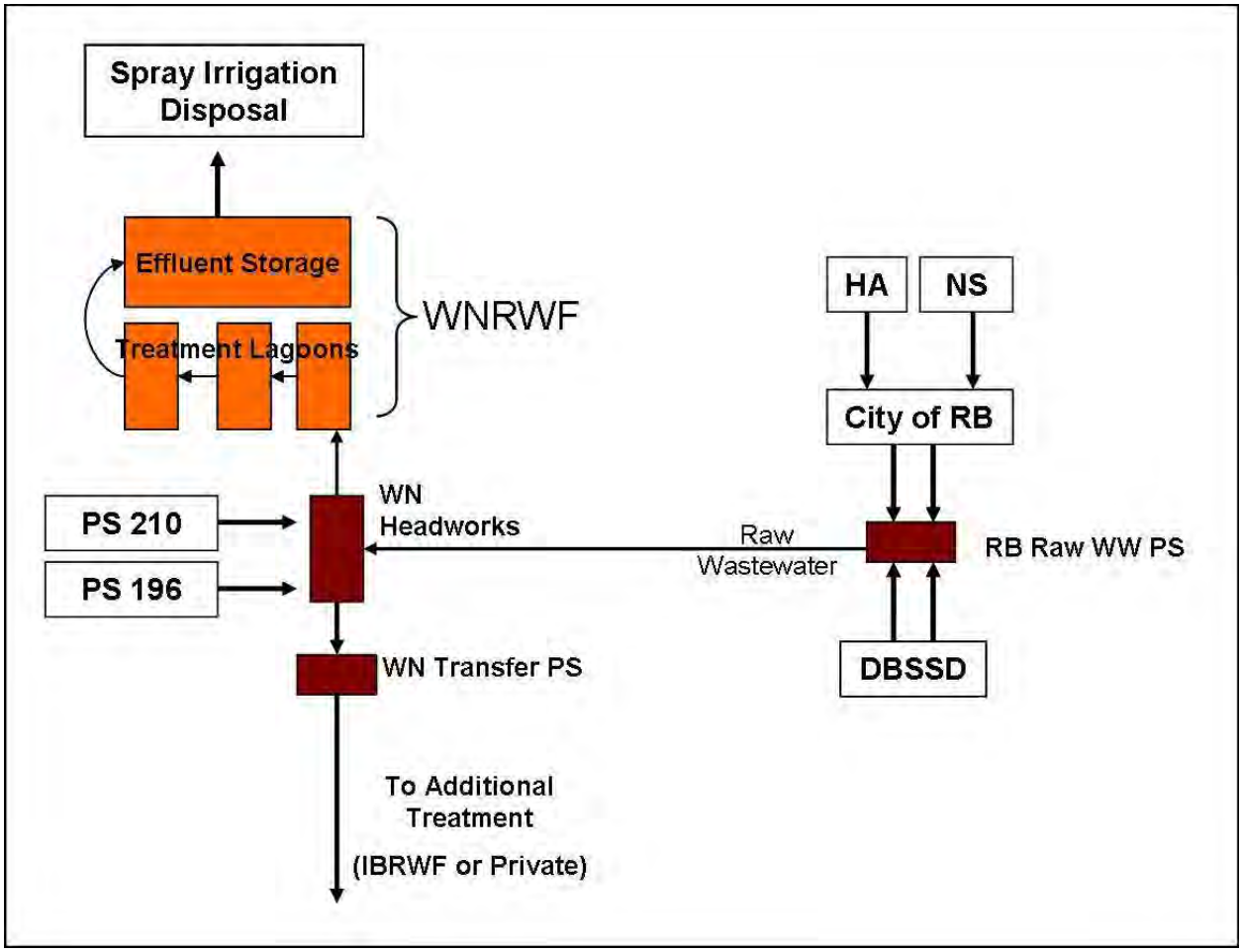


Figure 4.3-1: Alternative 1 Wastewater Flow Schematic

The excess wastewater will be sent either to the IBRWF for treatment and disposal. Figure 4.3-2 is the flow distribution diagrams for Alterative 1A. The flow rates given in these figures will be discussed in Chapter 7 of this report.

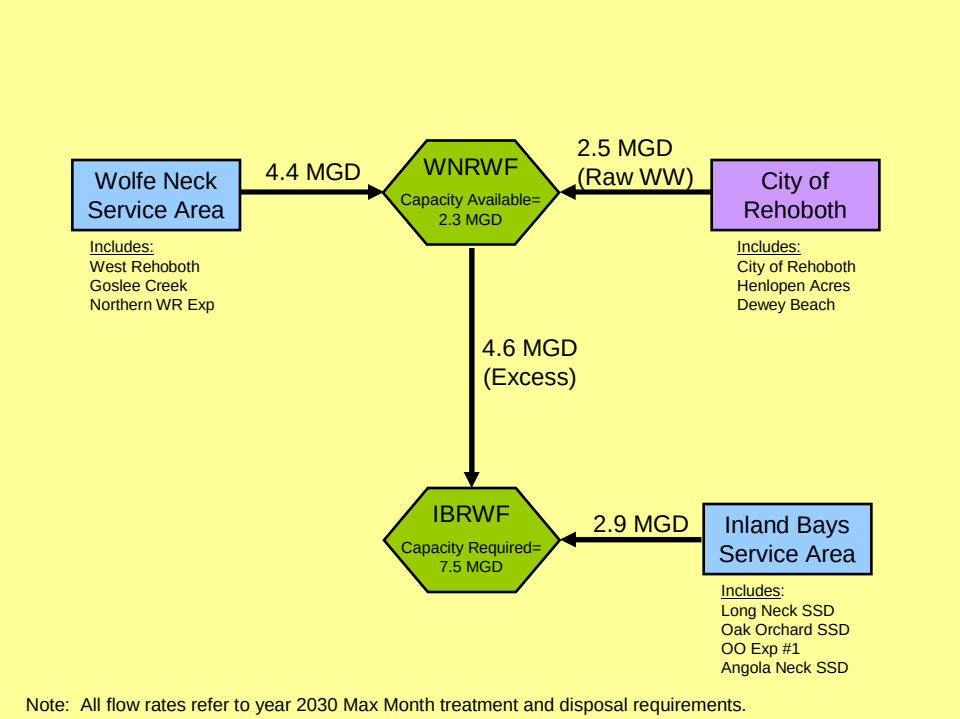


Figure 4.3-2: Alternative 1A NCPA Flow Distribution Diagram

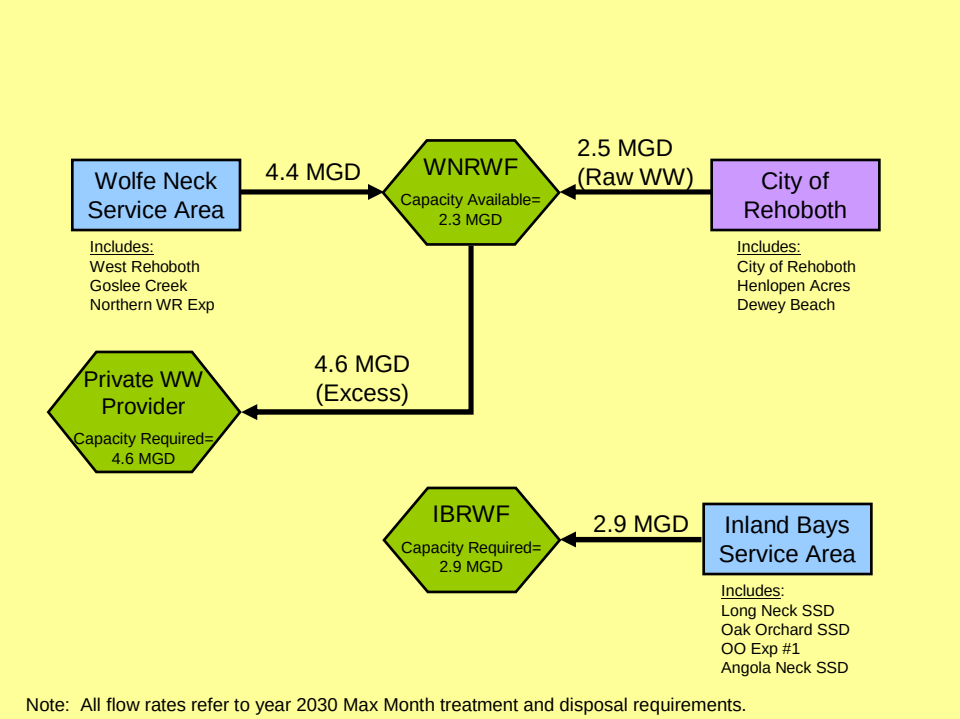


Figure 4.3-3: Alternative 1B NCPA Flow Distribution Diagram

If Alternative 1A is selected and excess wastewater is sent to the IBRWF for treatment and disposal, the treatment and disposal capacities at this facility will need to be expanded accordingly. This concept is discussed further in Chapter 9.

4.4 ALTERNATIVE 2

In Alternative 2, the RBSTP would continue to operate and achieve biological nutrient removal. Treated effluent from the RBSTP would be pumped by a new effluent pumping station and sent directly to the WNRWF treated effluent storage lagoon for spray irrigation disposal. A portion of the influent flow from the Wolfe Neck Service Area would continue to be treated in the existing WNRWF treatment lagoons and disposed of on-site along with the treated effluent from the RBSTP, while the balance of the raw wastewater from West Rehoboth would be transferred to either the IBRWF or a private contractor for treatment and disposal. Figure 4.4-1 is a schematic showing how the influent wastewater would be transferred between the RBSTP, WNRWF, and a third treatment facility.

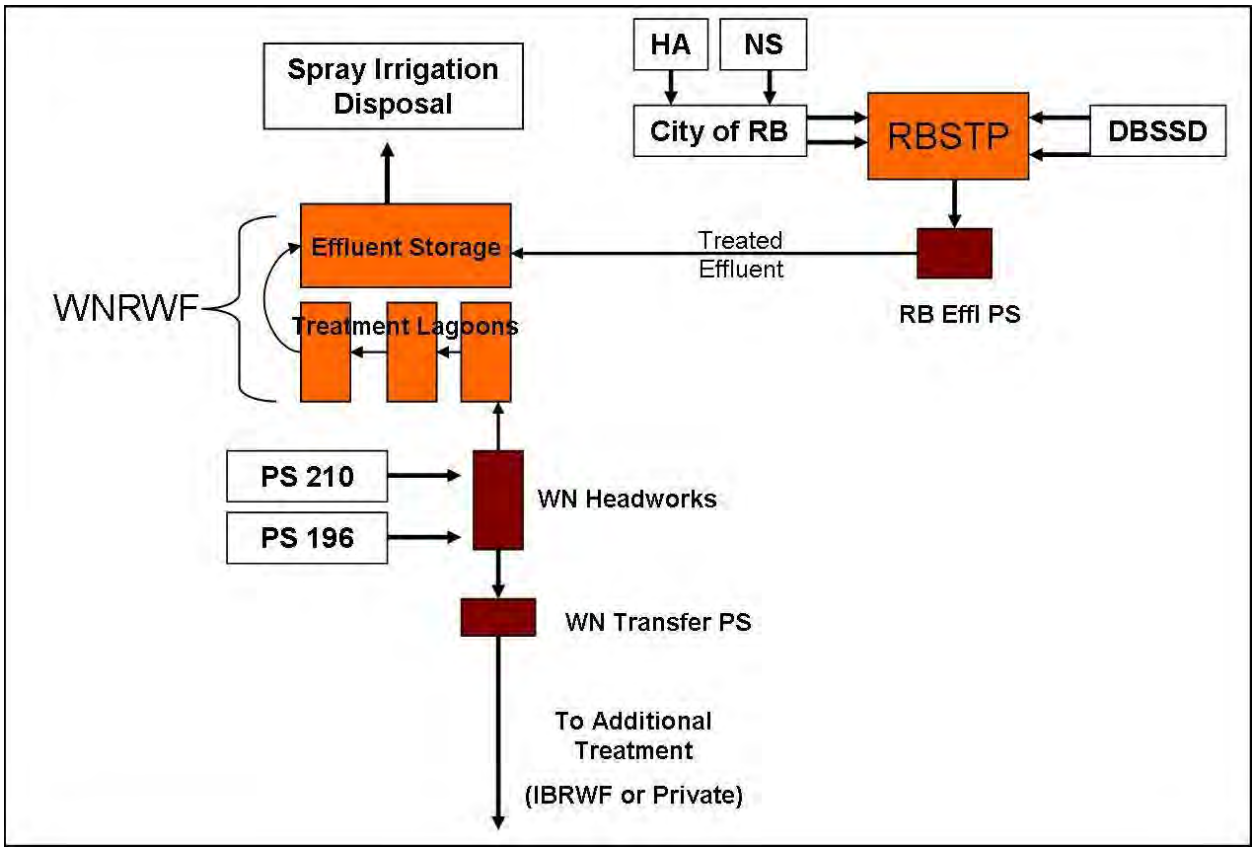


Figure 4.4-1: Alternative 2 Wastewater Flow Schematic

Figures 4.4-2 and 4.4-3 are flow distribution diagrams of Alterative 1A and 1B. The flow rates given in these figures will be discussed in Chapter 7 of this report.

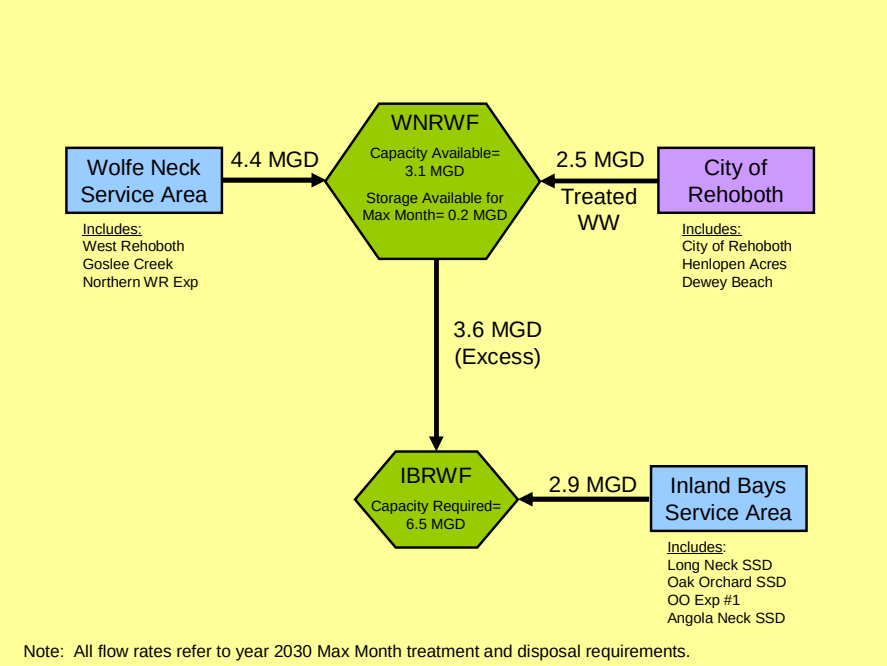


Figure 4.4-2: Alternative 2A NCPA Flow Distribution Diagram

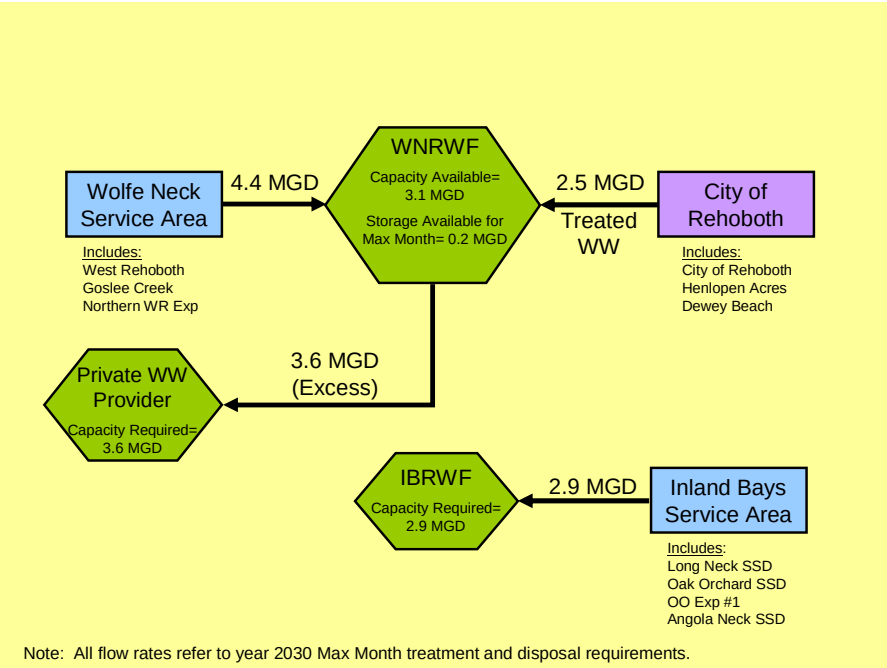


Figure 4.4-3: Alternative 2B NCPA Flow Distribution Diagram

Similar to Alternative 1A the IBRWF will need to be expanded if Alternative 2A is selected. This concept is discussed further in Chapter 9.

4.5 Alternative 3

In Alternative 3, the Rehoboth Beach would find its own solution for effluent discharge independent of the County. This solution would likely be an ocean outfall. Sussex County would then manage the NCPA wastewater at the WNRWF and IBRWF.

It is projected that in the future the influent wastewater from the Wolfe Neck service area will exceed the WNRWF treatment and disposal capacity and additional capacity will be required elsewhere. The IBRWF will likely provide the additional capacity required by the WNRWF and a private contractor option will no longer be necessary. Similar to Alternative 1, influent wastewater would enter into a new headworks at the WNRWF and be separated by what the WNRWF can treat and what will need to be sent to IBRWF. Wastewater to IBRWF will be transferred via the WNTPS. Figure 4.5-1 is a flow schematic of the wastewater treated by the WNRWF and the IBRWF. Figures 4.5-2 is a flow distribution diagram of Alterative 3. The flow rates given in Figure 4.5-2 will be discussed in Chapter 9 of this report.

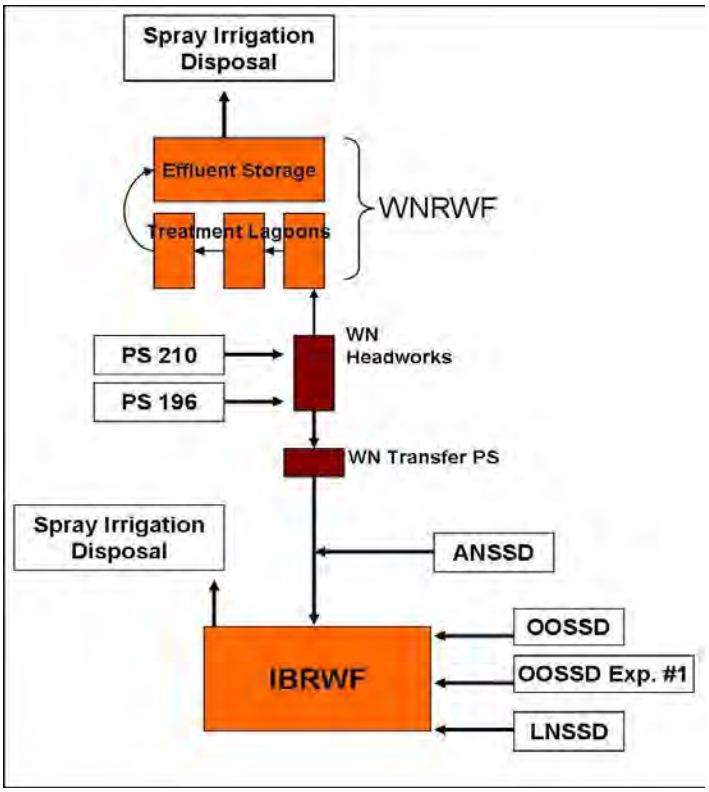


Figure 4.5-1: Alternative 3 Wastewater Flow Schematic

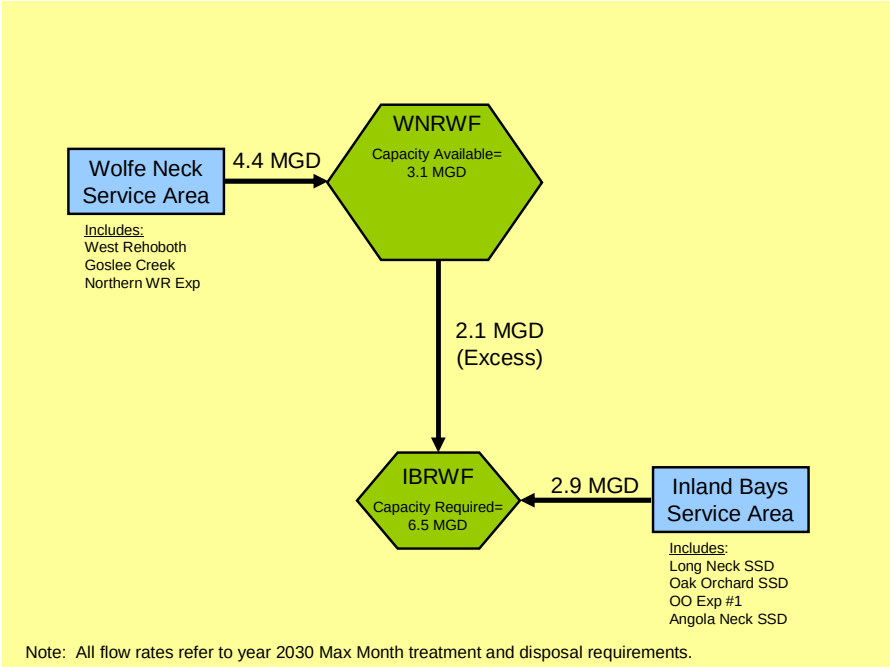


Figure 4.5-2: Alternative 3 NCPA Flow Distribution Diagram

4.6 Alternative 4

In Alternative 4, the RBSTP would continue to operate and achieve biological nutrient removal. Treated effluent from the RBSTP would be pumped by a new effluent pumping station and sent to an ocean outfall for disposal. A portion of the influent flow from the Wolfe Neck Service Area would continue to be treated in the existing WNRWF treatment lagoons and disposed of on-site. The balance of the raw wastewater from West Rehoboth would be treated through an independent treatment train designed to achieve biological nutrient removal. Figure 4.6-1 is a schematic showing how the influent wastewater would be transferred between the RBSTP, WNRWF, and the combined ocean outfall..

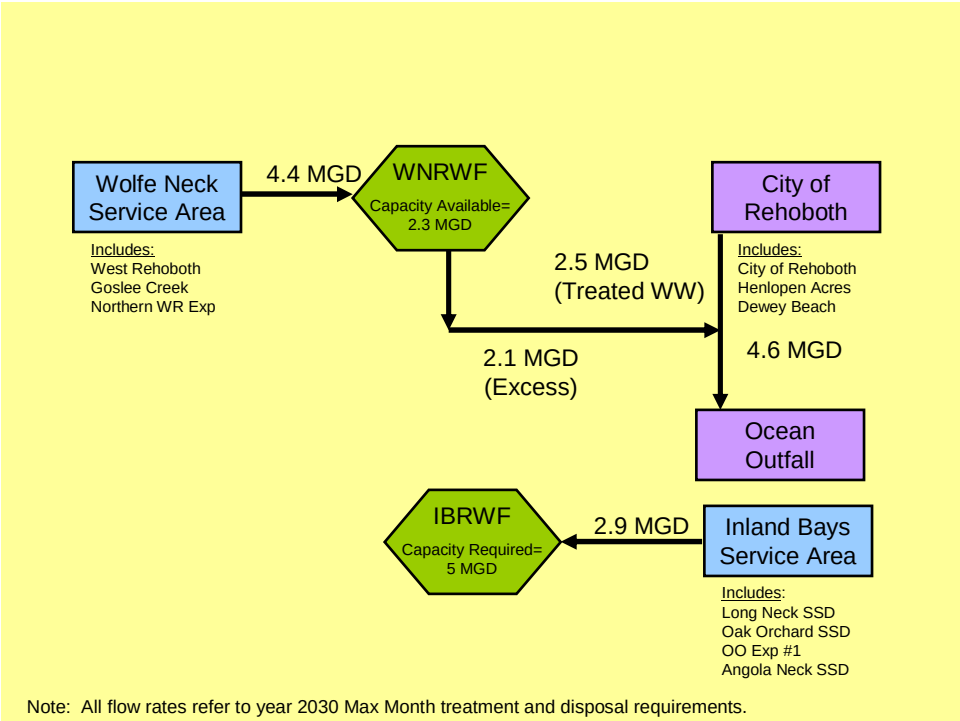


Figure 4.6-1: Alternative 4 NCPA Flow Distribution Diagram

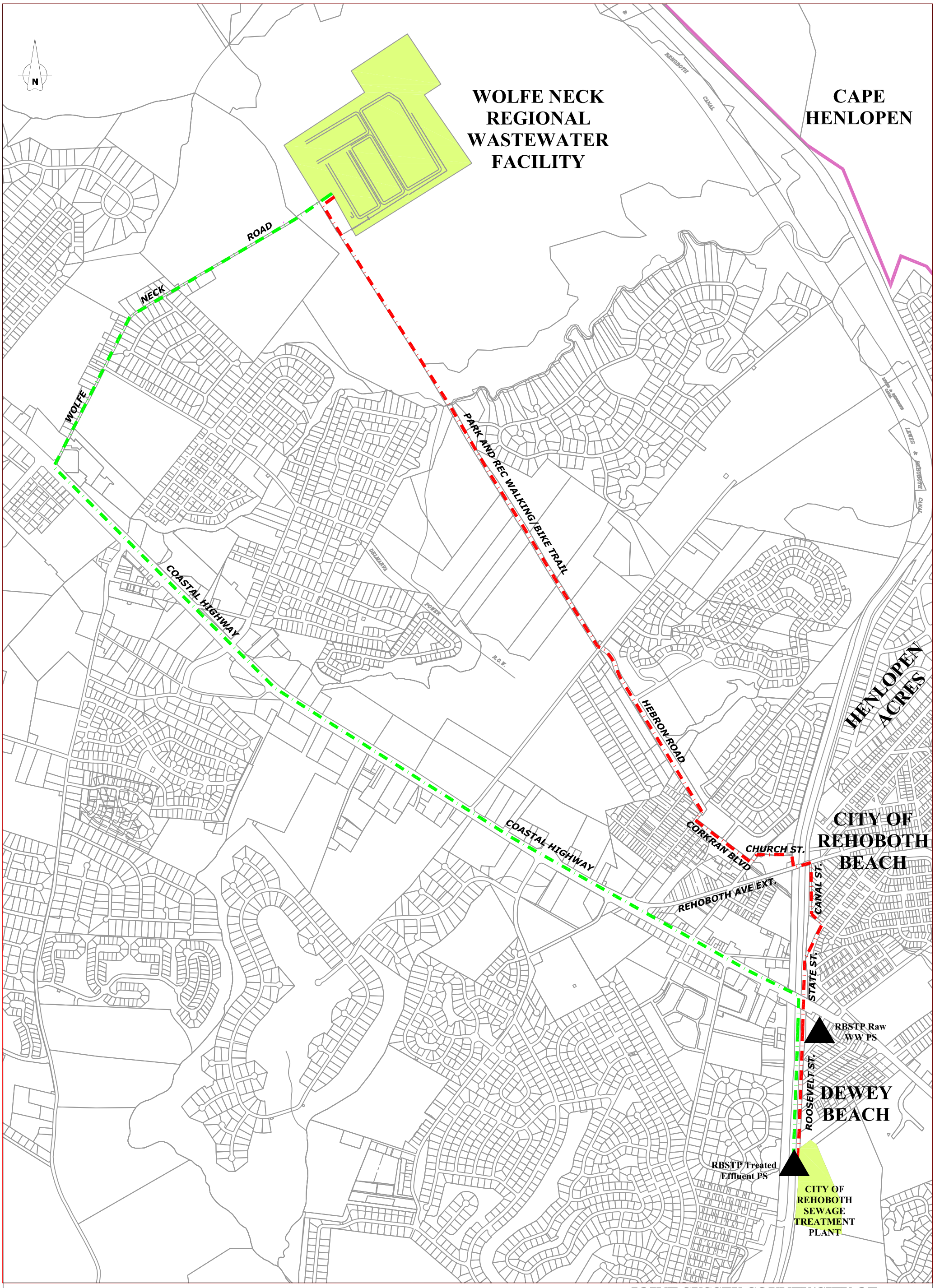
5. REHOBOTH BEACH CONVEYANCE SYSTEM

Of the four base alternatives (Alt. 1, 2, 3, &4) outlined in Chapter 5 for Rehoboth, Alternatives 1 and 2 will require conveyance of wastewater from the RBSTP to the WNRWF. This chapter presents the options and associated costs for conveying wastewater from the RBSTP to the WNRWF for Alternatives 1 (raw wastewater) and 2 (treated effluent). Per the Rehoboth Beach Alternative Discharge Evaluation, the required design flowrate for both alternatives is 10.2 mgd, which is the peak instantaneous design rate associated with the 3.4 mgd ultimate design of the RBSTP.

5.1 ALTERNATIVE 1: RAW WASTEWATER CONVEYANCE

In Alternative 1, the RBSTP will be taken out of service and a new pumping station will be constructed to collect raw wastewater from the City of Rehoboth Beach, the Dewey Beach SSD and the Henlopen Acres SSD and pump to the Wolfe Neck Regional Wastewater Facility. The location of this proposed station along with two potential force main alignments, has been indentified and are shown on Figure 5.1-1.

The force main alignment Option #1 involves the construction of approximately 16,200 lf of 30-inch force main from the proposed raw wastewater pumping station location, north along State Street and Canal Street to Rehoboth Avenue (SR 1A), where the force main will be installed underneath the Rehoboth Canal to Church Street. From this point the force main will be installed north and west along Church Street to Corkran Boulevard, northwest along Corkran Boulevard to Hebron Road and northwest along Hebron Road to the intersection of Holland Glade Road. The remaining portion of the force main will be installed in an easement along the Park and Recreational Walk/Bike Trial to Wolfe Neck Road, and then north and east along Wolfe Neck Road to the WNRWF headworks.



Whitman, Requardt & Associates LLP

in association with

STEARNS & WHELER LLC
Environmental Engineers and Scientists

LEGEND

- Alignment Option #1
- Alignment Option #2

JOINT SUSSEX COUNTY/CITY OF REHOBOTH BEACH LAND APPLICATION PROJECT

SUSSEX COUNTY, DELAWARE

Figure 5-1.1
October 2009

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Force main alignment Option #2 involves installing approximately 21,000 lf of 30-inch force main northwest along Coastal Highway (SR 1) to Wolfe Neck Road, and northeast along Wolfe Neck Road to the WNRWF headworks.

5.2 ALTERNATIVE 2: TREATED EFFLUENT CONVEYANCE

In Alternative 2, the RBSTP will remain in service and a new effluent pumping station would be constructed on or near the RBSTP site, as indicated in the previous Figure 5.1-1, to convey treated effluent to the WNRWF. From the Rehoboth Beach Alternative Discharge Evaluation, the design concept for this station would involve the retrofit of an existing reparation basin at the RBSTP and the installation of vertical turbine pumps to draw treated effluent from the RBSTP. This configuration would decrease the cost for the pump station as compared to Alternative 1.

The same force main alignment options will be considered for this alternative, with the exception that 2,000 lf of additional force main would need to be installed from the RBSTP to Roosevelt St.

5.3 FORCE MAIN DESIGN CRITERIA

In accordance with Sussex County Design Standards, a Hazen-Williams "C-factor" of 140 is used for all hydraulic computations for new PVC force main, with a target design force main velocity of 3 to 5 feet per second (ft/s). Table 5.3-1 is a summary of the hydraulic calculations for both alignment options under each treatment alternative.

Table 5.3-1 Summary of Force Main Hydraulic Information

				Alignment Option #1-Utility Easements		Alignment Option #2-Coastal Highway	
	Peak Q	FM size	Velocity	Length	Total Dynamic Head (1)	Length	Total Dynamic Head (1)
Treatment Alternative	(MGD)	(in.)	(ft/s)	(ft)	(ft)	(ft)	(ft)
#1 - Raw Wastewater	10.20	30	3.6	16,200	76	21,000	82
#2 - Treated Effluent	10.20	30	3.6	18,200	78	23,000	84

Notes:
1) 45 feet of static head was assumed along with 8' of minor losses were included in the calculation for Total Dynamic Head.

5.4 PRELIMINARY COST ESTIMATES

For Alternative 1, a new pump station would be constructed to intercept all flows entering the treatment plant. The station would be designed as a three pump station, with two pumps operating and one back-up pump. Based on the hydraulic conditions in Table 5.3.1, pumps in the 100-150 HP range are anticipated. This station would be a stand alone pump station similar to other large Sussex County regional pump stations such as Beaver Dam (PS#293), Ocean View (PS#99), or Rehoboth (PS#210). Construction would involve a cast-in-place concrete wetwell, with associated items such as an external valve vault, backup generator, and a control building to house the electrical equipment. Costs for the Alternative 1 pump station are based on bid costs for similarly sized County stations. The pump station cost for Alternative 2 is per the Rehoboth Beach Alternative Discharge Evaluation.

Cost estimates for the proposed force mains for each treatment alternative and each alignment option are presented in Appendix D. Table 5.4-1 provides a cost summary for both the pump stations and force main alignments for each Alternative. The total project costs for each alternative are one component of the cost sharing model as further described in Chapter 10.

Table 5.4-1 Summary of Rehoboth to WNRWF Conveyance Costs

Treatment Alternative	Alignment Option	Estimated FM Cost	Estimated PS Cost	Estimated Total Project Cost (1.)
Alternative #1 (Raw WW from New Pumping Station Location)	Option #1 (Park and Rec Easement)	$4,191,000	$4,039,000	$8,230,000
	Option #2 (Coastal Highway)	$7,247,000	$4,039,000	$11,286,000
Alternative #2 (Treated Effluent Pumped from RBSTP)	Option #1 (Park and Rec Easement)	$4,684,000	$1,208,000	$5,892,000
	Option #2 (Coastal Highway)	$7,766,000	$1,208,000	$8,974,000

Note:
1. Costs include 10% construction contingency and 22% project costs.

Table 5.4-2 provides a summary of the force main alignment options for both Conveyance Option 1 and Option 2. Based on the costs presented above for the FM, along with the added difficulty of construction along Coastal Highway, Alignment Option #1 through the Park and Recreational Walk/Bike Trail would be the preferred Option for either Alternative.

Table 5.4-2 Summary of Force Main Alignment Options

Description	Option #1 Utility Easement	Option #2 Coastal Highway
Details		
Total length	Option 1 - 16,200 feet Option 2 – 18,200 feet	Option 1 - 21,000 feet Option 2 – 23,000 feet
Size	30 inch	30 inch
Pavement restoration length	Option 1 - 4,000 feet Option 2 – 5,000 feet	Option 1 – 17,750 feet Option. 2 – 18,750 feet
Environmental Considerations	Rehoboth Canal Crossing	Rehoboth Canal Crossing
Crossings		
Major Water Crossings	1) Rehoboth Canal	1) Rehoboth Canal
Minor Stream Crossings	1	0
Construction		
Major Highway Installation	0	14,500
County Road Installation	10,000	8,500
Installation Ranking	**1**	**2**
Easements		
Temporary Easements	Yes	Yes
Permanent easements	Yes	Yes

Notes:

1) Major Highway Installation refers to installation along Coastal Highway, County Road Installation refers to installation along all other County Roads.
2) Pavement restoration length was obtained assuming 100% restoration in Major Highways and 50% restoration elsewhere.

6. SPRAY IRRIGATION DISPOSAL ANALYSIS

6.1 WOLFE NECK REGIONAL WASTEWATER FACILITY

The Wolfe Neck Regional Wastewater Facilities (WNRWF) began operating in the mid 1990s. It has five circular spray irrigation fields, which have a combined size of 319 acres. Field No. 1 is 165 acres; No. 2 is 66 acres; No. 3 is 46 acres; No. 4 is 25 acres; and No. 5 is 17 acres. Sussex County has a permit from DNREC, which requires that the average quantity of effluent discharged to the spray fields not exceed 3.1 million gallons/day (mgd) in any calendar month. The maximum permitted application rates are as follows: 2.6 inches/week in June and September; 2.75 inches/week in July and August; and 2.5 inches/week in October through May. Other permit conditions include a 24-hour rest period between spraying events, a prohibition on spraying when there is rain, snowfall, or freezing or saturated ground; and ground water mounds must be 2 feet or greater below the land surface.

Effluent data provided by the Sussex County for the period January 2006 to September 2008 indicates that they have sprayed a monthly average of 1.4 mgd to 2.7 mgd; and a peak day of 2.2 to 4.7 mgd. There are several possible reasons why less than the permitted monthly average of 3.1 mgd has been sprayed at the WNRWF. The first reason is that the effective area of the spray fields on a given day is less than the permitted 319 acres. The effective area has been estimated as 233 acres. Factors that tend to reduce the effective spray area include the farmer taking fields out of service for planting and harvesting; and the operators not spraying on fields when the ground conditions are freezing and the ground is saturated or ponded with water. The second reason is the reduced spraying days. The operating days per year are estimated as 268 days, i.e. less than a full year. The third reason is localized areas may be underlain by soils that may have been compacted by farming operations, or they may be naturally poorly draining soils. WR&A performed a disposal capacity analysis using a conservative (i.e. slow) infiltration rate based on field rates from the design development report for the WNRWF, assuming conservative estimates of 268 spraying days per year, and an effective area of 233 acres. The result of that analysis is a capacity estimate of 1.0

mgd for the spray fields. Assuming less conservative values for parameters leads to a higher capacity estimate. For example, a 3.1 mgd estimate can also be arrived at by selecting higher field-measured values from the design development report infiltration tests. A program consisting of plowing areas with compacted soils, and changes in farming practices, and increased storage for effluent, might lead to a 3.1 mgd monthly disposal at the existing fields. However, for planning purposes, a disposal rate of 2.3 mgd, which is closer to the actual recent disposal of 2.0 mgd, appears more realistic than the permitted 3.1 mgd.

6.2 INLAND BAYS REGIONAL WASTEWATER FACILITY

The Inland Bays Regional Wastewater Facilities (IBRWF) began operating in 1992. It has two, 103.9-acre circular spray irrigation fields which are designated the north and south fields. The County's spray irrigation permit requires that the average quantity of effluent discharged to the spray fields not exceed 1.5 million gallons per day in any calendar month. The maximum permitted application rate is 1.86 inches/week. The County sprayed an average of 0.5 to 1.45 million gallons per day (mgd), with peak days ranging from 0.65 to 1.6 mgd, in the period January 2006 through September 2008. Sussex County has purchased land surrounding the IBRWF, and it plans to expand the spray irrigation fields in phases. Table 6.2-1 provides capacity estimates for properties currently owned by Sussex County.

Table 6.2-1 IBRWF Capacity Estimates (4)

Category	Parcel Number (TM 2-34-22)	Site	Spray Fields (acres) (4)	Application Rate (inches/week)	Capacity (million gallons/day)
Existing	12	North field (1)	103.9	1.86	0.75
	13	South field (1)	103.9	1.86	0.75
Ex. Subtotal					***1.50***
Initial Exp. Areas	12	N. Burton(2)	52	1.5	0.30
	12	S. Burton(2)	47	1.0	0.18
	19	Hettie-Lingo(2)	54	2.0	0.43
	19	Hettie-Lingo(2)	81	1.0	0.31
	10	Townsend(2)	58	2.0	0.45
	10	Townsend(2)	56	2.5	0.55
	18	Cordrey Parcel (2)	192	2.0	1.49
Initial Exp Subtotal					***3.71***
Long Term Subtotal	(5)	Glatfelter Site (3)	1,000	2.0	***7.80***
Totals			**1,748**		**13.0**

Notes
(1) Capacity permitted by DNREC
(2) Capacity based on subsurface investigations and field-tested rates
(3) Capacity based on assumed rates, without subsurface investigations
(4) From Inland Bays Regional Wastewater Facility Design Development Report.
(5) Includes parcels 2-34-22-8, 2-34-21-145,148,149,150,151,152.02, and 2-34-28-1.

Hydrogeologic investigations have been performed on parcels 10, 12, and 19 on tax map number 2-34-22. Hydrogeologic or soil studies have not been performed at the Cordrey or Glatfelter sites. The estimates for these two expansion lands are based only on a desktop review of published maps.

6.3 IBRWF HYDROGEOLOGIC AND SOILS TESTING COSTS

A hydrogeologic study was completed in 2005 for approximately 650 acres associated with parcels 10, 12, and 19 at a cost of $235,000 or $360/acre. The total acreage for the Glatfelter and Cordrey parcels is approximately 1,195 and 250 respectively. Based on previous costs and adding a 15% factor for inflation and contingency would result in testing costs of approximately $500,000 for the Glatfelter parcel and $100,000 for the Cordery parcel.

7. WOLFE NECK REGIONAL WASTEWATER FACILITY IMPROVEMENTS

7.1 ALTERNATIVE 1 DISPOSAL CAPACITY

In Alternative 1 the proposed Rehoboth Beach Raw Wastewater Pumping Station (RBWWPS) will send raw wastewater to the WNRWF for treatment and disposal. All wastewater that exceeds the WNRWF treatment or disposal capacity will be pumped to the IBRWF or a PWWP for treatment and disposal. The raw wastewater from the RBWWPS would blend with the wastewater coming from Goslee Creek (GC) SSD and the WRESSD.

In Alternative 1, the limiting factor for effluent disposal is the total nitrogen limits. The WNRWF spray irrigation permit has two criteria for TN, the percolate concentration must be less than 10.0 mg/L and the total annual loading cannot exceed 396 lbs/ac/yr.

The average influent TN concentration for the WNRWF is 52 mg/L. The average influent TN concentration for wastewater pumped from the RBWWPS is not measured, but was estimated in Chapter 2 to be 40 mg/L. Because there is relatively little difference in these values, it is assumed that the blended influent TN concentration will not significantly change from the influent concentrations the WNRWF currently receives. Using this assumption, the future performance of the treatment lagoons at the WNRWF will be projected from current performance.

Currently, the WNWRF produces a final effluent TN concentration of 19.9 mg/ L at an annual influent flow of 1.5 mgd. At this flowrate, the plant is operating at approximately 50% of its 3.1 mgd design capacity. Assuming final effluent TN increases proportional to increase in flow, the effluent TN concentration was increased by a factor of two to project effluent performance of the existing lagoon treatment system. A linear projection

between these two points was compared to the maximum allowable TN concentrations at various flowrates to determine the operational limit. Figure 7.1-1 shows this comparison.

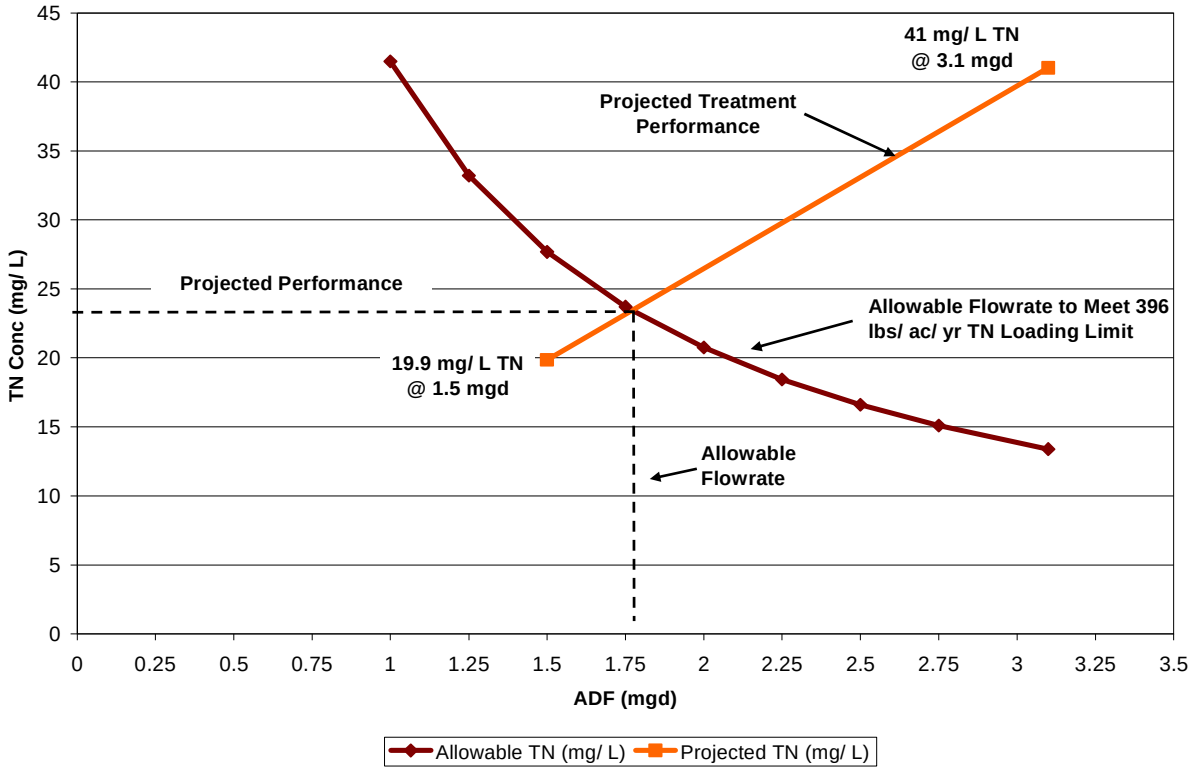

Figure 7.1-1: Alternative 1 Effluent Projection

Using this analysis, the projected performance and allowable flowrates intersect at a flowrate of 1.8 mgd. At this flowrate, the effluent TN concentration is approximately 23 mg/L. To adhere to the 396 lbs TN/ac/yr loading limit on 319 irrigated acres, the plant cannot exceed an annual average of 1.8 mgd to be discharged via spray irrigation.

The TN percolate concentration must also be calculated to verify 10.0 mg/L TN is not exceeded. Using the projected values of 23 mg/L TN and 1.8 mgd average daily flow, a nitrogen balance yielded an annual average percolate concentration of 6.3 mg/L with a maximum of 10.2 mg/L TN occurring in May. These values assume the current planting schedule of corn in summer and a winter cover crop of wheat is continued through 2030. The full nitrogen balance for the WNRWF is available in Appendix B.

Based on these two analyses, the WNRWF will be limited by annual TN loading. The maximum quantity of effluent spray irrigated cannot exceed 1.8 mgd on an annual average basis (2.3 mgd on a max month basis), even though the state spray application permit allows a hydraulic land application rate of up to 3.1 mgd as a maximum monthly average. Table 7.1-1 summarizes the performance characteristics of the WNRWF under Alternative 1.

Table 7.1-1: Alternative 1 Disposal Capacity Summary

Parameter	Value
Max Month ADF (mgd)	2.3
Summer ADF (mgd)	2.2
Winter ADF (mgd)	1.6
Annual ADF (mgd)	1.8
Effluent TN Conc. (mg/L)	23
Effluent TN Loading (lbs/ac/yr)	395

In order to spray apply more effluent in this alternative, the existing treatment lagoons would need to be replaced with a nitrogen removal process such as the activated sludge system being designed for the IBRWF. This upgrade would be quite costly and only result in the ability to marginally increase effluent disposal capacity from an annual ADF of 1.8 mgd to approximately 2.15 mgd as described in the next section.

7.2 ALTERNATIVE 2 DISPOSAL CAPACITY

In Alternative 2 the RBSTP will continue to operate. The treated effluent will be pumped directly into the WNRWF effluent storage lagoon to be discharged via spray irrigation. Because the treated effluent from RBSTP has a low TN concentration, both hydraulic loading and nutrient limits have to be considered.

In 2030, the RBSTP is expected to contribute a summer average of 2.3 mgd and a 0.93 mgd winter average. At this time, the entities contributing to the WNRWF are estimated to have seasonal averages of 4.2 mgd in summer and 3.1 mgd in the winter. Given the

increased flows and the land application permit hydraulic limit of 3.1 mgd as a monthly average, some combination of these flows will be treated at the WNRWF and the remaining wastewater will be sent to the IBRWF or a PWWP.

In the summer, the WNRWF will accept all of the treated effluent from the RBSTP directly into its storage lagoon to be land applied. The remaining 0.8 mgd of disposal capacity will be used for raw wastewater coming from Goslee Creek (GC) and the WRESSD, treated by the existing lagoons at the WNRWF. Any excess flow from these sewer districts will be sent to the IBRWF or a PTWP. Because the WNRWF has a large effluent storage lagoon, operations has the flexibility to potentially accept more wastewater in the summer from GC and the WRESSD as long as spray conditions allow and the effluent storage lagoon will be empty by the middle of fall (beginning of October).

Even though the summer averages are being used to define the operating schedule, the facility has to be able to accommodate maximum monthly flows in its storage lagoon. For the RBSTP in 2030, the maximum monthly flow is 2.5 mgd and the summer average is 2.3 mgd, a difference of 0.2 mgd. Over the span of a month (31 days assuming July is the maximum month), the total volumetric difference of treated effluent is 6.2 million gallons. The WNRWF historically has a 1.05 peaking factor; applied to the 0.8 mgd flow in 2030, the peak monthly flow would be 0.85 mgd. The total volumetric difference for the GC and WRESSD flows between an average month and maximum month is 1.5 million gallons. Together, the total excess volume of water for a maximum month is 7.7 million gallons. With a 69 MG capacity, the effluent storage lagoon will easily be capable of handling this extra volume. Figures 7.2-1 and 7.2-2 illustrate these calculations graphically.

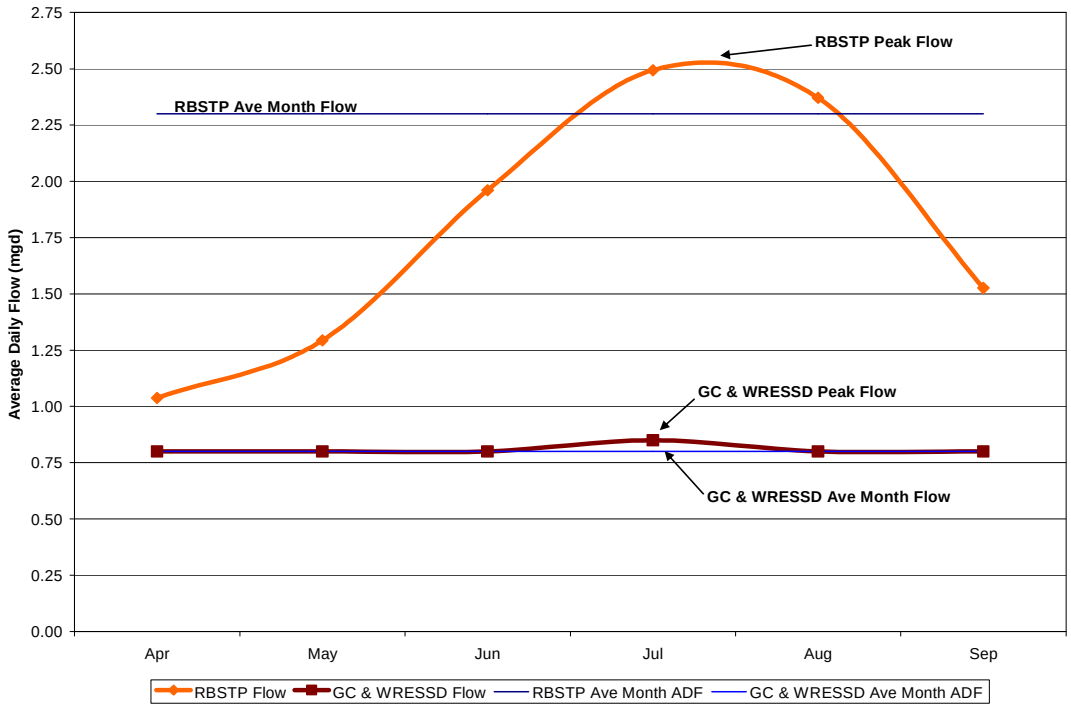

Figure 7.2-1: 2030 Summer Flows to WNRWF

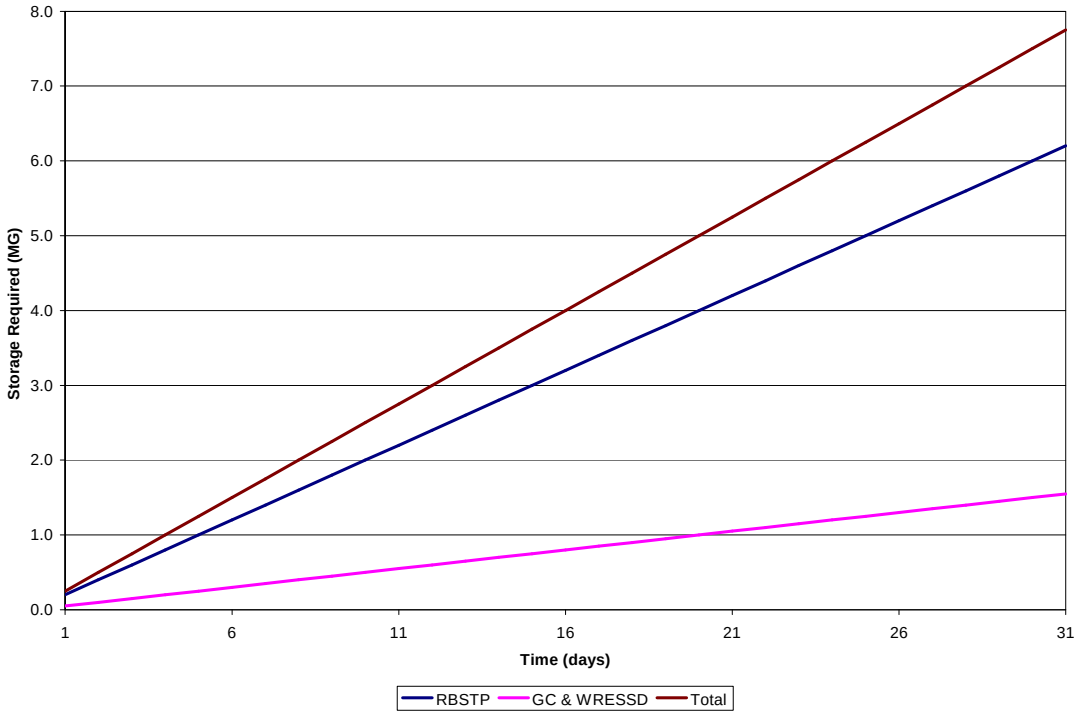

Figure 7.2-2: 2030 Alternative 2 Summer Storage Required

It is recommended that the WNRWF treat a constant monthly average of 0.8 mgd year-round, even though flows from RBSTP are lower in the winter months. Added to the expected 0.93 mgd from RBSTP, the total amount discharged in the winter will average approximately 1.73 mgd. This is approximately 30% more flow than is currently disposed of during the winter at the WNRWF based on 2005 to 2008 spray application data for the months of December through February. However, improvements currently being implemented to the WNWRF spray irrigation system will allow for increased spray coverage and, therefore, quantity during winter operation. The operators at the WNRWF were able to operate the spray irrigation system approximately 14.6 days per month during the winter from 2005 through 2008 compared to 24.2 days per month in the summer over the same period. If the facility can apply wastewater at the equivalent permitted spray rate of 3.1 mgd in the summer and the spray rate is proportionally reduced during the winter (14.2 days vs. 24.2 days, or 60%) disposal of up to 1.8 mgd should be possible in the winter after the irrigation rig optimization is completed. Deep plowing or other spray field improvements may also be required to maximize field disposal potential.

Maintaining a constant flowrate of 0.8 mgd is intended to keep plant operations relatively simple year round. Also, given the difficulty inherent to the spray application of wastewater in the winter, the reduced flowrate will provide a buffer if the fields cannot be sprayed for extended amounts of time due to unfavorable weather conditions. At an average daily flow rate of 1.73 mgd, the effluent storage lagoon can provide storage for just less than 40 days during the winter. WNWRF has recently converted the third treatment lagoon for winter storage. This adds approximately 28 MG of storage, which increases the total amount of storage to over 55 days.

Table 7.2-1 summarizes the seasonal treatment patterns for Alternative 2.

Table 7.2-1: 2030 Alternative 2 Disposal Capacity Summary

Facility	Max Month ADF (mgd)	Summer ADF (mgd)	Winter ADF (mgd)	Annual Average ADF (mgd)
RBSTP	2.5	2.3	0.93	1.35
WNRWF	0.8	0.8	0.8	0.8
Total	**3.3(1)**	**3.1**	**1.7**	**2.15**

Notes:
1. All flow in excess of 3.1 mgd, approximately 0.2 mgd, will be stored in the effluent storage lagoon to be discharged during a month with less flow.

Nitrogen loading also has to be considered in this scenario. The 396 lbs TN / ac/ yr loading limit translates into 126,000 lbs TN annually, assuming it is evenly spread across 319 acres. In 2030, the RBSTP is estimated to produce 24,700 lbs TN using the assumed values of 6.0 mg/L of TN and 1.35 mgd annual ADF. Because the amount of wastewater being treated at the WNRWF is decreasing to 0.8 mgd, effluent performance is expected to increase. Assuming a linear relationship between flowrate and performance (as in the Alternative 1 scenario), the estimated effluent TN concentration at an annual average daily flowrate of 0.8 mgd is 10.4 mg/ L. With this concentration and a 0.8 mgd flowrate, the total annual TN loading is estimated to be 25,300 lbs. The total annual TN loading for the facilities is 58,200 lbs, well under the allowable loading limit of 126,000 lbs TN. Table 7.2-2 summarizes these values.

Table 7.2-2: 2030 Alternative 2 Projected TN Loading

Treatment Facility	Annual Average Flow (mgd)	TN Concentration (mg/L)	TN Loading (lbs/yr)
RBSTP	1.35	8.0	33,000
WNWRF	0.8	10.4	25,300
Total	**2.15**	**8.9(1)**	**58,200**

Notes:
1. 8.9 mg/L TN concentration is a blended average of the effluent concentrations from RBSTP and WNRWF.

Using these performance values, the average TN percolate concentration was checked to make sure it did not exceed permissible limits. a nitrogen balance yielded an annual average percolate concentration of 1.4 mg/L with a maximum of 2.4 mg/L TN occurring

in May. This calculation takes into account the same assumptions for the WNRWF crop planting schedule. The full nitrogen balance for this scenario is provided in Appendix B.

In Alternative 2, the WNRWF disposal capacity is limited by a combination of hydraulic loading limits and effluent storage capacity. At an annual average of 2.15 mgd, it can spray apply more effluent than Alternative 1 by 0.35 mgd as an annual average. The maximum month capacity for Alternative 2 is 3.3 mgd compared to 2.3 mgd for Alternative 1.

7.3 ALTERNATIVE 3 DISPOSAL CAPACITY

In Alternative 3, the WNRWF will only treat influent wastewater from its existing service area, GCSSD and WRESSD. The RBSTP will continue to operate and discharge its treated effluent via an ocean outfall; no pump station conveying wastewater to the WNRWF, raw or treated, will be constructed. All wastewater that exceeds the WNRWF treatment or disposal capacity will be pumped to the IBRWF for treatment and disposal.

Similar to Alternative 1, the disposal capacity of the WNRWF is constrained by nutrient loading. Without treatment upgrades, the expected effluent performance is identical to that discussed in Section 7.1, an effluent TN concentration 23 mg/L at an annual average flow of 1.8 mgd. Table 7.4-1 summarizes the disposal capacities for the WNRWF under the Alternative 3 scenario.

Table 7.4-1: Alternative 3 Disposal Capacity Summary

Parameter	Value
Max Month ADF (mgd)	2.3
Summer ADF (mgd)	2.2
Winter ADF (mgd)	1.6
Annual ADF (mgd)	1.8
Effluent TN Conc. (mg/L)	23
Effluent TN Loading (lbs/ac/yr)	395

7.4 ALTERNATIVE 4 DISPOSAL CAPACITY

In Alternative 4, the WNRWF will only treat influent wastewater from its existing service area, GCSSD and WRESSD. The RBSTP will continue to operate and discharge its treated effluent via an ocean outfall; no pump station conveying wastewater to the WNRWF, raw or treated, will be constructed. The WNRWF will expand and upgrade its treatment capacity to accommodate the entire 2030 design influent wastewater flow of 4.4 mgd on a maximum monthly basis. Treated wastewater that exceeds the WNRWF disposal capacity will be pumped to the Rehoboth ocean outfall for disposal.

For this alternative, the current WNRWF treatment lagoons will continue to operate without improvements and treat up to 2.3 mgd on a maximum month basis. At this point, the disposal capacity will become nutrient limited. The year 2030 excess flow above 2.3 mgd, 2.1 mgd on a maximum month basis, will be treated separately through an independent treatment train designed to achieve biological nutrient removal. This treated wastewater will be pumped to the Rehoboth Beach ocean outfall. The treated effluent being disposed at the WNRWF site is identical to the Alternative 1 and 3 scenarios, and is summarized in Table 7.5-1.

Table 7.5-1: Alternative 3 Disposal Capacity Summary

Parameter	Value
Max Month ADF (mgd)	2.3
Summer ADF (mgd)	2.2
Winter ADF (mgd)	1.6
Annual ADF (mgd)	1.8
Effluent TN Conc. (mg/L)	23
Effluent TN Loading (lbs/ac/yr)	395

7.5 RECOMMENDED IMPROVEMENTS FOR ALTERNATIVE 1

Based on the projected influent flows, the WNRWF headworks will need to be upgraded. A two-phase approach is proposed. Phase 1 will be completed for the projected 2030

flows, and Phase 2 will have the capacity for the ultimate build out design. A summary of these flows and the corresponding pump stations is presented in Table 7.5-1.

Table 7.5-1: Alternative 1 Projected Influent Pumping to WNRWF

Entity	Year 2030 (mgd)(1)	Ultimate Design (mgd)(1)
Goslee Creek	0.6	6.5
Northern WRE Expansion	N/A	1.1
RBSTP	10.2	10.2
WRESSD	16.7	20.7
Total	**27.5**	**39.1**

Notes:
1. Pumping capacity given as peak capacity.

Phase 1 will increase the headworks capacity to handle the projected 2030 peak flowrate of 27.5 mgd. The upgrade will include a new headworks facility with two mechanical screens capable of handling the peak flowrate and a third parallel channel with an overflow weir and manual bar rack. The screens will discharge to a screw conveyor, which will bring the screenings to a compactor where the screenings will be washed and dewatered prior to discharge into a dumpster. Motorized gates will be used to isolate screenings channels for maintenance. All equipment will be enclosed in a heated block building for weather protection. Screened effluent will be routed to a new Transfer Pumping Station. A pipe from the Transfer Pumping Station will connect to a junction box to direct WNWRF influent to either treatment lagoon No. 1 or No. 2. The invert of the pipe to the junction box will be set above the normal water level in the pumping station so only flow in excess of the pumping set point will be directed to the treatment lagoons, as shown schematically in Figure 7.5-1. The new building will also contain an electrical room. A site plan of the proposed headworks and Transfer Pumping Station is shown in Figure 7.5-2

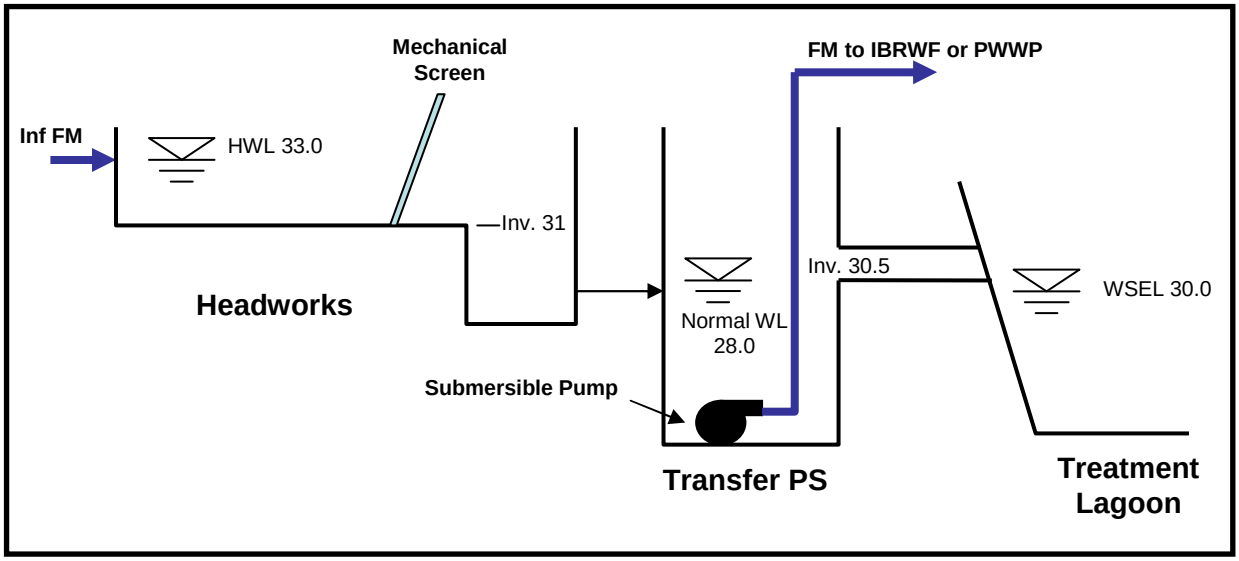

Figure 7.5-1: WNWRF Headworks and Transfer PS Flow Schematic

The Transfer Pump Station will send any flows above the WNRWF spray disposal capacity (2.3 mgd during the maximum month, 1.6 mgd in winter) to the IBRWF.

Table 7.5-2: Alternative 1 Flow Balance for 2030

Flows	Max Month ADF (mgd)	Summer ADF (mgd)	Winter ADF (mgd)	Annual ADF (mgd)
Flows To WNRWF (+)	4.4	4.2	3.1	3.5
RBSTP to WNRWF (+)	2.5	2.3	0.9	1.4
WN Disposal Capabilities (-)	2.3	2.2	1.6	1.8
Net Pumped Flow to IBRWF	**4.6**	**4.3**	**2.4**	**3.1**

In 2030, the estimated maximum monthly flow that will have to be sent to the IBRWF is approximately 4.6 mgd. The Transfer Pumping Station will be sized to pump 150% of the maximum monthly transfer flow, 6.9 mgd, to account for diurnal flow variations. The transfer pumps will operate on VFDs which ramp up and down on a pre-set diurnal flow pattern to mimic actual dry-weather diurnal flows. During storm events or other peak flows periods when actual influent flow exceeds the pre-set transfer flow, the excess flow will automatically be conveyed into the treatment lagoons when the normal high water level in the wet well is exceeded.

For ultimate build out, the headworks facility will be expanded to handle a peak flow of 39 mgd. To do so, a third fine screen will be fitted into the Phase 1 overflow channel. An overflow pipe will need to be added at this time as an emergency bypass around the screens. Table 7.5-3 shows the projected flowrates to the IBRWF or a PWWP for the ultimate design.

Table 7.5-3: Alternative 1 Flow Balance for Ultimate Design

Flows	Max Month ADF (mgd)	Summer ADF (mgd)	Winter ADF (mgd)	Annual ADF (mgd)
Flows To WNRWF (+)	7.2	6.9	5.1	5.7
RBSTP to WNRWF (+)	3.4	3.1	1.2	1.8
WN Disposal Capabilities (-)	2.3	2.2	1.6	1.8
Net Pumped Flow to IBRWF or PWWP	**8.3**	**7.8**	**4.7**	**5.7**

To account for diurnal flow variations, the Transfer Pumping Station will be sized for an annual average flow of 12.5 mgd (150% of the projected maximum month average daily flow).

7.6 RECOMMENDED IMPROVEMENTS FOR ALTERNATIVE 2

The same two phase approach will be taken if Alternative 2 is selected. However, the capacity will be reduced because the RBSTP will pump directly into the effluent storage lagoon. A summary of the projected flows for Alternative 2 is shown in Table 7.6-1.

Table 7.6-1: Alternative 2 Projected Influent Pumping to WNRWF

Entity	Year 2030 (mgd)(1)	Ultimate Design (mgd)(1)
Goslee Creek	0.6	6.5
Northern WRE Expansion	N/A	1.1
WRESSD	16.7	20.7
Total	17.3	28.3

Notes:
1. Pumping capacity given as peak capacity.

Phase 1 will include the same headworks building and electrical room as Alternative 1, but the screen sizes will be reduced accordingly. The WNRWF only treats 0.8 mgd year round in this scenario; all raw wastewater in excess of that amount is sent to the IBRWF. Table 7.6-2 shows the seasonal projected flowrates to be transferred to the IBRWF or a PWWP in 2030.

Table 7.6-2: Alternative 2 Flow Balance for 2030

Flows	Max Month ADF (mgd)	Summer ADF (mgd)	Winter ADF (mgd)	Annual ADF (mgd)
Flows To WNRWF (+)	4.4	4.2	3.1	3.5
WN Disposal Capabilities (-)	0.8	0.8	0.8	0.8
Net Pumped Flow to IBRWF or PWWP	**3.6**	**3.4**	**2.3**	**2.7**

To account for diurnal flow variations, the Transfer Pumping Station will be sized for maximum month average daily flow of 5.4 mgd (150% of the projected maximum month average daily flow).

Phase 2 will use the same strategy as Alternative 1 to increase capacity. A third fine screen will be fitted to the existing overflow channel; allowing the WNRWF to handle the 28.3 mgd projected flow. An overflow channel will be added in this phase. Table 7.6-3 shows the projected flowrates to the IBRWF or a PWWP for the ultimate design.

Table 7.6-3: Alternative 2 Flow Balance for Ultimate Design

Flows	Max Month ADF (mgd)	Summer ADF (mgd)	Winter ADF (mgd)	Annual ADF (mgd)
Flows To WNRWF (+)	7.2	6.9	5.1	5.7
WN Disposal Capabilities (-)	0.8	0.8	0.8	0.8
Net Pumped Flow to IBRWF or PWWP	**6.4**	**6.1**	**4.3**	**4.9**

To account for diurnal flow variations, the Transfer Pumping Station will be sized for a maximum month average daily flow of 9.6 mgd (150% of the projected maximum month average daily flow).

7.7 RECOMMENDED IMPROVEMENTS FOR ALTERNATIVES 3 AND 4

The influent wastewater flowrates to the WNRWF for Alternatives 3 and 4 are identical to those for Alternative 2. The two phase upgrade schedule will be designed for 2030 design flows and ultimate design flows, which are summarized in Table 7.7-1 below.

Table 7.7-1: Alternatives and 4 Projected Influent Pumping to WNRWF

Entity	Year 2030 (mgd)(1)	Ultimate Design (mgd)(1)
Goslee Creek	0.6	6.5
Northern WRE Expansion	N/A	1.1
WRESSD	16.7	20.7
Total	17.3	28.3

Notes:
1. Pumping capacity given as peak capacity.

The influent Phase 1 wastewater will flow into a common headworks designed to handle the above 2030 design flows. The headworks and electrical will be identical to the facilities described in Section 7.6.

In Alternative 3, the screened effluent will flow to a new Transfer Pump Station like the station designed for the Alternative 1 scenario. The Transfer Pump Station facility designed for either Alternative 3 will be reduced due to a lesser pumped flowrate. Any wastewater in excess of 2.3 mgd on a maximum monthly basis will be pumped to the IBRWF for treatment and disposal. Table 7.7-2 summarizes the transfer flowrates.

For Alternative 4, the screened effluent will be separated and sent to one of two treatment trains at the WNRWF. On a maximum monthly basis, 2.3 mgd will be treated and discharged through the existing partially aerated lagoon system and discharged via spray irrigation. Any flow above the 2.3 mgd threshold will be sent to a new treatment facility

on site that is capable of achieving biological nutrient removal. Due to the RBSTP permit limits, biological nutrient removal treatment will be required for all treated wastewater to be discharged via the ocean outfall. Due to limited space on the existing treatment facility property, a treatment operation with a small footprint, such as membrane biological reactors (MBR) or sequencing batch reactors (SBR) would likely be required. The new treatment train would also include disinfection and solids handing, if required. A new pump station will be constructed to pump the treated effluent to the Rehoboth Beach ocean outfall. Table 7.7-2 summarizes the transfer flowrates.

Table 7.7-2: Alternatives 3 and 4 Flow Balance for 2030

Flows	Max Month ADF (mgd)	Summer ADF (mgd)	Winter ADF (mgd)	Annual ADF (mgd)
Flows To WNRWF (+)	4.4	4.2	3.1	3.5
WN Disposal Capabilities (-)	2.3	2.2	1.6	1.8
Net Pumped Flow from WNRWF(1)	**2.1**	**2.0**	**1.5**	**1.7**

Note:
1. For Alternative 3 excess wastewater would be pumped to the IBRWF . For Alternative 4 treated effluent would be pumped to the Rehoboth Beach ocean outfall.

To account for diurnal flow variations, the Transfer Pumping Station will be sized for maximum month average daily flow of 3.2 mgd (150% of the projected maximum month average daily flow).

For the Ultimate Design flow the proposed headworks, treatment, pump facilities will be increased as necessary. Table 7.7-3 summarizes the pumping capacity required to accommodate the Ultimate Design flowrates.

Table 7.7-3: Alternatives 3 and 4 Flow Balance for Ultimate Design

Flows	Max Month ADF (mgd)	Summer ADF (mgd)	Winter ADF (mgd)	Annual ADF (mgd)
Flows To WNRWF (+)	7.2	6.9	5.1	5.7
WN Disposal Capabilities (-)	2.3	2.2	1.6	1.8
Net Pumped Flow from WNRWF(1)	**4.9**	**4.7**	**3.5**	**3.9**

Note:

1. For Alternative 3 excess wastewater would be pumped to the IBRWF. ForvAlternative 4 treated effluent would be pumped to the Rehoboth Beach ocean outfall.

To account for diurnal flow variations, the Transfer Pumping Station will be sized for a maximum month average daily flow of 7.4 mgd (150% of the projected maximum month average daily flow).

7.8 WOLFE NECK RWF UPGRADE PRLEMINARY COST ESTIMATES

Wolfe Neck RWF will need to increase its preliminary treatment capacity to be able to handle the projected influent flow rates. This section discusses the methodology and presents the capital costs for the recommended improvements for both Alternative 1 and Alternative 2. The conceptual design will allow the WNRWF to accommodate the projected 2030 flows. All dollar amounts are presented in year 2009 dollars.

Several different sources of information were consulted to develop the capital cost estimations. Where recent contractor bids or vendor proposals are available for similar projects, they have been used. If neither contractor bids nor proposals are available, quantity takeoffs were computed based on the conceptual designs described in sections 7.5 through 7.7.

Costs described in this section are based on conceptual design. As such, a level of detail appropriate to such a design was considered during the development of costs. Conceptual design does not provide the resolution needed for quantification of all construction materials. In recognition of this fact, percentages of construction cost have been applied to such items as piping, electrical, and site work. The percentages used for these items are summarized below:

- A 10% contingency was included with all construction costs.
- Yard Piping: 9% of subtotal.

- Electrical: 20% of subtotal.
- Planning, Engineering, and Administrative Services: 22% of subtotal.

Tables 7.8-1 through 7.8-3 below summarize the total capital costs for the WNRWF Headworks and Treatment upgrade for all four Alternatives.

Table 7.8-1: Estimated Alternative 1 Phase 1 Headworks Probable Project Cost

Description	Estimated Cost
Civil	$65,000
Structural	$151,000
Building Cost	$47,000
Screening Equipment	$634,000
Flow Measuring Equipment	$40,000
Plumbing	$10,000
Subtotal	**$947,000**
Yard Piping @ 9% of Subtotal	$85,000
Electrical @ 20% of Subtotal	$189,000
Site work @ 3% of Subtotal	$28,000
Startup @ 2% of Subtotal	$19,000
Subtotal	**$1,267,000**
General Conditions @ 5% of Subtotal	$63,000
Overhead @ 10% of Subtotal	$133,000
Profit @ 5% of Subtotal	$67,000
Subtotal	**$1,530,000**
Contingency @ 10% of Subtotal	$153,000
Total Construction Cost (Year 2009 Dollars)	**$1,683,000**
Planning, Engineering, and Admin @ 22% of Subtotal	$370,000
Total Project Cost (Year 2009 Dollars)	**$2,050,000**

Table 7.8-2: Estimated Alternatives 2, 3, and 4 Phase 1 Headworks Probable Project Costs

Description	Estimated Cost
Civil	$56,000

Structural	$114,000
Building Cost	$38,000
Screening Equipment	$542,000
Flow Measuring Equipment	$40,000
Plumbing	$10,000
Subtotal	**$800,000**
Yard Piping @ 9% of Subtotal	$72,000
Electrical @ 20% of Subtotal	$160,000
Site work @ 3% of Subtotal	$24,000
Startup @ 2% of Subtotal	$16,000
Subtotal	**$1,073,000**
General Conditions @ 5% of Subtotal	$54,000
Overhead @ 10% of Subtotal	$113,000
Profit @ 5% of Subtotal	$56,000
Subtotal	**$1,296,000**
Contingency @ 10% of Subtotal	$130,000
Total Construction Cost (Year 2009 Dollars)	**$1,430,000**
Planning, Engineering, and Admin @ 22% of Subtotal	$314,000
Total Project Cost (Year 2009 Dollars)	**$1,740,000**

Table 7.8-3: Estimated Alternative 4 Phase 1 Treatment Probable Project Costs

Description	Estimated Cost
Total Treatment Costs @ $10 per gallon	$21,000,000
Total Project Cost (Year 2009 Dollars)	**$21,000,000**

The civil site work includes the fill required to raise the headworks area to match the existing berm elevation, as well as any bedding and paving costs. Structural costs consist of the concrete needed for the facility and building costs include items such as aluminum grating and stairs. The screening equipment includes almost all of the mechanical equipment inside the headworks: mechanical screens and a manual bar rack, screenings conveyor, slide gates, a hoist, dumpster and insulation and heat tracing for all of the equipment that will require it. Flow measuring equipment includes the flow meter itself as well as a vault to house the device. All other costs were calculated as a percentage of

the subtotals and construction costs. Appendix D contains a detailed cost estimate for the headworks for both Alternative 1 and Alternative 2.

8. WOLFE NECK BAYS CONVEYANCE SYSTEM

This chapter presents the alternative alignments and associated costs for conveying flows from the WNRWF to either the IBRWF (Alt. 1A,2A,3), PWSP (Alt 1B, 2B), or a combined City/County ocean outfall (Alt 4). A Hazen-Williams "C-factor" of 140 is used for all hydraulic computations for new PVC pipeline and a "C-factor" of 100 for DIP. The target design velocity for all force mains is 3 to 5 feet per second (ft/s). All flow projections referenced in this chapter are provided in Appendix B.

Cost estimates are provided for Wolfe Neck Conveyance system for the various alternatives. However, this conveyance system is just one component of the cost sharing model as further described in Chapter 10.

8.1 ALTERNATIVE 1A, 2A, AND 3

8.1.1 ALIGNMENT ALTERNATIVES

Three alignments were evaluated for the conveyance of wastewater from the WNRWF to the IBRWF Figure 8.1.1-1 indicates three potential force main alignments from the WNRWF to the IBRWF.

Alignment Option #1 involves the installation of approximately 58,900 lf of force main south from the WNRWF along Wolfe Neck Road, crossing underneath Coastal Highway along John J. Williams Highway to Hollymount Road, where it will run west to Phillips Branch Road, then southwest to Indian Mission Road, then south to Cannon Road and then west on Inland Bays Road to the IBRWF headworks.

Alignment Option #2 involves the installation of approximately 72,600 lf of force main along a similar alignment to the intersection of John J. Williams Highway and Mullberry Knoll Road, where it will run west to Cedar Grove Road and then south along

CITY OF LEWES

CAPE HENLOPEN

PS#196

PS#210

EX. 30"FM - WEST REHOBOTH

Wolfe Neck Regional Wastewater Facility

WNRWF Transfer Station

WOLFE NECK ROAD

8"FM

COASTAL HIGHWAY

HENLOPEN ACRES

REHOBOTH BEACH

DEWEY BEACH

Rehoboth Beach Sewage Treatment Plant

MULLBERRY KNOLL ROAD

CEDAR GROVE ROAD

ROBINSONVILLE ROAD

KENDALE ROAD

JOHN J. WILLIAMS HIGHWAY

DAM ROAD

BEAVER DAM ROAD

HOLLYMOUNT ROAD

INDIAN

PHILLIPS BRANCH ROAD

MISSION ROAD

CANNON ROAD

Inland Bays Regional Wastewater Facility

LOVE CREEK

GUINEA CREEK

REHOBOTH BAY

INDIAN RIVER BAY

INDIAN RIVER

N

LEGEND

- Aligment Option #1
- Aligment Option #2
- Aligment Option #3
- Existing Infrastructure
- Inland Bays Planning Area Boundary
- Environmentally Sensitive Development Area

Whitman, Requardt & Associates LLP

in association with

STEARNS & WHELER LLC
Environmental Engineers and Scientists

JOINT SUSSEX COUNTY/CITY OF REHOBOTH BEACH LAND APPLICATION PROJECT

SUSSEX COUNTY, DELAWARE

Figure 8.1-1
October 2009

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Robinsonville Road to the intersection of John J. Williams Highway. From this point, it will follow the same alignment as Option #1 to the IBRWF headworks.

Alignment Option #3 involves the installation of approximately 68,600 lf of force main following a similar alignment as Option #2 to the intersection of Robinsonville Road and Kendale Road, at which point it will run west to Beaver Dam Road, then south to Indian Mission Road. From this point it will follow the same alignment as Options #1 and #2 along Indian Mission Road to the IBRWF headworks.

8.1.2 FORCE MAIN HYDRAULICS

As outlined in Chapter 7, the Wolfe Neck transfer pump station for Alt. 1A (raw wastewater), Alt. 2A (treated effluent) and Alt. 3 (County only flows) will be required to pump 6.9 mgd, 5.4 mgd, and 3.2 mgd respectively in year 2030. Table 8.1.2-1 summarizes the hydraulic calculations for all three treatment alternatives for all three alignment options in year 2030.

Table 8.1.2-1: Alternative 1A, 2A and 3 Hydraulics Summary

Treatment Alternative				Alignment Option #1 John J. Williams Highway (SR.24)		Alignment Option #2 Robinsonville Road (CR 277)		Alignment Option #3 Beaver Dam Road (SR 23)	
	Peak Q (mgd)	**FM Size** (in)	**Vel.** [1] (ft/s)	**Length** (ft)	**TDH**[1] (ft)	**Length** (ft)	**TDH** [1] (ft)	**Length** (ft)	**TDH** [1] (ft)
Alt 1A	6.9	24	3.7	58,900	155	72,600	178	68,600	171
Alt 2A	5.4	24	2.9	58,900	118	72,600	133	68,600	129
Alt 3	3.2	18	3.0	58,900	150	72,600	172	68,600	160

Notes:

1. Velocities and head losses are based on C-900 PVC reduced interior diameters (i.e. 23" inside diameter for a 24"FM).

The velocities and head conditions presented in these tables represent a preliminary evaluation, as the final length of the alternative route will impact actual headlosses.

Based on this information the recommended force main size is 24-inches for Alt. 1A and 2A and 18-inches for Alt. 3.

There is the potential for a portion of these proposed force mains to be shared with a proposed Angola Neck Sanitary Sewer District Regional Force Main, which is slated for construction in the spring of 2010. This force main follows the same alignment as Option #1 from the intersection of Robinsonville Road (CR 277) and John J. Williams Highway (SR 24) down to the IBRWF. The portion of this force main from Indian Mission Road (SR 5) to the IBRWF could be shared with alignment Option #3.

8.1.3 PUMP STATION DESIGN

The proposed stations in these alternatives would be designed as a three pump station, with two pumps operating and one stand-by pump. Table 8.1.3-1 summarizes the ranges of pump sizes required each alignment option.

Table 8.1.3-1 Preliminary Pump Size

	Alignment Option #1	Alignment Option #2	Alignment Option #3
	HP Range (per pump)	HP Range (per pump)	HP Range (per pump)
Alternative 1A	160-185	185-250	185-250
Alternative 2A	90-110	160-185	160-185
Alternative 3	80-100	160-185	80-100

Notes:

1) Horsepower ranges supplied are based on preliminary pump selections, assuming a three pump station with two pumps operating and 1 stand-by.

The proposed pumping station for either Alt. 1A or Alt. 2A from the WNRWF to the IBRWF would be large regional pump stations, involving a cast-in-place wetwell with external valve vault and a small control building to house the electrical equipment. Alt. 3 would involve a smaller station with pre-cast wetwell and valve vault structures.

8.1.4 COST ESTIMATES

To account for varying installation conditions, traffic control, and road restoration and requirements, each FM alignment was broken into the following four categories from most expensive to least expensive:

- Major Highway Construction
- Intermediate Highway Construction
- County Road Construction
- Easement Construction

Cost estimate breakdowns for the proposed force mains for each alignment option are provided in Appendix E. Table 8.1.4-1 provides a summary of each alternative.

Table 8.1.4-1 WNRWF to IBRWF Force Main Cost Summary

Force Main Alignment	Estimated Total Project Cost
Option #1 - John Williams Highway	$18,122,000
Option #2 – Robinsonville Road	$19,298,000
Option #3 – Beaver Dam Road	$17,493,000

Based on these cost estimates, Option #3 appears to be the most cost effective alignment. Option #1 is the shortest alignment, but would present the most challenging construction conditions due to the high traffic nature of John J. Williams Highway, along with the significant number of unknowns along this roadway. Option #3 is the preferred alignment as far as overall cost and constructability. One disadvantage of Option #3 is it provides the least amount of potential shared costs with the imminent Angola Neck SSD Force Main to IBRWF.

Cost estimate breakdowns for the proposed pumping stations from the WNRWF to the IBRWF are provided in Appendix E. Table 8.1.4-2 provides a summary of both alternatives.

Table 8.1.4-2 Pumping Station Cost Summary

Force Main Alignment	Estimated Total Project Cost
Alternative 1A (Raw Wastewater PS)	$3,300,000
Alternative 2A (Treated Effluent PS)	$3,050,000
Alternative 3 (County Only)	$2,680,000

8.1.5 SUMMARY

Table 8.1.5-1 provides a summary of the alignment options for the WNRWF to IBRWF alternatives. As stated previously, alignment Option #3 is the preferred alignment.

Table 8.1.5-1 Summary of WNRWF to IBWRF Alignment Options

Description	Option 1 John Williams Highway (SR 24)	Option 2 Robinsonville Road (CR 277)	Alternative 3 Beaver Dam Road (SR 23)
Total length	58,900 feet	72,600 feet	68,600 feet
Size	24 inch	24 inch	24 inch
Pavement restoration length	43,825 feet	41,700 feet	37,850 feet
Potential County Shared Costs	25,400 lf	25,400 lf	10,700 lf
Environmental Ranking	3	2	1
Operation and Maintenance Ranking	1	3	2
Crossings			
Major Roadway Crossings	1) Coastal Highway 2) John J. Williams Hwy.	1) Coastal Highway 2) John J. Williams Hwy.	1) Coastal Highway
Major Stream Crossings	1) Love Creek 2) Burton Prong	1) Burton Prong	None
Minor Stream Crossings	3	6	5
Construction			
Major Highway Installation	28,750	10,800	7,100
Intermediate Highway Installation	1,700	5,000	28,550
County Road Installation	28,450	56,800	32,950
Installation Ranking	**3**	**2**	**1**
Easements			
Temporary Easements	Yes	Yes	Yes
Permanent easements	Yes	Yes	Yes

Notes:

1) Major Roadway Installation refers to John J. Williams Highway, Intermediate Roadway Installation refers to Beaveer Dam Road and Indian Mission Road, County Road Installation refers to installation along all other County Roads.

2) Pavement restoration length was obtained assuming 100% restoration in Major Highways and 50% restoration elsewhere.

8.2 ALTERNATIVE 1B AND 2B

8.2.1 ALIGNMENT ALTERNATIVES

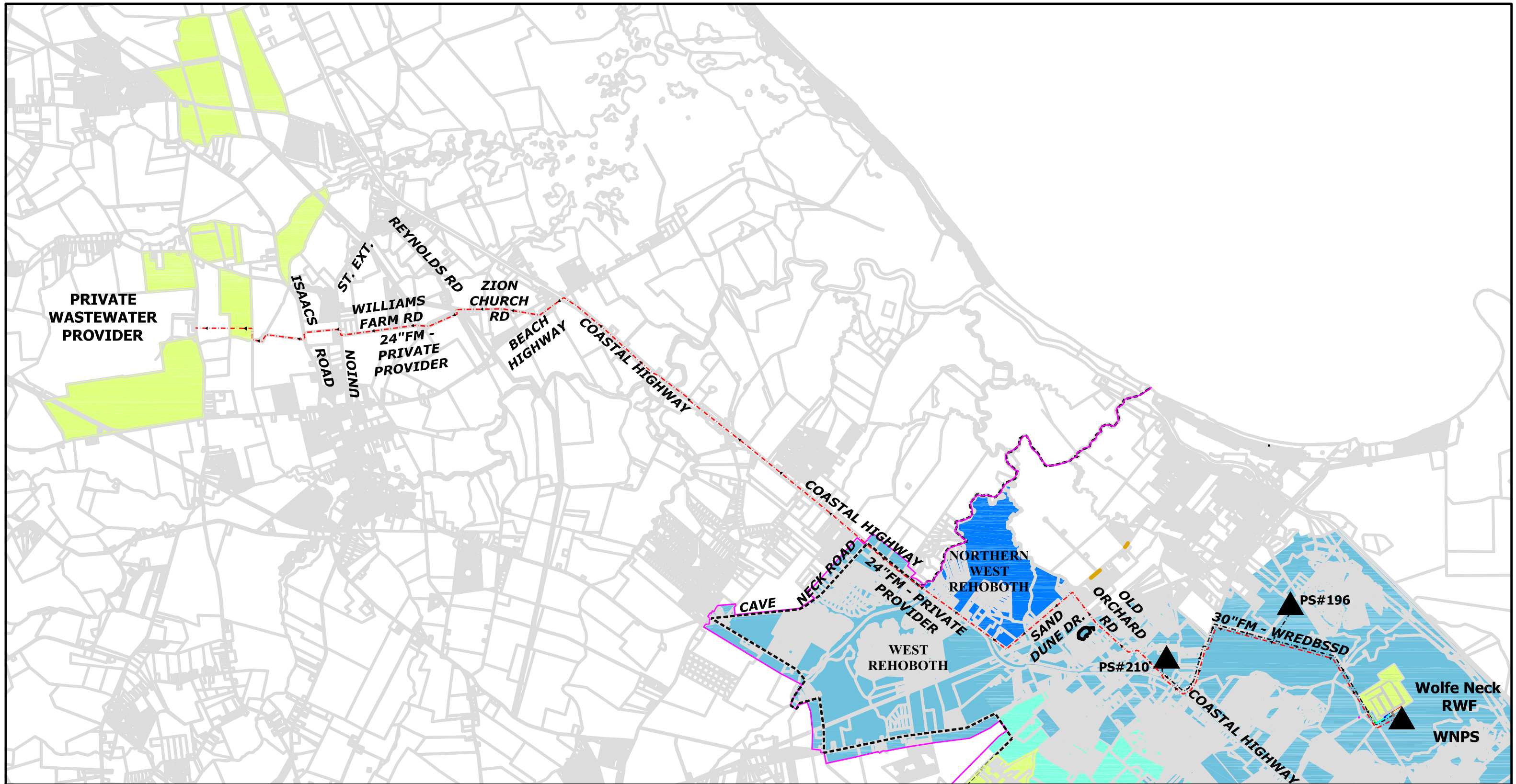
Only one alignment was evaluated to go from the WNRWF to the Private Wastewater Provider's (PWWP) treatment and disposal site. This alignment is indicated on Figure 8.2-1 and is based on a contract proposal received from Artesian Wastewater Services. Similar to Alternatives 1A and 2A, a transfer pumping station will be required at the WNRWF to accept flow in excess of the plant's capacity. This pumping station will pump through a 24-inch force main, approximately 82,000 LF to the treatment and disposal lands. The PWWP has proposed a booster pumping station at the intersection of Coastal Highway and Cave Neck Road in order to accept flow from outside the County's planning area. This station has been excluded from this report since it would provide capacity for flows that are not being contributed by the County.

8.2.2 FORCE MAIN HYDRAULICS

The transfer station for Alt. 1B (raw wastewater) and Alt. 2B (treated effluent) will be required to pump 6.9 mgd and 5.4 mgd respectively in year 2030. Table 8.2.2-1 summarizes the hydraulic calculations for both treatment alternatives.

Table 8.2.2-1: Alternative 1B and 2B Hydraulics Summary

Treatment Alternative	Peak Q	FM Size	Vel. (1)	Length	TDH(1)
	(mgd)	(in)	(ft/s)	(ft)	(ft)
Alt 1B	6.9	24	3.7	82,000	194
Alt 2B	5.4	24	2.9	82,000	143



GRAPHIC SCALE

5000 0 5000 10,000

SCALE: 1" = 5000'

LEGEND

- 24" Force Main from WNRWF to Private Provider
- EX. 30" Force Main from PS#210 to WNRWF
- Inland Bays Planning Area Boundary
- Environmentally Sensitive Development Area
- Sanitary Sewer District Boundary

OCTOBER 2009

WR&A Whitman, Requardt & Associates LLP in association with STEARNS & WHELER Environmental Engineers and Scientists

SUSSEX COUNTY ENGINEERING DEPARTMENT
GEORGETOWN, DELAWARE

JOINT SUSSEX COUNTY/CITY OF REHOBOTH BEACH LAND APPLICATOIN PROJECT

FIGURE 8.2-1

The velocities and head conditions presented in these tables represent a preliminary evaluation, as the final length of the alternative route will impact actual headlosses. Based on this information the recommended force main size is 24-inches for both Alt. 1B and 2B.

8.2.3 COST ESTIMATES

Cost estimate breakdowns for the proposed alignment option are provided in Appendix E. This estimate was broken into two sections to maintain constancy with what was presented by the PWWP. Table 8.2.3-1 provides a summary for each section.

Table 8.2.3-1 WNRWF to PWWP Force Main Cost Summary

Force Main Alignment	Estimated Total Project Cost
Section #1 – WNRWF to Cave Neck Road	$9,240,000
Section #2 – Cave Neck Road to the PWWP site	$11,820,000
Total	**$21,060,000**

As compared to Alternatives 1A and 2A, Alternative 1B and 2B would result in higher costs due to larger pumps and associated electrical gear. This is due to the higher associated TDH from the longer pumping distance. However, the costs for the pump station structures and mechanical piping would be similar. Cost estimate breakdowns for Alt. 1B and 2B stations were assumed to be the same as those previously presented for Alt. 1A and 2A respectively.

8.3 ALTERNATIVE 4

8.3.1 ALIGNMENT

For Alternative 4, all flows from the West Rehoboth District and future Goslee Creek District would be treated at the WNRWF. All excess flows that could not be disposed of at the WNRWF would be disposed of through a combined City/County ocean outfall. For this analysis, it is assumed that the force main from the Wolfe Neck Transfer PS would manifold into the Rehoboth force main and be conveyed by a common effluent force main to the ocean outfall.

In chapter 5, two alignment options were reviewed for the proposed force main from Rehoboth to WNRWF, with alignment option #1 chosen as the recommended alternative. This same alignment corridor would be recommended for the alternative alignment from WNRWF to Rehoboth. See Chapter 5 for alignment specifics.

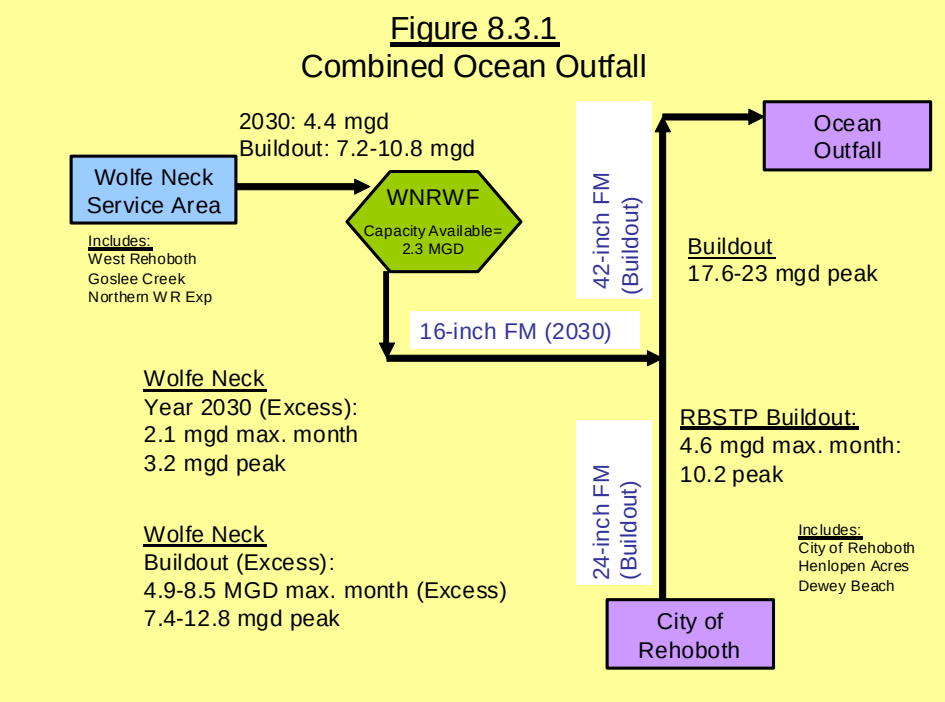
8.3.2 FORCE MAIN HYDRAULICS

To remain consistent with the cost analysis performed for other alternatives, the WNRWF to Rehoboth FM was sized for year 2030 flows. For the WNWRF, the projected 2020 maximum month flow is 4.4 mgd (based on 150 gpd/EDU). Similar to other alternatives, it was assumed that 2.3 mgd would be disposed of at the WNRWF and the rate to be pumped by the Wolfe Neck Transfer Pump Station is 150% of the excess maximum month or 1.5*(4.4 mgd-2.3 mgd) = 3.2 mgd. This 2030 flowrate would require a 16-inch FM from the WNTPS to the Rehoboth effluent force main manifold.

All ocean outfall alternatives presented by Rehoboth were based on buildout flows of 3.4 mgd for maximum month and 10.2 mgd at an instantaneous peak. For these flows, a 24-inch effluent force main and ocean outfall was recommended in the Rehoboth Beach Alternative Discharge Evaluation. For the combined City/County ocean outfall, all flows

were also analyzed on a buildout basis. The buildout design for the WNRWF has been projected at 7.2 mgd based on 150 gpd/EDU. Assuming 2.3 mgd is disposed of at the WNRWF, the peak County contribution to the outfall would be (7.2 mgd-2.3 mgd)*1.5=7.4 mgd. The combined City/County flow through the effluent force main and outfall would be 17.6 mgd. Based on this design rate, the effluent force main and ocean outfall would need to be 36-inches at a design velocity of approximately 4 ft/s.

If Alternative 4 is implemented, considering the expense of installing the ocean outfall and the amount of potential growth within the WNRWF service area, the impacts of using a higher flowrate may need to be reviewed. For example, at a future flow contribution of 225 gpd/EDU, the maximum month average daily flow increases to 10.8 mgd. This would increase the County contribution to the effluent force main and outfall to (10.8 mgd -2.3 mgd)*1.5=12.8 mgd and the total flow to the outfall to 23 mgd. At this flowrate, the design flowrate through a 36-inch outfall would be 5 ft/s or through a 42-inch outfall would be almost 4 ft/s. Using a 42-inch would be most conservative, but could also cause issues due to low initial velocities. If Alternative 4 is implemented, a more detailed evaluation would be required to determine the final effluent force main/outfall size. Regardless, for this study, the more conservative 42-inch was assumed. Figure 8.3.1 indicates this configuration.



8.3.3 FORCE MAIN HYDRAULICS

From the previous Figure 8.3.1, the WNTPS would pump against losses from its own 16-inch FM as well the competing heads from the Rehoboth pump station through the effluent force main and ocean outfall. It was assumed that the effluent force main and ocean outfall is non –PVC (i.e. DIP or concrete encased steel). Preliminary hydraulic calculations were performed based on this configuration and assuming a static head of 10-feet going from the IBRWF to the ocean outfall. For the 3.2 mgd peak design flow, pumping heads would vary from 70 to 85-feet depending on the size of the effluent force main and outfall (i.e. 36 or 42 inches). This would require the installation of three 50-70 HP pumps.

8.3.4 COST ESTIMATES

Cost estimate breakdowns for the force main alignment are provided in Appendix E. Based on this, the estimated total project cost for the 16-inch is $2.3M. Based on previous

County pump stations of this size, the Alternative 4 Wolfe Neck Transfer Pump Station costs have been estimated at approximately $2.3M.

Cost breakdowns for the effluent force main and Ocean Outfall for both Alternatives 3 and 4 are outlined in Table 8.3.4-1. Alternative 3 costs are from the Rehoboth Beach Alternative Discharge Evaluation. Costs for Alternative 4 were developed based on an upsizing of the effluent force main and ocean outfall from 24-inches to 42-inches. The upsizing costs for 12,100 l.f. of effluent force main were based on recent bids from other projects. The upsizing cost for the Ocean Outfall was assumed to be $300/l.f. to primarily account for increased material costs.

Table 8.3.4-1 WNRWF to PWWP Force Main Cost Summary

Component	Alt. 3	Alt. 4
Effluent Force Main	$2,560,000	$6,160,000
Effluent FM Contingency (10%)	$256,000	$616,000
Effluent FM Subtotal	*$2,816,000*	*$6,776,000*
Outfall	$14,800,000	$16,600,000
Outfall Contingency (15%)	$2,220,000	$2,490,000
Outfall Subtotal	*$17,020,000*	*$19,090,000*
Outfall permitting (5% of outfall subtotal)	$850,000	$950,000
Engineering/Admin (22% of Effluent FM and Outfall Subtotal)	$4,360,000	$5,690,000
Project Total	**$25,050,000**	**$32,510,000**

9. INLAND BAYS REGIONAL WASTEWATER FACILITY IMPACTS

9.1 INTRODUCTION

The Inland Bays Regional Wastewater Facility (IBRWF) is a partially aerated lagoon treatment facility with effluent spray irrigation. It currently serves the Long Neck SSD (LNSSD) and the Oak Orchard SSD (OOSSD). Sussex County has recently started designing the facility upgrade and expansion necessary to accommodate the growth in these districts and the planned Angola Neck SSD (ANSSD), the Oak Orchard Expasnion Area #1 (OOEA#1), as well as future anticipated flow from the Herring Creek SSD (HCSSD).

The expansion is designed to be completed in three phases, the timing of which depends on the growth of its service districts and the solution chosen for RBSTP and WNWRF. To comply with the recent Inland Bays TMDL requirements and to ensure total nitrogen loading does not limit spray field capacity before hydraulic loading rates do, process improvements at the IBRWF are planned. The existing treatment lagoons will be converted into phased aeration lagoons, followed by secondary clarifiers using an activated sludge process. This is expected to reduce effluent TN concentrations to 10 mg/L or below. This reduction will allow the IBRWF to load the irrigation fields to their hydraulic limit without exceeding either the permitted nitrogen loading rate of 250 lbs/ac/yr or the Inland Bays TMDL percolate requirement of 5.0 mg/L or less as an annual average.

To remain in compliance with its effluent spray irrigation limits, the IBRWF has acquired over 2,000 acres of agricultural land for effluent disposal; over 700 acres of this land will be used to accommodate the facility's short term expansion. The additional property acquired is expected to bring the total short term effluent disposal capacity to 5.2 mgd using spray irrigation. A detailed hydrogeological soil survey has not been completed on the long term expansion lands, but preliminary studies estimate that it provides

approximately 7.8 mgd of effluent disposal capacity using spray irrigation. Combined with the short term storage capacity, the property owned by the County at the IBRWF provides an estimated spray irrigation disposal capacity of approximately 13.0 mgd. Additional capacity could be obtained with the purchase of additional property for spray irrigation or the use of alternative disposal methods at this site.

Table 9.1-1 summarizes the phased expansion approach and lists the total effluent disposal capacity for each.

Table 9.2-2: IBRWF Expansion Phases and Disposal Capacity

Design Phase	Added Disposal Acreage per Phase	Total Disposal Capacity (mgd)
Current	206	1.5
Phase 1	150	2.1
Phase 2	203	3.7
Phase 3A	190	5.2
Phase 3B	To be determined(1)	6.0

Note:

1. A detailed hydrogeolocial soil survey will be completed prior to determining the area required for additional effluent disposal capacity.

Please reference the Inland Bays PER for a detailed explanation on the upgrade and expansion. The possibility of wastewater from additional service areas being sent to IBRWF will affect the expansion schedule, but not the treatment design. The possible alternatives for the NCPA discussed in this report will each impact the IBRWF uniquely. The scenarios discussed in this chapter are presented from the least impact to the most impact on the IBRWF expansion schedule.

A. Either Alternatives 1B, 2B, or 4 is chosen. RBSTP and WNRWF create a separate solution that does not involve IBRWF. These solutions could be either ocean outfall or an off-site PWTP. IBRWF will expand according to its original schedule.

B. Alternative 3 is chosen. RBSTP devises a separate solution independent of WNRWF or IBWRF. WNWRF would send all raw wastewater in excess of 1.8 mgd on an annual basis (2.3 mgd on a maximum month basis) to IBWRF for treatment and disposal. This is based on the analysis that using existing facultative aerated lagoon treatment system, the effluent disposal capacity at the WNRWF will be nitrogen limited at 1.8 mgd on an annual average basis.

C. Alternative 1A is chosen. The RBWWPS and WNRWF SSDs will send all raw wastewater flow greater than 1.8 mgd on an annual basis (2.3 mgd on a maximum month basis) to IBRWF for treatment and disposal. The IBRWF will receive an increased raw wastewater flow because the RBWWPS raw wastewater is included in the flow to WNRWF.

D. Alternative 2A is chosen. All raw wastewater flow greater than 0.8 mgd from the WNRWF SSDs will be sent to Inland Bays for treatment and disposal.

9.2 SCENARIO A

Scenario A entails RBSTP and WNRWF choosing a solution that does not involve the IBRWF. To accomplish this, RBSTP and WNRWF will likely choose to dispose of treated effluent either by discharging it to an ocean outfall (Alt. 4), or off-site spray irrigation (Alt. 1B or 2B). Regardless of the disposal mechanism, the timeline for the expansion of the IBRWF will be based on the wastewater flow projections from the districts currently served or planned for service by this facility (ANSSD, HCSSD, LNSSD, OOSSD).

The current maximum month flow received at the IBRWF is 0.7 mgd (July 2005). With the continued growth of the LNSSD and OOSSD and the addition of the ANSSD and HCSSD, the IBRWF service area influent flows will increase substantially in the future.

Based on 150 gpd/ EDU for all existing and future EDUs, projected 2030 flow rates are summarized in Table 9.2-1.

Table 9.2-1: Projected 2030 Flows for IBRWF Contributing Entities

Service Districts	Max Month ADF (mgd)(1)	Summer ADF (mgd)(2)	Winter ADF (mgd)(3)	Annual ADF (mgd)(4)
LNSSD	1.8	1.7	1.1	1.4
OOSSD	0.48	0.45	0.28	0.36
ANSSD	0.50	0.47	0.30	0.37
HCSSD	0.09	0.08	0.05	0.06
Total	2.90	2.7	1.7	2.1

Notes:

1. Max month ADF based on growth projecting using 150 gpd/ EDU for existing and future connections.
2. Summer ADF determined by applying observed IBRWF 1.1:1 max month ADF to summer ADF ratio to projected max month ADF.
3. Winter ADF determined by applying observed IBRWF 1.6:1 summer ADF to winter ADF ratio to projected summer ADF.
4. Annual ADF determined by applying observed IBRWF 1.4 max month ADF to annual ADF ratio to projected max month ADF.

The ultimate projected wastewater flow to the IBRWF under this scenario is 6.3 mgd on a maximum monthly basis.

Figure 9.2-1 shows the projected IBRWF flows vs. the disposal capacities for each expansion phase.

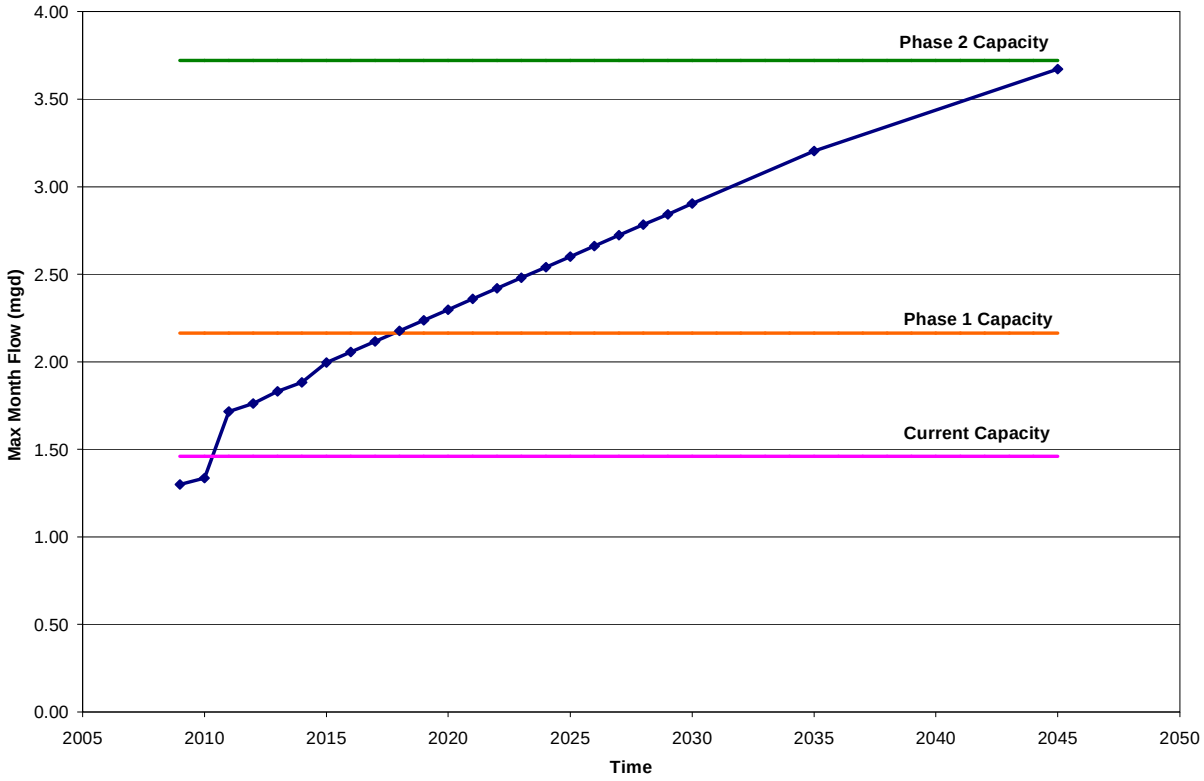


Figure 9.2-1: Scenario A IBRWF Projected Flows and Expansion Timeline

The Phase 1 expansion has recently entered the design phase and will be completed in time to accommodate the increased flows through 2017. As indicated on Figure 9.2-1 the Phase 2 expansion will be sufficient to treat the projected influent flows through 2045. The ultimate build out flow of 6.3 mgd (not shown) will require additional treatment and disposal capacity at the IBRWF.

9.3 SCENARIO B

In Scenario B, the RBSTP will not transfer any wastewater or treated effluent to either the WNRWF or the IBRWF. If this is chosen, the RBSTP will likely discharge its treated effluent via an ocean outfall (Alt. 3). The WNRWF will continue to treat all incoming wastewater and dispose of it using spray irrigation until the annual average daily flow exceeds 1.8 mgd. At this flowrate, the WNRWF irrigation fields will become nitrogen

limited and the remaining wastewater will be sent to the IBRWF for treatment. Table 9.3-1 shows the contributing entities and their associated flows to the IBRWF.

Table 9.3-1: Scenario B 2030 Projected Influent Flowrates to IBRWF

Service Districts	Max Month ADF (mgd)(1)	Summer ADF (mgd)(2)	Winter ADF (mgd)(3)	Annual ADF (mgd)(4)
LNSSD	1.8	1.7	1.08	1.4
OOSSD	0.48	0.45	0.28	0.36
ANSSD	0.50	0.47	0.30	0.37
HCSSD	0.09	0.08	0.05	0.06
WNRWF(5)	2.1	1.9	1.5	1.7
Total	**5.0**	**4.7**	**3.2**	**3.8**

Notes:

1. Max month ADF based on growth projection using 150 gpd/ EDU for existing and future connections.
2. IBRWF summer ADF determined by applying observed IBRWF 1.1:1 max month ADF to summer ADF ratio to projected max month ADF.
3. IBRWF winter ADF determined by applying observed IBRWF 1.6:1 summer ADF to winter ADF ratio to projected summer ADF.
4. IBRWF annual ADF determined by applying observed IBRWF 1.4:1 max month ADF to annual ADF ratio to projected max month ADF.
5. WNRWF flows are determined using observed seasonal flow ratios (Table 3.2-3)

The ultimate projected wastewater flow to the IBRWF under this scenario is 11.2 mgd on a maximum monthly basis.

Using growth projections, the entire expansion timeline will be accelerated. WNRWF will start sending raw wastewater to IBRWF as soon as a transfer pumping station and forcemain can be constructed (likely 2012). Both Phase 1 and Phase 2 expansions will need to be completed by that time. The Phase 3A expansion will be required by 2022, with Phase 3B after 2035. If IBRWF accepts flow from WNWRF an additional expansion, Phase 4, will also be required. To accommodate the ultimate build out flowrate of 11.2 mgd, an extensive upgrade or new treatment facility will be required in the future. Figure 9.3-1 shows the expansion timeline for scenario B.

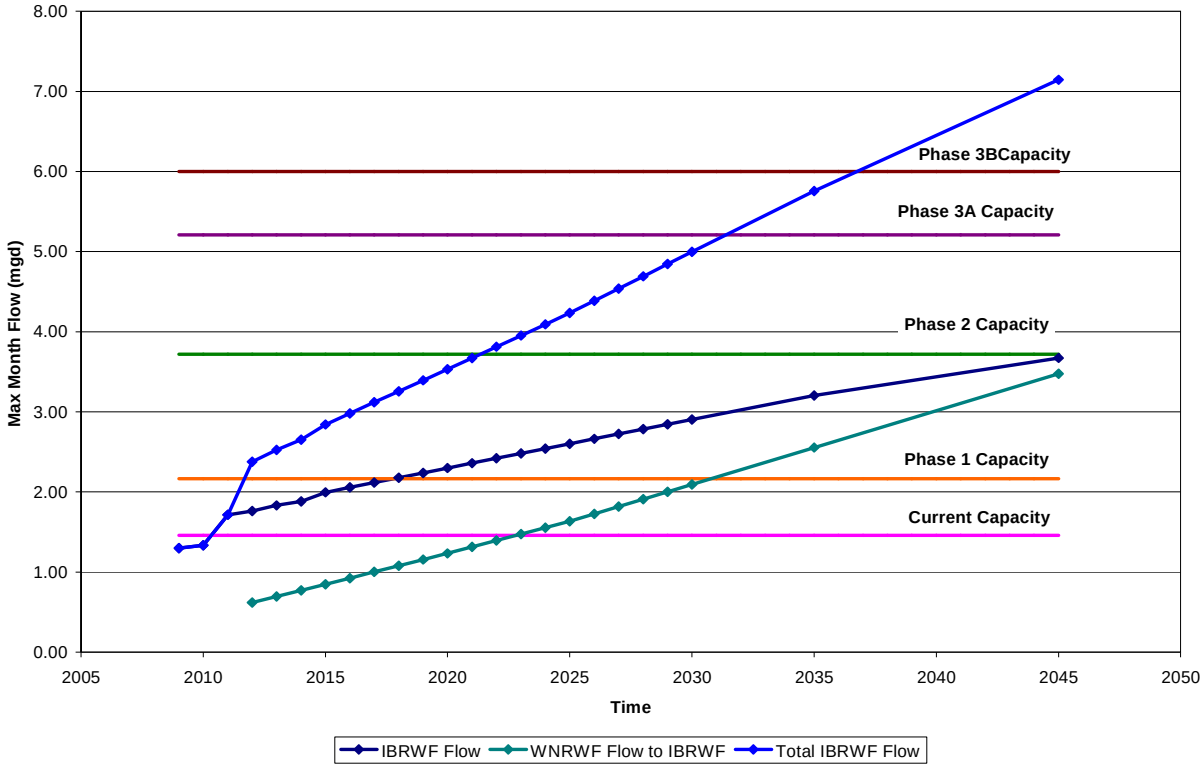


Figure 9.3-1: Scenario B IBRWF Projected Flows and Expansion Timeline

Due to the short interval in between when Phases 1 and 2 are required, there may be cost savings associated with immediately beginning the design on Phase 2 so construction of the expansions can be simultaneous or continuous. Before the Phase 3 expansion is required soil investigations and hydrogeological studies on the Cordrey parcel will need to be performed. If this scenario is chosen, it may be more cost effective to build a new treatment facility to accommodate the ultimate build out wastewater flows, rather than expanding the IBRWF further.

9.4 SCENARIO C

In Scenario C, Alternative 1A is chosen to manage RBSTP and WNWRF wastewater. The RBSTP will shut down and the RBWWPS will be constructed to send raw wastewater to WNWRF. For the Wolfe Neck Transfer Pump Station, this option is very similar as Scenario B. At an annual average of 1.8 mgd (2.3 mgd during the maximum

month), the WNRWF will become nitrogen limited and any additional wastewater will be transferred to the IBRWF. Table 9.4-1 shows the contributing entities and their associated flows to the IBRWF.

Table 9.4-1: Scenario C 2030 Projected Influent Flowrates to IBRWF

Service Districts	Max Month ADF (mgd)(1)	Summer ADF (mgd)(2)	Winter ADF (mgd)(3)	Annual ADF (mgd)(4)
LNSSD	1.8	1.7	1.08	1.4
OOSSD	0.48	0.45	0.28	0.36
ANSSD	0.50	0.47	0.30	0.37
HCSSD	0.09	0.08	0.05	0.06
WNRWF(5)(6)	4.6	4.3	2.4	3.1
Total	**7.5**	**7.0**	**4.1**	**5.2**

Notes:

1. Max month ADF based on growth projection using 150 gpd/ EDU for existing and future connections.
2. Summer ADF determined by applying observed IBRWF 1.1:1 max month ADF to summer ADF ratio to projected max month ADF.
3. Winter ADF determined by applying observed IBRWF 1.6:1 summer ADF to winter ADF ratio to projected summer ADF.
4. Annual ADF determined by applying observed IBRWF 1.4:1 max month ADF to annual ADF ratio to projected max month ADF.
5. WNRWF flows are determined using observed seasonal flow ratios (Table 3.2-3).
6. WNRWF includes the projected 2030 flows from the RBWWPS.

The ultimate projected wastewater flow to the IBRWF under this scenario is 14.6 mgd on a maximum month basis.

Because the RBSTP is contributing raw wastewater to the WNRWF, more flows relative to Scenario B will have to be transferred to the IBRWF. To comply with their permit, the IBRWF will need to construct expansion Phases 1 and 2 as soon as possible (likely 2012). Assuming RBSTP start sending raw wastewater to te WNRWF in 2014, the total incoming IBRWF flow is 4.1 mgd; expansion Phase 3 will need to be completed by that time. To accommodate the projected 2030 influent flow rate of 7.5 mgd, a fourth expansion phase will be required. Similarly to Scenario B, the County may want to explore a new treatment facility to accommodate the ultimate build out wastewater flowrate of 14.6 mgd. Figure 9.4-1 displays when the IBRWF flows will exceed the disposal capacities for each expansion phase.

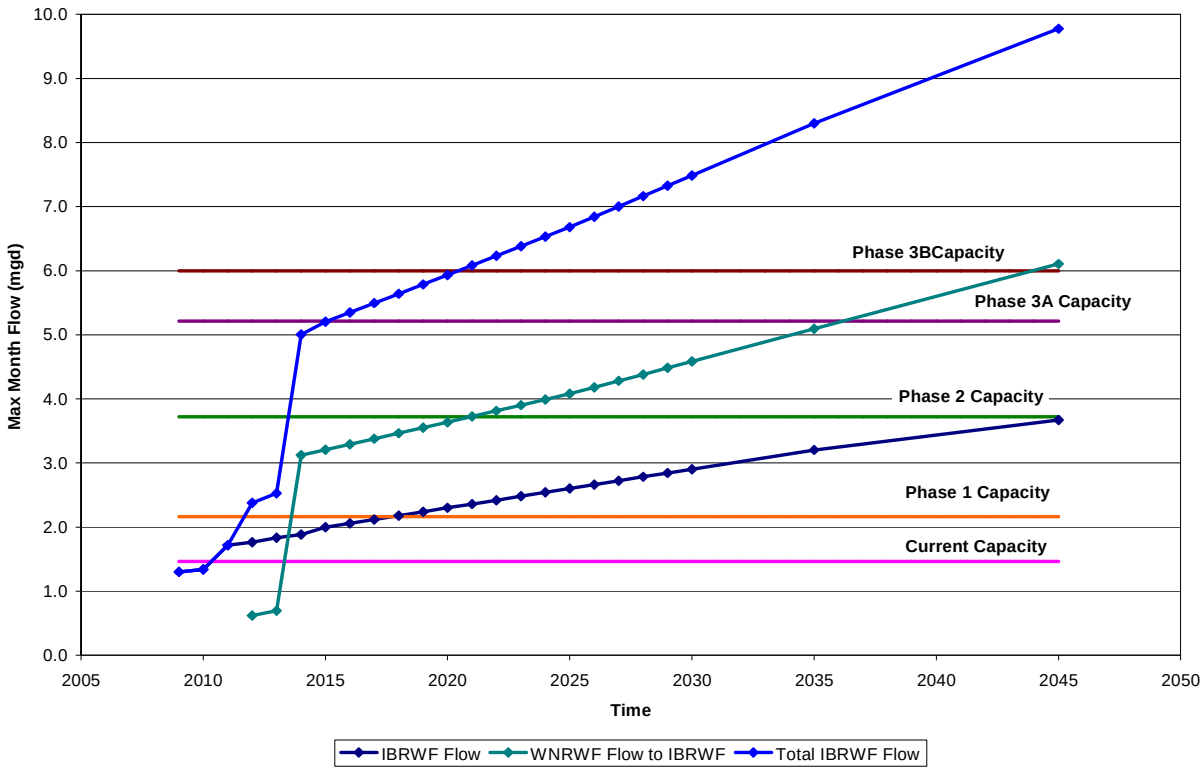


Figure 9.4-1: Scenario C IBRWF Projected Flows and Expansion Timeline

This timeline assumes that the RBSTP will start sending raw wastewater to WBRWF in 2014. If RBSTP starts transferring war wastewater prior to 2014, the IBRWF will need to expand sooner. This situation would most likely dictate simultaneous construction of multiple expansion phases. Under this scenario, the ultimate projected wastewater flow to the IBRWF cannot be accommodated by spray irrigation at the existing site.

9.5 SCENARIO D

Alternative 2A is chosen for Scenario D. In this scenario the RBSTP will continue treating wastewater and will send the treated effluent directly into the WNRWF effluent storage lagoon to be discharged via spray irrigation. The other WNRWF contributing entities (GC, WRESSD, etc) and WRESSD contributions will be limited to

approximately 0.8 mgd year round, and all excess flow will be transferred to IBRWF for treatment and disposal. Table 9.5-1 shows the contributing entities and their associated flows to IBRWF.

Table 9.4-1: Scenario D 2030 Projected Influent Flowrates to IBRWF

Service Districts	Max Month ADF (mgd)(1)	Summer ADF (mgd)(2)	Winter ADF (mgd)(3)	Annual ADF (mgd)(4)
LNSSD	1.8	1.7	1.08	1.4
OOSSD	0.48	0.45	0.28	0.36
ANSSD	0.50	0.47	0.30	0.37
HCSSD	0.09	0.08	0.05	0.06
WNRWF(5)	3.6	3.4	2.3	2.7
Total	**6.5**	**6.1**	**4.0**	**4.8**

Notes:

1. Max month ADF based on growth projecting using 150 gpd/ EDU for existing EDUs and future connections.
2. Summer ADF determined by applying observed IBRWF 1.1:1 max month ADF to summer ADF ratio to projected max month ADF.
3. Winter ADF determined by applying observed IBRWF 1.6:1 summer ADF to winter ADF ratio to projected summer ADF.
4. Annual ADF determined by applying observed IBRWF 1.4:1 max month ADF to annual ADF ratio to projected max month ADF.
5. WNRWF flows are determined using observed seasonal flow ratios (Table 3.2-3).

The ultimate projected wastewater flow to the IBRWF under this scenario is 15.9 mgd on a maximum month basis.

This scenario sends the second most wastewater to IBRWF; scenario C sends approximately 1 more. WNRWF would start sending wastewater in excess of 1.8 mgd on an annual average basis (2.3 mgd during the maximum month) to the IBRWF once the transfer pump station and force main are constructed, assumed to be 2012; both Phases 1 and 2 will be required by that time. The will RBSTP begin sending treated effluent to the WNRWF for disposal by 2014. At this time, the WNRWF only continue to treat and discharge 0.8 mgd, all excess wastewater will be sent to Inland Bays. This will increase the total wastewater influent at IBRWF to 4.1 mgd, requiring the Phase 3 upgrade to be completed by this time. Depending on the schedule for the RBSTP to stop discharging to the Lewes-Rehoboth Canal, this timeline could be further accelerated. Given the

schedule proximity of the necessary expansions, some cost savings could be gained by designing and constructing multiple phases simultaneously. Under this scenario, the total influent to the IBRWF is 6.5 mgd in 2030, which will require an additional expansion. Additional treatment and disposal capacity will be required to treat the ultimate build out projected influent flowrate of 15.9 mgd. Figure 9.5-1 illustrates this expansion timeline with the associated flows.

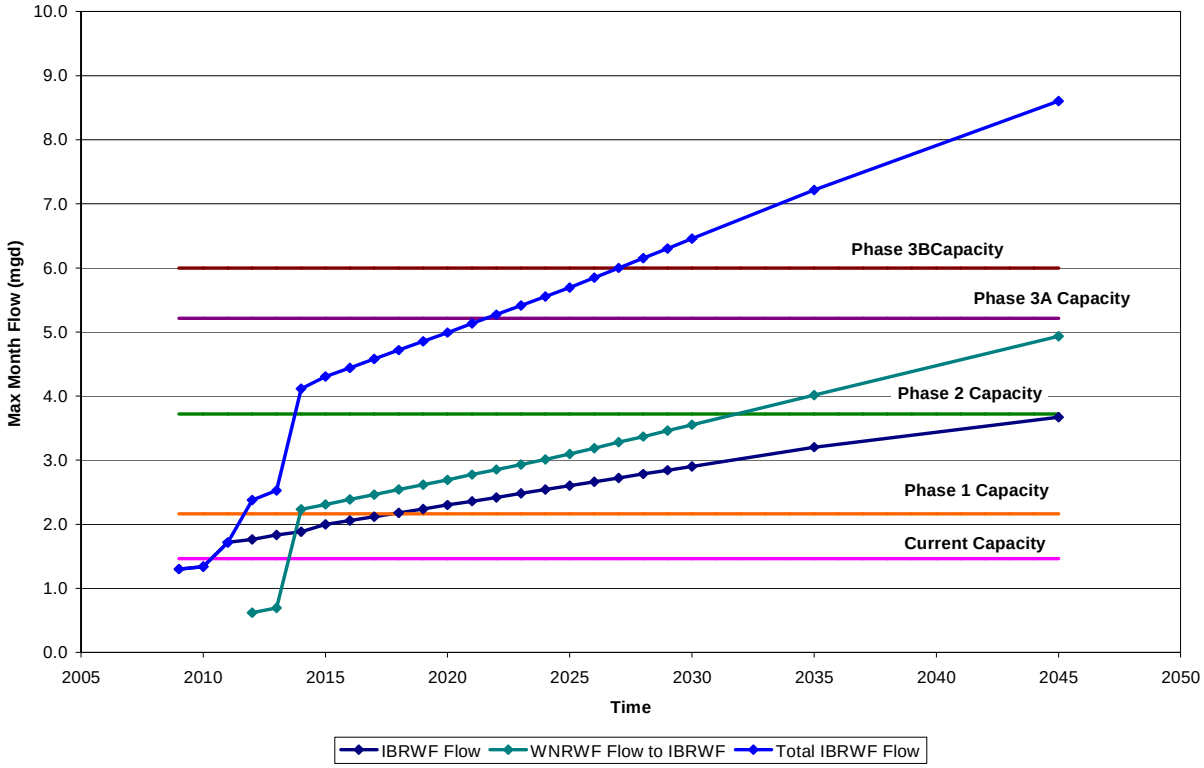


Figure 9.5-1: Scenario D IBRWF Projected Flows and Expansion Timeline

Under this scenario, the ultimate projected wastewater flow to the IBRWF cannot be accommodated by spray irrigation at the existing site.

9.6 PLANNED IMPROVEMENTS FOR THE INLAND BAYS RWF

As described in Section 9.1 the County is beginning the design of upgrading and expanding the IBRWF. The planned improvements for the treatment facility will enable the IBRWF to achieve biological nutrient removal and increase its treatment and disposal capacity. Please reference the Inland Bays PER for more detailed information about the improvements planned for the facility.

To enable the facility to handle increased influent flows, the headworks will be expanded to add an additional mechanical screen as part of each expansion phase. A grit removal system will be installed as part of the Phase 2 expansion.

To achieve biological nutrient removal, each phase of expansion will convert one existing partially aerated treatment lagoon into two phased-aeration treatment lagoons. Circular clarifiers will be constructed (two in Phase 1, one each in Phases 2 and 3) to separate the activated sludge from the wastewater. Clarified effluent will be disinfected via chlorination in a new chlorine contact tank. The treated wastewater will enter effluent lagoons to be stored until it can be discharged via spray irrigation.

Phase 2 expansion will include solids handling facilities capable of achieving Class A biosolids. Waste sludge will be pumped to holding lagoons to achieve preliminary thickening. Thickened sludge will subsequently undergo dewatering (likely by a belt filter press) and lime pasteurization. The treated biosolids will be dried and stored as cake to be distributed to regional farmers.

Auxiliary improvements will also be constructed as necessary. This includes structures such as the distribution boxes for the raw influent and clarifiers, chemical storage, sludge pumping stations, and an improved electrical and process control infrastructure.

Inland Bays Upgrade and Expansion Preliminary Cost Estimates

This section discusses the methodology and presents the capital costs for the recommended improvements for Phase 1 through 3 expansions. All dollar amounts are presented in year 2009 dollars.

Several different sources of information were consulted to develop the capital cost estimations. Where recent contractor bids or vendor proposals are available for similar projects, they have been used. If neither contractor bids nor proposals are available, quantity takeoffs were computed based on the conceptual designs described in this chapter and the Inland Bays PER.

Costs described in this section are based on conceptual design. As such, a level of detail appropriate to such a design was considered during the development of costs. Conceptual design does not provide the resolution needed for quantification of all construction materials. In recognition of this fact, percentages of construction cost have been applied to such items as piping, electrical, and site work. The percentages used for these items are summarized below:

- A 10% contingency was included with all construction costs.
- Yard Piping: 9% of subtotal.
- Electrical: 20% of subtotal.
- Planning, Engineering, and Administrative Services: 22% of subtotal.

In addition to the percentages listed above, several other assumptions had to be made regarding the construction of the facilities. Major assumptions made during this process are bulleted below:

- Distribution boxes for unit processes would be constructed during Phase 2 for the Phase 3B design flows to simplify future construction.
- Solids handling facilities will be built in Phase 2 and sized to accommodate Phase 3B

flows.

- The grit removal system will be built in Phase 2 to handle Phase 3B flows.
- A new building would be constructed during Phase 1 for the sodium hypochlorite disinfection system and would include space provisions for future bulk storage tanks and chemical feed systems.
- It was assumed piles would not be required under concrete structures, based on our experience with other facilities constructed in the area.

Phase 3B specific costs were not developed because most of the required process expansions are included in previous phases. There is not sufficient site information for Phase 3B to develop detailed costs for effluent storage and disposal.

Tables 9.6-1 through 9.6-3 summarize the costs for the IBRWF Phase 1 through 3 expansions, respectively.

Table 9.6-1: Cost Summary for Phase 1 Expansion

DESCRIPTION	ESTIMATED COST
Screening	$540,000
Biolac Treatment System (Convert Treatment Lagoon No. 1)	$1,800,000
Secondary Clarifiers	$1,650,000
RAS/ WAS Pump Station	$370,000
Chlorine Contact Tank	$270,000
Chemical Feed System	$570,000
New Storage Lagoon	$1,700,000
Irrigation Pumping Station	$1,070,000
Subtotal	**$8,000,000**
General Site Work @ 3% of Subtotal	$240,000
Yard Piping @ 9% of Subtotal	$720,000
Electrical/Controls @ 20% of Subtotal	$1,600,000
Startup/Testing @ 2% of Subtotal	$160,000
Parcels #12 and # 19 Spray Field Development	$560,000
Subtotal	**$11,300,000**
Construction Contingencies @ 10% of Subtotal	$1,100,000
Total Construction Cost (Year 2009 Dollars)	**$12,400,000**
Project Costs @ 22% of Construction Cost	$2,700,000
Total Project Costs (Year 2009 Dollars)	**$15,100,000**

Table 9.6-2: Cost Summary for Phase 2 Expansion

DESCRIPTION	ESTIMATED COST
Screening	$540,000
Grit Removal	$880,000
Influent Dist Box	$370,000
Biolac Treatment System (Convert Treatment Lagoon 2)	$1,800,000
Secondary Clarifier Distribution Box	$370,000
Secondary Clarifiers	$1,070,000
RAS/ WAS Pump Station	$370,000
Chlorine Contact Tank	$400,000
New Storage Lagoon	$2,610,000
Irrigation Pumping Station	$870,000
Solids Handling System	$3,920,000
Waste Sludge Holding Lagoon (Convert Lagoon 3)	$690,000
Cake Storage Building	$370,000
Administration Building Expansion	$740,000
Subtotal	**$15,000,000**
General Site Work @ 3% of Subtotal	$450,000
Yard Piping @ 9% of Subtotal	$1,350,000
Electrical/Controls @ 20% of Subtotal	$3,000,000
Startup/Testing @ 2% of Subtotal	$300,000
FM to Spray Field #10	$195,000
Parcel # 10 Spray Field Development	IBRWF
Subtotal	**$20,300,000**
Construction Contingencies @ 10% of Subtotal	$2,000,000
Total Construction Cost (Year 2009 Dollars)	**$22,300,000**
Project Costs @ 22% of Construction Cost	$4,900,000
Total Project Costs (Year 2009 Dollars)	**$27,200,000**

Note:

1. Budgetary cost allocation provided by Sussex County. Conceptual design of these components has not been completed.

Table 9.6-3: Cost Summary for Phase 3A Expansion

DESCRIPTION	ESTIMATED COST
Screening	$540,000
Biolac Treatment System (Convert WAS Lagoon)	$1,200,000
Secondary Clarifiers	$1,070,000
Chlorine Contact Tank	$290,000
New Storage Lagoon	$2,300,000
Irrigation Pumping Station	$1,170,000
Waste Sludge Holding Lagoons	$1,540,000
Subtotal	**$8,100,000**
General Site Work @ 3% of Subtotal	$240,000
Yard Piping @ 9% of Subtotal	$730,000
Electrical/Controls @ 20% of Subtotal	$1,620,000
Startup/Testing @ 2% of Subtotal	$160,000
Cordrey Parcel Spray Field Development	$1,840,000
Subtotal	**$12,700,000**
Construction Contingencies @ 10% of Subtotal	$1,300,000
Total Construction Cost (Year 2009 Dollars)	**$14,000,000**
Project Costs @ 22% of Construction Cost	$3,100,000
Total Project Costs (Year 2009 Dollars)	**$17,100,000**

10. SUSSEX COUNTY/REHOBOTH BEACH COST SHARING MODEL

This chapter will present the cost sharing model developed between the City of Rehoboth and Sussex County for the six identified treatment and disposal alternatives. This cost model was developed to estimate the financial implications of each of these alternatives to Sussex County and the City of Rehoboth Beach. Flow schematics and associated descriptions for each of the six alternatives (Alt. 1A, 1B, 2A, 2B, 3, and 4) previously discussed are provided. In addition, as discussed in the following sections, a 7th alternative (Alternative 4B) has been added for cost sharing discussion purposes.

- **Alternative 1A/1B:** The RBSTP shuts down and sends all of its raw wastewater to the WNRWF, which will treat as much wastewater as possible and send the excess to another facility to be treated. The excess wastewater will be treated by the County owned and operated Inland Bays Regional Wastewater Facility (Alt 1A) or a Private Wastewater Provider (PWWP) (Alt 1B).

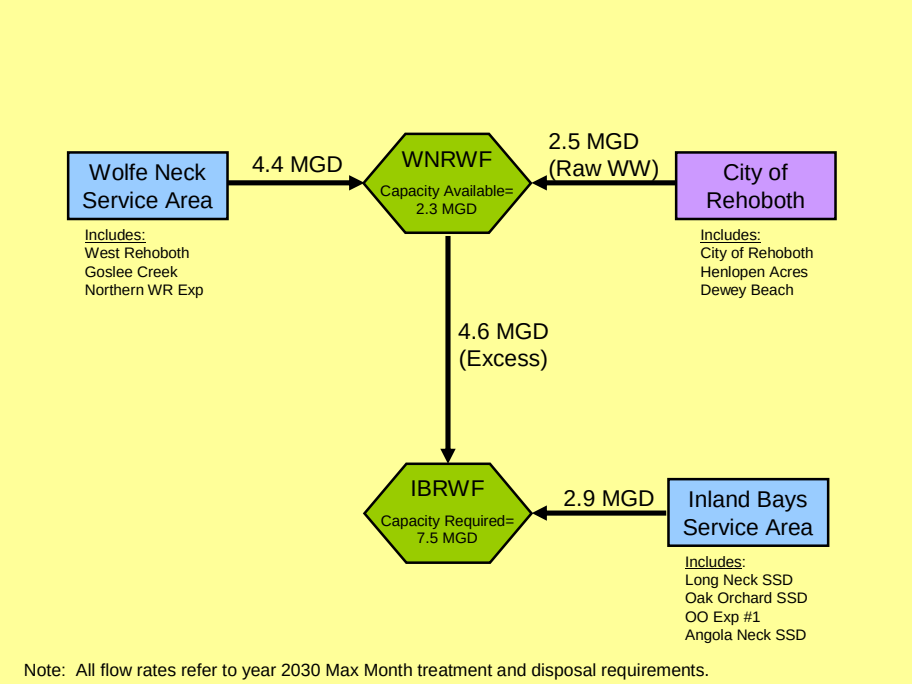


Figure 10-1: Alternative 1A Flow Distribution Diagram

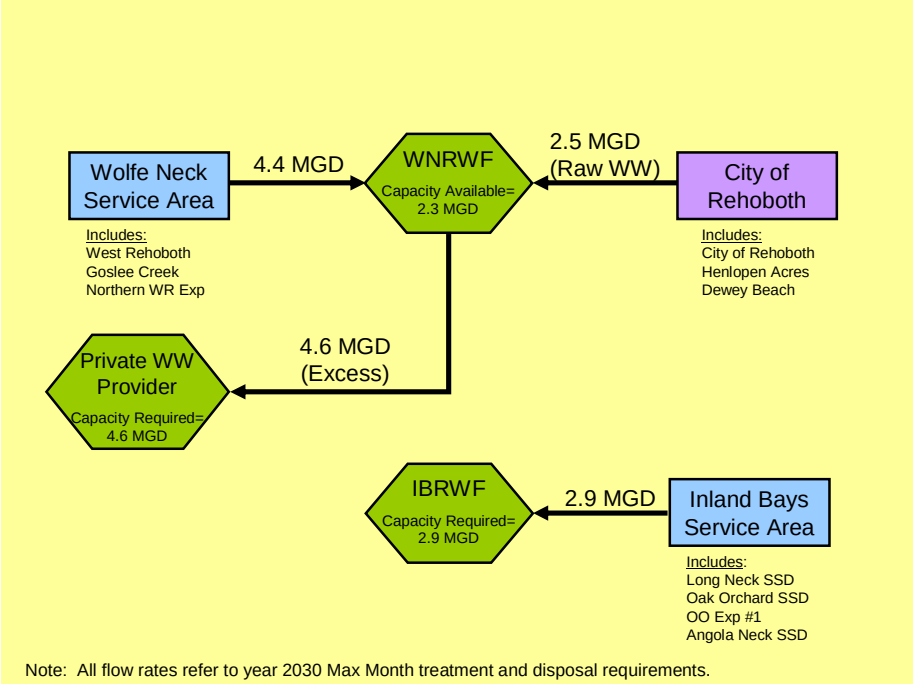


Figure 10.1-2: Alternative 1B Flow Distribution Diagram

- **Alternative 2A/2B**: The RBSTP remains in service and sends its treated effluent to the WNRWF for disposal via spray irrigation. A reduced amount of WNRWF influent wastewater from its service area will continue to be treated at that facility, with all excess being sent to either to the Inland Bays Regional Wastewater Facility (Alt 2A) or a PWWP (Alt 2B).

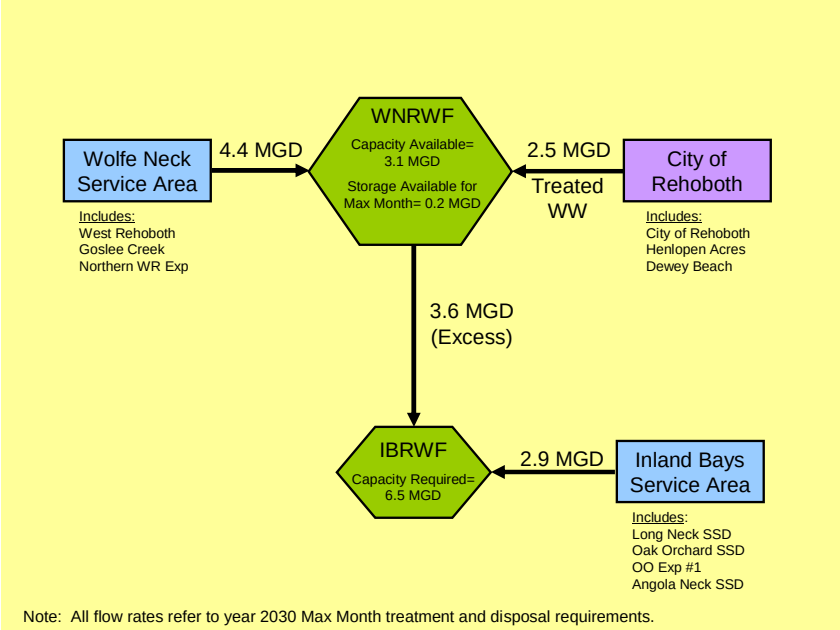


Figure 10.1-3: Alternative 2A Flow Distribution Diagram

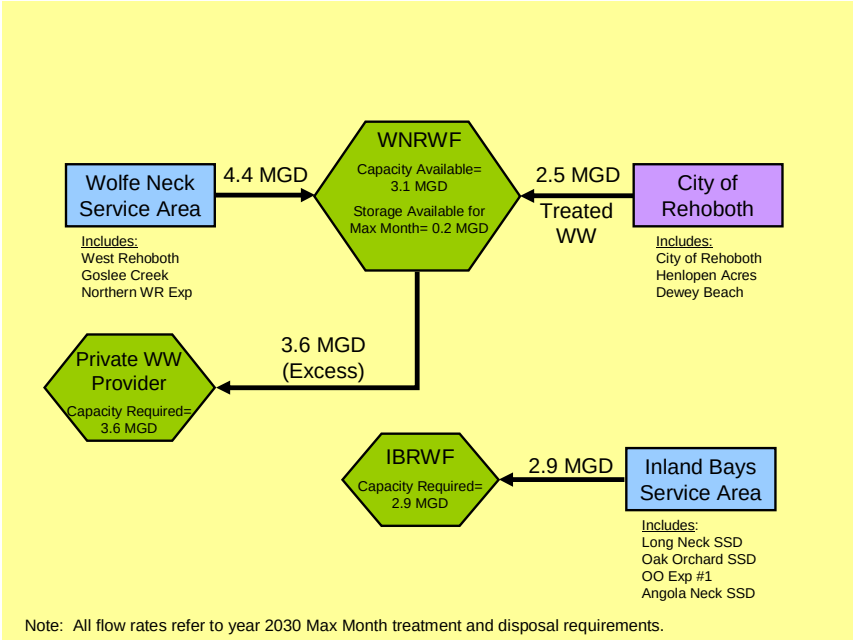


Figure 10.1-4: Alternative 2B Flow Distribution Diagram

- **Alternative 3**: The RBSTP remains in service and discharges treated effluent via an ocean outfall. In this scenario, the County will continue treating and disposing wastewater via land application at its existing facilities. The WNRWF will

remain in service and continue treating and disposing wastewater from its service area. Any excess flow to the WNRWF above the capacity of the facility will be sent to the IBRWF for treatment and disposal.

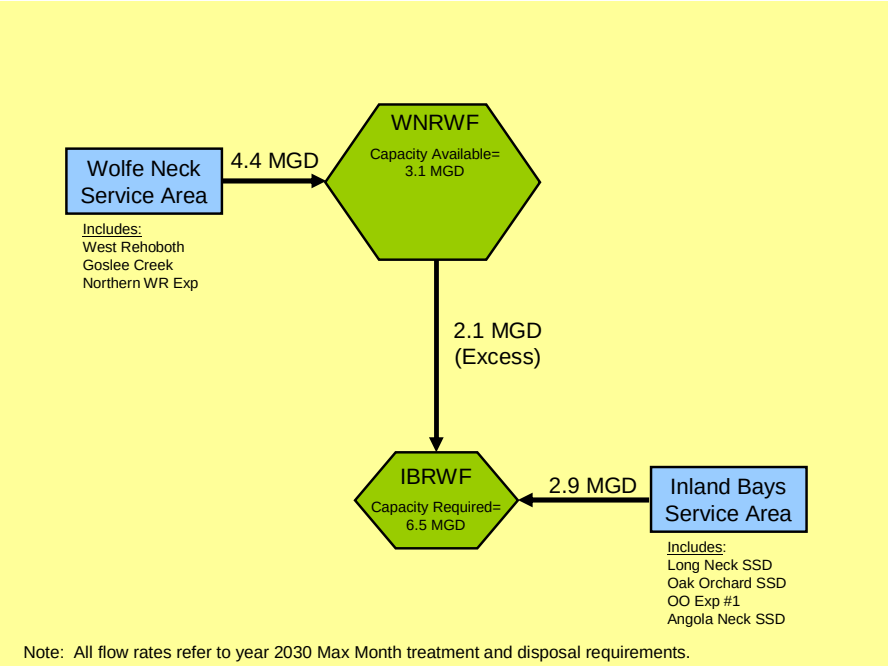


Figure 10.1-5: Alternative 3 Flow Distribution Diagram

- **Alternative 4**: The RBSTP remains in service and discharges treated effluent via an ocean outfall. The County continues to treat wastewater via land application at the WNRWF. The WNRWF will expand and upgrade its treatment capacity. Treated wastewater that exceeds the WNRWF disposal capacity will be pumped to the Rehoboth ocean outfall for disposal.

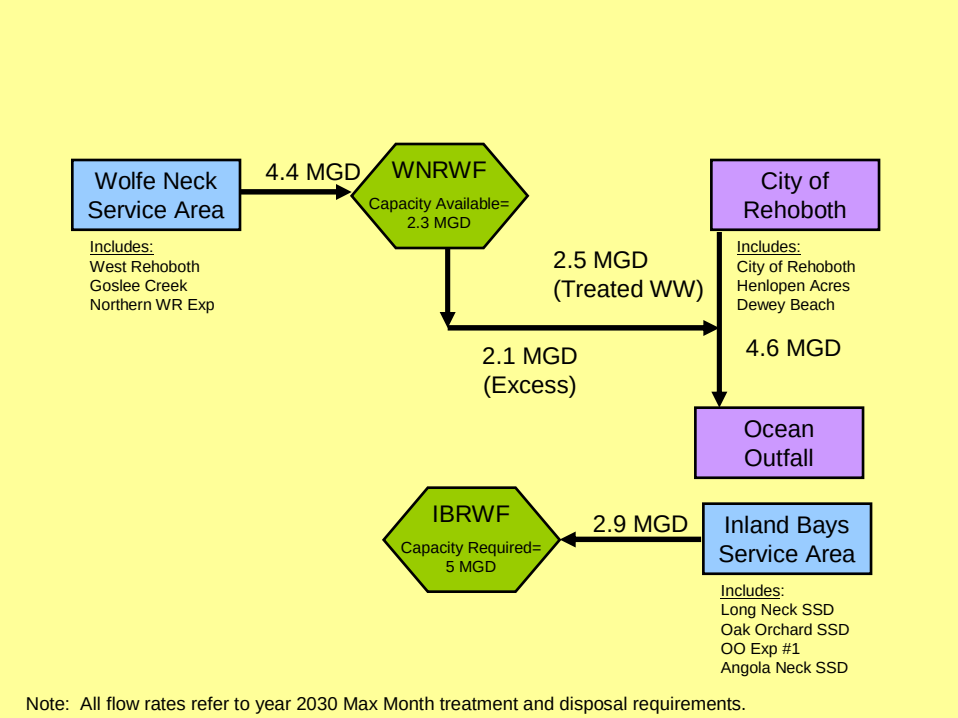


Figure 10.1-6: Alternative 4 Flow Distribution Diagram

- **Alternative 4B**: Alternative 4B is the same treatment and disposal concept as Alternative 4, with the exception of what flows are used for the cost sharing analysis. All other alternatives use the maximum month 2030 year flows. Alternative 4B uses buildout maximum month flows.

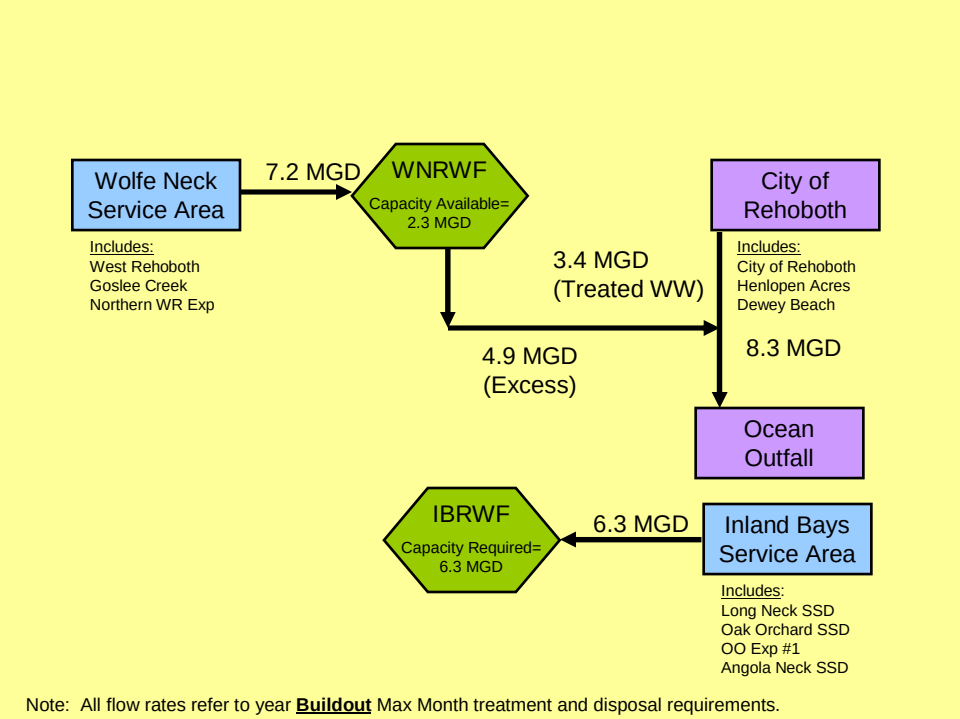


Figure 10.1-7: Alternative 4B Flow Distribution Diagram

10.1 ANNUAL USERS COSTS

Total annual user costs for each alternative were evaluated based on anticipated initial capital costs, the associated project costs and contingencies, contract service costs associated with the private provider option and the long term operation and maintenance costs. All of these components are discussed in the following sections.

10.1.1 CAPITAL COSTS

Each of the seven alternatives has specific required conveyance and treatment/disposal components. Capital costs associated with each of these components were discussed in the previous chapters as follows:

- Chapter 5: Rehoboth to WNRWF Conveyance Costs
- Chapter 7: WNRWF Upgrades Costs

- Chapter 8: WNRWF to IBRWF/PWWP Conveyance Costs
- Chapter 9: IBRWF Upgrades

The following Table 10.1.1-1 summarizes the capital cost components used for the cost sharing analysis.

Table 10.1.1-1: Summary of Capital Cost Components for Cost Sharing Analysis

Item #	Description	Chapter Discussed
1	RBSTP Pumping Station	5
2A	Force Main from RBSTP to WNRWF (Option #1)	5
2B	Force Main from WNRWF to Rehoboth (Option #1)	8
3A	Rehoboth Treatment Upgrades	NA (1)
3B	Rehoboth FM to Ocean Outfall	NA (1)
3C	Rehoboth Ocean Outfall	NA (1)
4	WNRWF Upgrades	7
5	WNRWF Headworks Upgrades	7
6	WNRWF to IBRWF/PSP P.S.	8
7	Force Main to IBRWF (Option #3)	8
8	IBRWF Phase 2 Upgrades	9
9	IBRWF Phase 3 Upgrades	9
10	IBRWF Phase 4 Upgrades	9
11A	Force Main to Cave Neck Road	8
11B	Force Main from Cave Road to PWWP	8

Notes:
(1) From 2009 Rehoboth Beach Alternative Discharge Evaluation

As described in Chapters 5 and 8, for several of the alternatives, there were several alignment options reviewed. For the cost sharing analysis it was assumed that the recommended alignment would be implemented. Items indicated in parentheses, such as for the Force Main to WNWRF (Option 1), are in reference to the alignment options recommended in the other sections.

All costs for the IBRWF Phase 1 Expansion were excluded from this analysis. The Phase 1 expansion is currently in the design phase and is primarily being implemented to service customers in the existing IBRWF service area and is therefore independent of this cost sharing analysis.

10.1.2 PROJECT COSTS AND CONTINGENCIES

Additional project costs and contingencies associated with each alternative included the items listed in Table 10.1.2-1

Table 10.1.2-1: Project Cost Components for Cost Sharing Analysis

Item #	Description
12	PWWP Treatment and Disposal
13	Land/Easements
14A	10% Contingency (All Items Except Ocean Outfall and RBSTP)
14B	15% Contingency (Ocean Outfall and RSTP Upgrade Only)
15	Engineering and Administration
16	Permitting (Ocean Outfall Only) (5%)

Costs for Item 12 were based on the Private Wastewater Provider's Contract Proposal received by the County in December 2008.

For Item 13, if either Alternative 1A and 2A was implemented, the City of Rehoboth Beach would be required to reimburse the County for its equivalent amount of land required for disposal. This value has been estimated at $11.25M for 450 acres of land at $25,000 per acre. Easement costs and engineering costs for the PWWP alternatives (Alternatives 1B and 2B) were based on the December 2008 PWWP proposal. There are no land sharing costs associated with Alternative 3 (Rehoboth outfall) or Alternative 4 (combined ocean outfall).

As indicated in Table 10.1.2-1, a 10% contingency was included for all capital costs items, with the exception of Rehoboth items #3A and #3C. As specified by the City of Rehoboth, a 15% contingency was applied to these two items per the Rehoboth Beach Alternative Discharge Evaluation. The outfall permitting costs were also in accordance with the Rehoboth Beach Alternative Discharge Evaluation.

Engineering and administration costs were allocated as 22% of construction costs, with the exception of the PWWP, which was based on the Private Wastewater Provider's Contract Proposal.

10.1.3 COST SHARE PERCENTAGES

Cost share percentages were calculated for each project cost line item. In general, cost percentages were calculated based on the 2030 maximum month average daily flow associated with each line item. As such, the City of Rehoboth Beach will be responsible for 100% of the RBSTP pumping station and the associated force main to the WNRWF. The cost for the WNRWF transfer pumping station, its associated force main, and any treatment/disposal costs will be split between the County and the City of Rehoboth Beach on a 2030 maximum month flow rated basis unless noted below.

1. All costs for the WNRWF headworks upgrade are split on a flow rated basis, with the exception of Alternatives 2A and 2B (treated effluent alternatives). For these alternatives, the treated effluent from Rehoboth is only disposed of and bypasses the WNRWF headworks facility. Therefore, Rehoboth would not share in any of the headworks upgrades costs.
2. For treatment costs associated with Alternatives 1A and 2A, the City of Rehoboth is displacing disposal capacity at County facilities for County sewer customers and would be responsible for the applicable costs of treatment and disposal capacity at the IBRWF. For example, in Alternative 1A, the County would provide Rehoboth 2.5 mgd of treatment/disposal capacity. Phase II upgrades will increase the IBRWF's treatment and disposal capacity from 2.0 mgd to 3.7 mgd (max month). Phase III upgrades will increase the plant capacity from 3.7 mgd to 5.2 mgd. It was assumed that the City of Rehoboth would be responsible for 100% of Phase II upgrades, and 53% (or 0.8 mgd) of Phase III upgrades.
3. As discussed previously, for Alternative 4B, the buildout maximum month is used to calculate flow splits associated with the Rehoboth effluent force main and

ocean outfall. This changes the County/City flow split from 46/54 for Alt 4 to 59/41 for Alt 4B.

Tables summarizing the resulting percentages used for all seven alternatives (Alt. 1A, 1B, 2A, 2B, 3, 4, and 4B) are included in Appendix L.

10.1.4 OPERATION AND MAINTENANCE COSTS

Annual operation and maintenance costs were estimated for each alternative. For all $/gallon Sussex County annual costs, a value of 450 mg/year was used as the average annual flow for the current 2030 planning period. For all $/gallon PWWP annual costs, a value of 730 mg/year was used. This is based on a minimum 2 mgd annual average charge required by the PWWP. Table 10.1.4-1 summarizes each of these components.

Table 10.1.4-1: O&M Components for Cost Sharing Analysis

Item	Cost/Year	Applicable Alternatives
Rehoboth - Plant Operations	$1,590,000	All
Rehoboth – Collection System	$150,000	All
Sussex County WNRWF Pump Station Maintenance	$100,000	Alt 1A, 1B
Sussex County Operations and Maintenance –Treatment and Disposal	$5.08/1,000 gal	Alt 1A
Private Service Provider - Treatment and Disposal (1)	$6.84/1,000 gal	Alternative #1B, #1C
Sussex County Operations and Maintenance- Conveyance Only to PWWP	$1.21/1000 gal	Alternative #1B, #1C
Sussex County Operations and Maintenance- Conveyance System (Disposal Only) (2)	$2.00/1,000 gal	Alt 2A
Rehoboth - Pump Station, FM and Outfall	$150,000	Alt 3 & 4,4B

Notes:
(1) The agreement specifies an annual increase of 3% or the CPI, whichever is greater.
(2) Includes WNWRF PS maintenance.

10.2 PROJECTED USER RATES

Based on the estimated capital costs, O&M costs, and cost share percentages, Rehoboth's anticipated user rates were calculated for each of the alternatives. Rehoboth's rates were calculated assuming 56.3% of all plant operations costs and 92.5% of all collection system costs were paid for by Rehoboth customers. The remainder of costs (43.7% and 7.5% respectively) will be paid for by County customers (i.e. Dewey Beach, Henlopen Acres, and North Shore) that are served through the Rehoboth system. These percentages were estimated in the Rehoboth Beach Alternative Discharge Evaluation based on flow contributions from each entity. User rates were calculated assuming a 20 year loan at a 4.4% interest rate, which was the financing option presented in the Rehoboth Beach Alternative Discharge Evaluation.

Table 10.2-1 on the following page provides a summary of the resulting County/Rehoboth Costs, as well as the anticipated Rehoboth User Rates. Backup tables for all alternatives are provided in Appendix L.

An additional financing option to the one presented in the Rehoboth Beach Alternative Discharge Evaluation was also evaluated. This option assumes 1/3 of the loan is financed for 20 years at a 4.4%, with the remaining 2/3 of the loan financed for 40 years at 5%. Table 10.2-2 provides a City of Rehoboth user rate comparison for the two financing options.

Table 10.2-1: Impacts of Alternatives on City of Rehoboth User Rates [(1) (2)]

Alt.	Description	Total Project Cost ($ M)	County Cost Share ($ M)	Rehoboth Cost Share ($ M)	Annual Capital Cost - Rehoboth	Annual Maintenance Cost- Rehoboth	**Rehoboth User Rates**
#1A	Raw Wastewater Pumped to WNRWF with Disposal at IBRWF	$112	$44	$68	$2,900,000	$1,500,000	$1,160
#1B	Raw Wastewater Pumped to WNRWF with Disposal at Private Service Provider	$100	$50	$50	$2,100,000	$3,300,000	$1,430
#2A	Treated Effluent Pumped to WNRWF with Disposal at IBRWF	$103	$48	$54	$2,300,000	$1,500,000	$1,010
#2B	Treated Effluent Pumped to WNRWF with Disposal at Private Service Provider	$91	$54	$37	$1,600,000	$3,800,000	$1,420
#3	Rehoboth Pumps to Ocean Outfall Alternative with County Pumping to IBRWF	$94	$64	$30	$1,300,000	$1,100,000	$630
#4	Rehoboth and County Pump to Common Outfall with County Continuing to use IBRWF for Southern Service Area (2030 Max. Month)	$87	$64	$23	$1,000,000	$1,100,000	$550
#4B	Rehoboth and County Pump to Common Outfall with County Continuing to use IBRWF for Southern Service Area (Buildout Max. Month)	$87	$68	$19	$800,000	$1,100,000	$500

Notes:
(1) All annual capital costs, maintenance costs, and users rates are based on 4.4% for 20 years.
(2) All total project costs, annual costs and user rates are rounded to the nearest $1M, $0.1M, and $10 respectively.

Table 10.2-2 : Comparison of Financing Options (1)

Alt.	Description	Rate/Year: (SRF 4.4% for 20 years)	Rate/Year: 1/3 SRF @ 4.4% for 20 years & 2/3 RD @ 5% for 40 years
#1A	Raw Wastewater Pumped to WNRWF with Disposal at IBRWF	$1,160	$1,040
#1B	Raw Wastewater Pumped to WNRWF with Disposal at Private Service Provider	$1,430	$1,340
#2A	Treated Effluent Pumped to WNRWF with Disposal at IBRWF	$1,010	$920
#2B	Treated Effluent Pumped to WNRWF with Disposal at Private Service Provider	$1,420	$1,360
#3	Rehoboth Pumps to Ocean Outfall Alternative with County Pumping to IBRWF	$630	$580
#4	Rehoboth and County Pump to Common Outfall with County Continuing to use IBRWF for Southern Service Area (Based on 2030 max. Month)	$550	$510
#4B	Rehoboth and County Pump to Common Outfall with County Continuing to use IBRWF for Southern Service Area (Based on Buildout max. Month)	$500	$470

Notes:
(1) Rates have been rounded to the nearest $10.

Table 10.2-3 provides a summary of the resulting impact on County User Rates for Alternatives 2, 3 and 4.

Table 10.2-3 : Impacts of Alternatives on County Rates

	Dewey Beach User Rates		Henlopen Acres User Rates		City of Rehoboth Beach User Rates	
Alternative	Existing Rate	New Rate (1)	Existing Rate	New Rate (1)	Existing Rate	New Rate (2)
#2A	$350	$770	$588	$1,460	$325	$1,010
#2B	$350	$1,210	$588	$1,750	$325	$1,420
#3	$350	$540	$588	$1,030	$325	$630
#4	$350	(3)	$588	(3)	$325	$550
#4B	$350	(3)	$588	(3)	$325	$550

Notes:
(1) New rates have been rounded to the nearest $10 and are based on a 40 year loan at 5%,
(2) New rates have been rounded to the nearest $10 and are based on a 20 year loan at 4.4%,
(3) Not evaluated to date

10.3 CONCLUSIONS

Based on the analysis conducted for this study, the following observations are provided.

10.3.1 ALTERNATIVES 1A AND 2A (COUNTY SPRAY ALTERNATIVES)

If spray irrigation is chosen as the method of treatment and disposal by Rehoboth, it appears that Alternative 2A (treated effluent) would be the most cost effective alternative. The main advantage of Alternative 1A would be that the City of Rehoboth could take their existing treatment plant off-line; However the lost treatment capacity would have to be reconstructed elsewhere as a result. Alternative 2A is less expensive from a user rate standpoint.

10.3.2 ALTERNATIVES 1B AND 2B (PWWP ALTERNATIVES)

A public/private partnership with a PWWP (Alt 1B or 2 B) does not appear to be cost effective as compared to other alternatives from a user rate perspective. While the initial capital costs are lower, the long term service agreement and O&M costs create user rates that are significantly higher for Alt. 1A and 1B as compared to all other alternatives. Some additional unknowns with the PWWP include:

- Future cost increases. Per the draft proposal provided by Artesian, for 3 years from the initial service date, the initial bulk rate (i.e. $6.84/ 1,000 gallons) will be adjusted for inflation at a variable rate. This variable rate will be either 3% or the % change in the consumer price index over the 3 year time period, whichever is greater. After this 3 year period, a cost of service adjustment could be requested from the Public Service Commission to further rate increases. Neither inflation nor potential cost increases have been accounted for in this analysis.
- Term of conditions. The term of conditions is 25 years.

- Minimum flow rate: The draft proposal requires a minimum annual flowrate of 2.0 mgd (or 730 mgal/year). The projected 2030 annual average flow rates for the RBSTP and the WNRWF are 1.40 mgd and 2.15 mgd respectively, for a total annual average of 3.55 mgd. The annual average treatment and disposal capacity used in this analysis for the WNRWF is 1.8 mgd. Thus, unless treatment and disposal is reduced at the WNRWF, the annual average being sent to the PWWP in year 2030 would be 1.75 mgd (or 639 mgal/year) and the County would never reach, but would still be paying fees associated with the minimum annual flowrate throughout the current 2030 planning period.

10.3.3 ALTERNATIVES 3, AND 4/4B (OCEAN OUTFALL ALTERNATIVES)

For the City of Rehoboth, the most cost effective alternative appears to be the combined ocean outfall (Alt. 4 or 4B). The inclusion of the County provides an opportunity for cost sharing and a reduction in user rates as compared to all the other alternatives. However, there may be other non-economic factors such as public perception or permitting which may impact the City's final decision.

For the County, the costs of for a combined ocean outfall verses conveyance and treatment/disposal at the IBRWF (Alternative 3) are essentially equal. However, all costs incurred by the City have an impact on user rates for County customers served through the City. Other general pros and cons for Alternatives 3 and 4 are as follows:

- Alternative 4/4B would provide the County with multiple methods of disposal (land disposal and ocean discharge).
- The County has already made a capital investment in land at the IBRWF. Buildout flow projection estimates for the current IBRWF service area range from 6.3 to 9.5 mgd on a maximum month basis depending on future flow/EDU contributions. Based on preliminary estimates, the disposal capacity of the lands purchased by the County is 13 mgd. If Alternative 4/4B is implemented, there

may be excess lands, which could potentially be used to provide sewer service to new areas or partner with other entities. Conversely, total buildout flows from the IBWRF and WNRWF service areas have been projected to be between 13.5 to 20.2 mgd depending on future flow/EDU contributions.

- An advanced wastewater treatment plant train with an ocean outfall (Alt 4/4B) is typically more reliable than a lagoon treatment/spray irrigation system (Alt 3) based on factors such as weather and variable soil conditions introducing higher uncertainties for spray irrigation disposal.
- The long term O&M will likely be less for Alternative 4/4B. While the cost analysis model developed did incorporate a level of O&M costs, specific costs such as increased energy consumption were not accounted for. For example, due to its longer pumping distance and greater total dynamic head (TDH), Alternative 3's energy costs would be expected to be 50% higher than Alternative 4/4B due to longer pumping distances. Based on the information on pump sizes given in Chapter 8, this corresponds to an increase in County energy costs of approximately $20K/year for Alternative 3 as compared to Alternative 4/4B. Other O&M costs such as utility locating responsibilities and maintenance of force main appurtenances would also be expected to be higher.
- This current analysis was through year 2030. Future upgrades beyond 2030 will likely be higher for Alternative 3 as compared to 4/4B. This is due to the fact that the ocean outfall and effluent force main are assumed to be sized for buildout flows. So while 16,000 l.f. of future parallel force main would be required from the WNRWF to Rehoboth, a majority and the most costly portion of the WNRWF conveyance system would already be constructed. For Alternative 3, a future parallel 69,000 l.f. of force main from the WNRWF to the IBRWF would be required.
- For Alternative 3, the County could review upsizing the WNRWF to IBWRF force main. Based on information provided in Chapter 8, the buildout force main would be required to handle anywhere from 7.4 to 12.8 mgd based on future flow contributions. This would require a 30 to 36-inch force main, which would have

very low initial velocities, likely creating additional O&M issues. For Alternative 4/4B, while the currently proposed 36 to 42-inch effluent force main and ocean outfall is not ideal, there will be two sources of initial wastewater which will create a larger base flow. In addition, the effluent force main and ocean outfall are both conveying treated wastewater. So presumably, sedimentation issues from lower initial velocities should not be as big an issue as compared to Alternative 3.

APPENDIX A

Rehoboth Sewage Treatment Plant Data and Future Flows

Appendix A:

Table A-1 Rehoboth Beach Sewage Treatment Plant Flow Data 2005-2008

Date	Rehoboth Beach		Dewey Beach		Henlopen Acres		North Shores		Total Rehoboth Beach Service Area		
	Monthly Flow (MG)	Average Daily Flow (mgd)	Monthly Flow (MG)	Average Daily Flow (mgd)	Monthly Flow (MG)	Average Daily Flow (mgd)	Monthly Flow (MG)	Average Daily Flow (mgd)	Monthly Flow (MG)	Average Daily Flow (mgd)	Max Day Flow (mgd)
Jan-2005	12.46	0.40	6.77	0.22	1.10	0.04	0.88	0.03	21.21	0.68	1.98
Feb-2005	11.48	0.41	6.07	0.22	0.88	0.03	0.98	0.03	19.40	0.69	1.27
Mar-2005	14.62	0.47	7.57	0.24	1.04	0.03	1.07	0.03	24.29	0.78	1.58
Apr-2005	19.49	0.65	8.26	0.28	1.00	0.03	1.18	0.04	29.93	1.00	2.77
May-2005	22.72	0.73	9.64	0.31	1.31	0.04	1.79	0.06	35.46	1.14	3.29
Jun-2005	26.95	0.90	23.28	0.78	1.53	0.05	2.19	0.07	53.96	1.80	2.55
Jul-2005	41.14	1.33	24.71	0.80	1.86	0.06	3.65	0.12	71.37	2.30	3.52
Aug-2005	33.00	1.06	26.44	0.85	1.09	0.04	3.46	0.11	63.99	2.06	3.26
Sep-2005	23.23	0.77	14.34	0.48	1.26	0.04	1.62	0.05	40.45	1.35	2.33
Oct-2005	17.85	0.58	10.08	0.33	1.20	0.04	1.41	0.05	30.53	0.98	1.59
Nov-2005	13.81	0.46	7.66	0.26	1.12	0.04	1.14	0.04	23.72	0.79	1.16
Dec-2005	14.65	0.47	6.29	0.20	1.14	0.04	0.98	0.03	23.07	0.74	1.18
Jan-2006	15.78	0.51	7.20	0.23	1.08	0.03	0.80	0.03	24.86	0.80	2.05
Feb-2006	13.36	0.48	5.92	0.21	0.77	0.03	0.65	0.02	20.70	0.74	1.32
Mar-2006	14.56	0.47	6.41	0.21	0.81	0.03	0.68	0.02	22.46	0.72	1.09
Apr-2006	16.94	0.56	6.56	0.22	0.84	0.03	0.90	0.03	25.24	0.84	1.21
May-2006	18.13	0.58	11.64	0.38	1.17	0.04	1.44	0.05	32.38	1.04	2.29
Jun-2006	34.02	1.13	12.78	0.43	1.05	0.03	2.11	0.07	49.97	1.67	2.22
Jul-2006	31.33	1.01	30.28	0.98	2.17	0.07	3.56	0.11	67.35	2.17	3.28
Aug-2006	34.75	1.12	22.39	0.72	1.72	0.06	4.13	0.13	62.99	2.03	3.39
Sep-2006	25.85	0.86	13.94	0.46	1.19	0.04	1.52	0.05	42.50	1.42	2.63
Oct-2006	20.22	0.65	9.34	0.30	1.04	0.03	1.04	0.03	31.64	1.02	1.44
Nov-2006	18.95	0.63	8.00	0.27	0.84	0.03	1.16	0.04	28.95	0.96	2.20
Dec-2006	17.13	0.55	6.89	0.22	0.82	0.03	0.74	0.02	25.57	0.82	1.23
Jan-2007	13.21	0.43	7.11	0.23	1.19	0.04	0.96	0.03	22.46	0.72	1.37
Feb-2007	10.80	0.39	5.75	0.21	1.05	0.04	0.75	0.03	18.35	0.66	1.21
Mar-2007	14.57	0.47	6.67	0.22	1.01	0.03	0.88	0.03	23.13	0.75	1.61
Apr-2007	15.25	0.51	8.97	0.30	1.22	0.04	1.34	0.04	26.77	0.89	1.29
May-2007	17.64	0.57	11.83	0.38	1.17	0.04	1.43	0.05	32.08	1.03	2.29
Jun-2007	26.73	0.89	16.92	0.56	1.29	0.04	2.04	0.07	46.98	1.57	2.12
Jul-2007	28.69	0.93	25.59	0.83	1.81	0.06	3.11	0.10	59.20	1.91	2.52
Aug-2007	31.70	1.02	22.28	0.72	1.65	0.05	3.28	0.11	58.92	1.90	2.32
Sep-2007	21.79	0.73	12.55	0.42	1.01	0.03	1.24	0.04	36.59	1.22	2.22
Oct-2007	14.55	0.47	9.98	0.32	1.13	0.04	0.89	0.03	26.55	0.86	1.22
Nov-2007	13.45	0.45	6.41	0.21	1.12	0.04	1.27	0.04	22.25	0.74	1.52
Dec-2007	11.79	0.38	5.95	0.19	1.09	0.04	0.93	0.03	19.76	0.64	1.12
Jan-2008	12.08	0.39	5.94	0.19	1.12	0.04	0.67	0.02	19.81	0.64	0.84
Feb-2008	12.82	0.44	5.09	0.18	1.05	0.04	0.81	0.03	19.76	0.68	1.59
Mar-2008	13.12	0.42	6.26	0.20	1.07	0.03	0.83	0.03	21.28	0.69	0.94
Apr-2008	13.77	0.46	6.71	0.22	1.03	0.03	0.73	0.02	22.24	0.74	1.52
May-2008	18.82	0.61	12.29	0.40	1.38	0.04	1.82	0.06	34.31	1.11	2.21
Jun-2008	23.76	0.79	18.24	0.61	1.64	0.05	2.29	0.08	45.93	1.53	2.75
Jul-2008	30.43	0.98	24.73	0.80	2.02	0.07	3.69	0.12	60.86	1.96	3.06
Aug-2008	29.69	0.96	24.86	0.80	2.01	0.06	3.51	0.11	60.08	1.94	2.68
Sep-2008	17.65	0.59	13.54	0.45	1.35	0.05	1.14	0.04	33.68	1.12	2.94
Oct-2008	14.41	0.46	7.83	0.25	1.17	0.04	0.94	0.03	24.34	0.79	1.93
Nov-2008	12.63	0.42	6.85	0.23	1.38	0.05	1.02	0.03	21.88	0.73	0.95
Dec-2008	15.51	0.50	6.91	0.22	1.63	0.05	1.62	0.05	25.67	0.83	1.72
2005-2008 Average	**19.74**	**0.65**	**11.91**	**0.39**	**1.24**	**0.04**	**1.59**	**0.05**	**34.48**	**1.13**	**1.97**

Appendix A:
Table A-1 Rehoboth Beach Sewage Treatment Plant Flow Data 2005-2008

Yearly Averages	Rehoboth Beach		Dewey Beach		Henlopen Acres		North Shores		Total Rehoboth Beach Service Area	
	Monthly Flow (MG)	Average Daily Flow (mgd)	Monthly Flow (MG)	Average Daily Flow (mgd)	Monthly Flow (MG)	Average Daily Flow (mgd)	Monthly Flow (MG)	Average Daily Flow (mgd)	Monthly Flow (MG)	Average Daily Flow (mgd)
2005	20.95	0.69	12.59	0.41	1.21	0.04	1.69	0.06	36.45	1.20
2006	21.75	0.71	11.78	0.39	1.12	0.04	1.56	0.05	36.22	1.19
2007	18.35	0.60	11.67	0.38	1.23	0.04	1.51	0.05	32.75	1.08
2008	17.89	0.59	11.60	0.38	1.40	0.05	1.59	0.05	32.49	1.07

Monthly Averages	Rehoboth Beach		Dewey Beach		Henlopen Acres		North Shores		Total Rehoboth Beach Service Area	
	Monthly Flow (MG)	Average Daily Flow (mgd)	Monthly Flow (MG)	Average Daily Flow (mgd)	Monthly Flow (MG)	Average Daily Flow (mgd)	Monthly Flow (MG)	Average Daily Flow (mgd)	Monthly Flow (MG)	Average Daily Flow (mgd)
January	13.38	0.43	6.76	0.22	1.12	0.04	0.82	0.03	22.08	0.71
February	12.11	0.43	5.71	0.20	0.94	0.03	0.80	0.03	19.55	0.69
March	14.22	0.46	6.73	0.22	0.98	0.03	0.86	0.03	22.79	0.74
April	16.36	0.55	7.63	0.25	1.02	0.03	1.04	0.03	26.05	0.87
May	19.33	0.62	11.35	0.37	1.26	0.04	1.62	0.05	33.56	1.08
June	27.87	0.93	17.81	0.59	1.38	0.05	2.16	0.07	49.21	1.64
July	32.90	1.06	26.33	0.85	1.96	0.06	3.50	0.11	64.69	2.09
August	32.28	1.04	24.00	0.77	1.62	0.05	3.60	0.12	61.49	1.98
September	22.13	0.74	13.59	0.45	1.20	0.04	1.38	0.05	38.31	1.28
October	16.76	0.54	9.30	0.30	1.14	0.04	1.07	0.03	28.27	0.91
November	14.71	0.49	7.23	0.24	1.11	0.04	1.15	0.04	24.20	0.81
December	14.77	0.48	6.51	0.21	1.17	0.04	1.07	0.03	23.52	0.76

Summer Averages[1]	Rehoboth Beach		Dewey Beach		Henlopen Acres		North Shores		Total Rehoboth Beach Service Area	
	Monthly Flow (MG)	Average Daily Flow (mgd)	Monthly Flow (MG)	Average Daily Flow (mgd)	Monthly Flow (MG)	Average Daily Flow (mgd)	Monthly Flow (MG)	Average Daily Flow (mgd)	Monthly Flow (MG)	Average Daily Flow (mgd)
2005	33.695	1.097	24.814	0.809	1.494	0.049	3.101	0.101	63.104	2.055
2006	33.369	1.089	21.817	0.708	1.646	0.053	3.269	0.106	60.102	1.957
2007	29.042	0.946	21.596	0.703	1.584	0.052	2.810	0.091	55.031	1.792
2008	27.961	0.910	22.609	0.736	1.891	0.062	3.163	0.103	55.624	1.811

Note: 1. Summer is defined as June, July, August

Winter Averages[1]	Rehoboth Beach		Dewey Beach		Henlopen Acres		North Shores		Total Rehoboth Beach Service Area	
	Monthly Flow (MG)	Average Daily Flow (mgd)	Monthly Flow (MG)	Average Daily Flow (mgd)	Monthly Flow (MG)	Average Daily Flow (mgd)	Monthly Flow (MG)	Average Daily Flow (mgd)	Monthly Flow (MG)	Average Daily Flow (mgd)
2005	11.969	0.406	6.420	0.218	0.989	0.033	0.928	0.032	20.306	0.689
2006	14.570	0.493	6.558	0.222	0.926	0.031	0.725	0.024	22.780	0.771
2007	13.712	0.455	6.582	0.219	1.019	0.034	0.815	0.027	22.127	0.735
2008	12.228	0.404	5.660	0.186	1.086	0.036	0.802	0.026	19.775	0.653

Note: 1. Winter is defined as December, January, February

Appendix A:
Table A-2: Rehoboth Beach Service Area Growth Projections

Rehoboth Beach Service Area

Stearns & Wheler LLC	Service Area Growth Projections	July-09	40284
Environmental	Subject	Date	Job No.
Engineers and Scientists		JVS	TAY
		Comp. by	Checked by

Assumptions

		Notes:
Annual EDU Growth (%)	0.36%	Based on historical data provided by SCED
GDP/ EDU	225	
Baseline Flow (mgd)	2.3	Based on average ADF from max month (July 2005)
Baseline EDUs	10222	

Rehoboth Beach Service Area Growth History

Year	Rehoboth Airport					Dewey Beach					Rehoboth Beach (estimated)			
	EDU	EDUs Gained	Summer EDU	Summer Average Daily Flow (mgd)	Summer gpd/ EDU	EDU	EDUs Gained	Summer EDU	Summer Average Daily Flow (mgd)	Summer gpd/ EDU	EDU	Summer EDU	Summer Average Daily Flow (mgd)	Summer gpd/ EDU
2003	202	3	203.5	0.059	292	3584	19	3593.5	0.77	213	N/A	5209.2	1.17	225
2004	205	0	206	0.064	314	3603	6	3606	0.79	219	N/A	4512.5	1.02	225
2005	205	-2	204	0.049	239	3609	-12	3603	0.81	224	N/A	4873.7	1.10	225
2006	203	2	204	0.053	262	3597	18	3606	0.71	196	N/A	4938.3	1.09	225
2007	205	2	206	0.052	250	3616	15	3622.5	0.70	194	N/A	4206.3	0.95	225
2008	207	0	207	0.062	298	3630	16	3636	0.74	202	N/A	4046.6	0.91	225
2009	207					3646								
	Net EDUs Gained	5				Net EDUs Gained	64							
				Average Summer gpd/ EDU	276				Average Summer gpd/ EDU	208				
				Maximum Summer gpd/ EDU	314				Maximum Summer gpd/ EDU	224				

Rehoboth Beach Service Area Annual Growth Calculation

Growth Determination for Rehoboth Beach Service Area	
EDUs Gained from HA	5
EDUs Gained From DB	64
Total EDUs Gained 2003-2008	69
EDUs Gained/ Year	14
HA & DB Average Annual Flows (MG/ yr)	157.63
Total RBWWTP Average Annual Flows (MG/ yr)	413.71
Percent Contribution of HA & DB to RBRWF (%)	38.15%
EDUs Gained by RBRWF per Year (Proportional)	37

Rehoboth Beach Service Area Projected Growth

Year	Total EDUs	EDUs Added per Year	Maximum Month Flow
2008	10,222	37	2.30
2009	10,259	37	2.31
2010	10,296	37	2.32
2011	10,333	37	2.32
2012	10,370	38	2.33
2013	10,408	38	2.34
2014	10,446	38	2.35
2015	10,484	38	2.36
2016	10,522	38	2.37
2017	10,560	38	2.38
2018	10,598	38	2.38
2019	10,636	38	2.39
2020	10,674	38	2.40
2021	10,713	39	2.41
2022	10,752	39	2.42
2023	10,791	39	2.43
2024	10,830	39	2.44
2025	10,869	39	2.45
2026	10,908	39	2.45
2027	10,947	40	2.46
2028	10,987	40	2.47
2029	11,027	40	2.48
2030	11,067	40	2.49
2031	11,107	40	2.50
2032	11,147	40	2.51
2033	11,187	40	2.52
2034	11,227	41	2.53
2035	11,268	41	2.54
2036	11,309	41	2.54
2037	11,350	41	2.55
2038	11,391	41	2.56
2039	11,432	41	2.57
2040	11,473	42	2.58
2041	11,515	42	2.59
2042	11,557	42	2.60
2043	11,599	42	2.61
2044	11,641	42	2.62
2045	11,683	42	2.63
2046	11,725	42	2.64
2047	11,767	43	2.65
2048	11,810	43	2.66
2049	11,853	43	2.67
2050	11,896	43	2.68

Rehoboth Beach STP Projected Growth Summary

Design Period	Max Month ADF (mgd)	Summer ADF (mgd)	Winter ADF (mgd)	Annual ADF (mgd)
Current	2.30	1.91	0.72	1.13
Year 2030	2.49	2.27	0.93	1.35
Ultimate Design	3.40	3.10	1.27	1.85

Appendix A:
Table A-3: Rehoboth Beach Sewage Treatment Plant Performance Data 2005-2008

Date	Biological Oxygen Demand (BOD5)				Total Suspended Solids (TSS)				Total Nitrogen (TN)					Total Phosphorus (TP)				
	Concentration (mg/L)		Loading		Concentration (mg/L)		Loading		Concentration (mg/L)			Loading		Concentration (mg/L)			Loading	
	Average	Maximum	Average Daily (lbs/day)	Monthly (lbs/month)	Average	Maximum	Average (lbs/day)	Monthly (lbs/month)	Minimum	Average	Maximum	Average Daily (lbs/day)	Monthly (lbs/month)	Minimum	Average	Maximum	Average Daily (lbs/day)	Monthly (lbs/month)
Jan-2005	2.0	5.0	15	354	3.0	7.0	17	531	2.9	7.8	12.1	44	1,379	0.2	0.3	0.5	2	53
Feb-2005	2.0	4.0	12	324	4.0	7.0	23	647	6.0	9.5	15.2	55	1,537	0.1	0.2	0.3	1	32
Mar-2005	2.0	4.0	9	405	4.0	10.0	26	811	0.8	11.7	21.8	77	2,372	0.1	0.2	0.3	1	41
Apr-2005	1.0	4.0	8	250	7.0	14.0	58	1,748	1.8	4.0	8.3	33	999	0.1	0.4	1.0	3	100
May-2005	1.0	5.0	10	296	2.0	9.0	19	592	2.0	5.3	13.9	51	1,589	0.1	0.3	1.2	3	89
Jun-2005	1.0	9.0	15	450	3.0	10.0	45	1,350	2.2	5.2	8.8	78	2,341	0.3	0.9	1.4	14	405
Jul-2005	1.0	4.0	19	595	3.0	14.0	58	1,785	0.4	4.1	9.6	79	2,440	0.3	0.5	0.9	10	298
Aug-2005	2.0	7.0	34	1,067	4.0	14.0	69	2,135	2.3	4.7	15.0	81	2,508	0.3	0.7	1.3	12	374
Sep-2005	3.0	14.0	34	1,012	4.0	9.0	45	1,349	2.8	4.2	6.7	47	1,417	0.2	0.5	1.7	6	169
Oct-2005	2.0	4.0	16	509	3.0	11.0	25	794	2.1	5.2	12.7	43	1,324	0.2	0.6	1.4	5	153
Nov-2005	3.0	6.0	20	694	1.0	6.0	7	198	3.4	9.9	15.6	65	1,969	0.1	0.5	1.1	3	99
Dec-2005	2.0	6.0	12	385	3.0	14.0	19	577	7.8	11.1	14.5	69	2,135	0.1	0.1	0.3	1	19
Jan-2006	2.0	4.0	13	415	3.0	12.0	20	622	4.6	8.2	12.4	55	1,700	0.0	0.2	0.4	1	41
Feb-2006	1.0	3.0	6	173	2.0	13.0	12	346	1.5	8.5	11.1	52	1,467	0.1	0.2	0.4	1	35
Mar-2006	1.0	2.0	6	187	1.0	5.0	6	187	0.8	4.8	8.6	29	898	0.0	0.2	0.5	1	37
Apr-2006	1.0	2.0	7	210	3.0	21.0	21	631	1.9	4.6	9.3	32	968	0.0	0.2	0.4	1	42
May-2006	3.0	4.0	26	811	3.0	9.0	26	811	1.3	2.8	7.0	24	756	0.0	0.2	0.4	2	54
Jun-2006	2.5	3.0	35	1,043	2.0	7.0	28	834	2.5	3.8	5.5	53	1,585	0.6	0.9	1.3	13	375
Jul-2006	1.0	3.0	18	562	3.0	9.0	54	1,685	2.7	3.1	3.8	56	1,741	0.3	0.4	0.9	7	225
Aug-2006	1.0	3.0	17	525	3.0	13.0	51	1,576	1.5	2.5	3.7	42	1,313	0.1	0.3	0.6	5	158
Sep-2006	1.0	5.0	12	355	3.0	7.0	35	1,064	2.0	4.0	6.5	47	1,418	0.2	0.7	1.2	8	248
Oct-2006	1.0	2.0	9	284	4.0	11.0	34	1,056	2.0	3.8	5.8	32	1,003	0.1	0.2	0.4	2	53
Nov-2006	1.0	2.0	8	241	3.0	13.0	24	724	2.5	4.0	5.2	32	968	0.0	0.2	0.4	2	48
Dec-2006	2.0	4.0	14	427	2.0	12.0	14	427	5.9	9.8	15.0	67	2,090	0.1	0.4	0.7	3	85
Jan-2007	2.0	4.0	12	374	3.0	11.0	18	562	4.1	10.3	15.7	62	1,928	0.1	0.4	0.6	2	75
Feb-2007	1.0	4.0	5	153	3.0	5.0	16	459	8.8	10.7	12.9	58	1,637	0.4	0.6	0.8	3	92
Mar-2007	2.0	9.0	12	386	3.0	10.0	19	579	2.3	8.3	9.9	39	1,216	0.3	0.6	1.1	4	116
Apr-2007	0.1	1.0	1	22	4.0	19.0	30	893	1.1	4.2	6.8	31	937	0.0	0.4	1.1	3	89
May-2007	5.0	12.0	43	1,338	5.0	15.0	43	1,338	1.6	6.9	21.2	60	1,846	0.1	0.2	0.3	2	54
Jun-2007	1.0	2.0	13	392	4.0	17.0	52	1,567	1.5	3.3	6.3	43	1,293	0.0	0.4	0.6	5	157
Jul-2007	1.0	2.0	16	494	2.0	5.0	32	987	2.2	3.4	7.2	54	1,678	0.2	0.4	0.7	6	197
Aug-2007	2.0	4.0	32	982	3.0	10.0	49	1,474	0.7	3.9	11.8	62	1,916	0.1	0.6	1.3	10	295
Sep-2007	2.0	4.0	20	610	4.0	12.0	41	1,221	1.2	2.4	3.6	24	733	0.1	0.5	1.1	5	153
Oct-2007	0.2	1.0	1	44	3.0	17.0	21	664	1.1	3.4	5.4	24	752	0.1	0.2	0.3	1	44
Nov-2007	2.0	4.0	12	371	4.0	10.0	25	743	0.9	6.7	14.2	41	1,244	0.1	0.2	0.5	1	37
Dec-2007	1.0	2.0	5	165	7.0	15.0	37	1,153	3.7	8.8	12.1	47	1,449	0.0	0.1	0.2	1	16
Jan-2008	2.0	4.0	11	330	5.0	16.0	27	826	2.2	8.3	16.4	44	1,371	0.0	0.2	0.4	1	33
Feb-2008	2.0	3.0	11	329	5.0	12.0	28	824	4.4	9.3	15.6	53	1,532	0.0	0.1	0.3	1	16
Mar-2008	1.0	3.0	6	177	2.0	7.0	11	355	1.6	5.0	9.7	29	887	0.1	0.2	0.3	1	35
Apr-2008	2.0	5.0	12	371	3.0	10.0	19	556	0.8	3.0	7.7	19	556	0.1	0.2	0.3	1	37
May-2008	2.0	4.0	18	572	2.0	9.0	18	572	1.5	4.3	8.1	40	1,231	0.1	0.2	0.6	2	57
Jun-2008	1.0	3.0	13	383	1.0	6.0	13	383	2.1	4.5	10.2	57	1,724	0.1	0.7	1.2	9	288
Jul-2008	1.0	4.0	16	508	3.0	10.0	49	1,523	0.7	2.5	4.0	41	1,269	0.3	0.5	0.8	8	254
Aug-2008	3.5	8.3	57	1,754	3.0	9.0	46	1,503	2.2	4.5	8.9	73	2,255	0.0	0.8	1.7	13	401
Sep-2008	2.0	4.0	19	562	2.5	15.5	23	702	0.0	7.3	22.2	68	2,051	0.1	0.8	1.1	7	225
Oct-2008	2.5	3.0	16	507	3.0	9.0	20	609	4.7	14.0	32.6	92	2,841	0.3	0.6	0.9	4	122
Nov-2008	3.0	3.0	18	547	4.0	11.0	24	730	1.7	10.4	19.7	63	1,897	0.0	0.2	0.3	1	36
Dec-2008	3.0	6.0	21	642	5.0	20.0	35	1,070	2.1	8.3	12.9	57	1,777	0.1	0.2	0.3	1	43
2005-2008 Average	**1.7**	**4.3**	**16**	**489**	**3.3**	**11.2**	**30**	**911**	**2.4**	**6.1**	**11.3**	**51**	**1,540**	**0.1**	**0.4**	**0.7**	**4**	**127**

Yearly Averages	Biological Oxygen Demand (BOD_5)				Total Suspended Solids (TSS)				Total Nitrogen (TN)					Total Phosphorus (TP)				
	Average Concentration (mg/L)	Max Concentration (mg/L)	Average Daily Loading (lbs/day)	Average Monthly Loading (lbs/ month)	Average Concentration (mg/L)	Max Concentration (mg/L)	Average Daily Loading (lbs/day)	Average Monthly Loading (lbs/ month)	Min Concentration (mg/L)	Average Concentration (mg/L)	Max Concentration (mg/L)	Average Daily Loading (lbs/day)	Average Monthly Loading (lbs/ month)	Min Concentration (mg/L)	Average Concentration (mg/L)	Max Concentration (mg/L)	Average Daily Loading (lbs/day)	Average Monthly Loading (lbs/ month)
2005	1.7	6.0	17	520	3.4	10.3	34	1041	2.9	6.0	12.9	60	1832	0.2	0.5	1.0	5	153
2006	1.4	3.1	14	434	2.7	10.9	27	830	2.4	4.4	7.8	44	1326	0.1	0.4	0.6	4	117
2007	1.6	4.1	16	444	3.6	12.2	32	970	2.4	5.1	10.7	46	1388	0.1	0.4	0.7	4	110
2008	2.1	4.2	18	503	3.0	11.2	26	715	2.0	6.0	13.9	53	1468	0.1	0.5	0.7	4	124

Year	Summer Average BOD_5 (mg/L)	Winter Average BOD_5 (mg/L)	Summer Average TSS (mg/L)	Winter Average TSS (mg/L)	Summer Average TN (mg/L)	Winter Average TN (mg/L)	Summer Average TP (mg/L)	Winter Average TP (mg/L)
2005	1.34	1.70	3.34	2.70	4.62	9.27	0.68	0.17
2006	1.42	1.72	2.72	2.61	3.08	10.22	0.50	0.46
2007	1.36	1.67	2.93	5.67	3.65	8.80	0.47	0.13
2008	1.90	3.00	2.45	5.03	3.77	8.30	0.68	0.20
Average	1.50	1.87	2.87	3.70	3.76	9.15	0.58	0.24

Notes:
1. Summer is defined as June, July, August.
2. Winter is defined as December, January, February

APPENDIX B

Wolfe Neck Regional Wastewater Facility Flow, Performance Data and Future Flows

Appendix B:
Table B-1: Wolfe Neck Regional Wastewater Facility Influent Data 2005 - 2008

Wolfe Neck Regional Wastewater Facility Influent Wastewater Characteristics

Date	Influent Average Daily Flow (mgd)	Biological Oxygen Demand (BOD_5)		Total Suspended Solids (TSS)		Total Keldahl Nitrogen (TKN)		Organic Nitrogen (Org-N)		Ammonia (NH_3-N)	
		Concentration (mg/L)	Loading (lbs/day)	Concentration (mg/L)	Loading (lbs/day)	Concentration (mg/L)	Loading (lbs/day)	Concentration (mg/L)	Loading (lbs/day)	Concentration (mg/L)	Loading (lbs/day)
Jan-2005	1.27	375	3,975	213.00	2,258	-	-	-	-	-	-
Feb-2005	1.23	328	3,366	102.00	1,047	-	-	-	-	-	-
Mar-2005	1.29	313	3,370	136.00	1,464	-	-	-	-	-	-
Apr-2005	1.26	325	3,415	76.00	799	-	-	-	-	-	-
May-2005	1.22	515	5,237	133.00	1,352	-	-	-	-	-	-
Jun-2005	1.65	358	4,626	76.00	1,046	42	-	-	-	-	-
Jul-2005	1.80	423	6,353	198.00	2,974	37	-	-	-	-	-
Aug-2005	1.81	393	5,946	206.00	3,117	45	-	-	-	-	-
Sep-2005	1.50	298	3,734	215.00	2,694	48	-	-	-	-	-
Oct-2005	1.42	330	3,910	194.00	2,299	47	-	-	-	-	-
Nov-2005	1.34	265	2,956	150.00	1,673	47	-	-	-	-	-
Dec-2005	1.33	390	4,311	320.00	3,538	55	-	-	-	-	-
Jan-2006	1.34	[illegible]	[illegible]	[illegible]	[illegible]	-	-	-	-	-	-
Feb-2006	1.30	[illegible]	[illegible]	[illegible]	[illegible]	-	-	-	-	-	-
Mar-2006	1.26	355	3,721	163	1,708	48	-	-	-	-	-
Apr-2006	1.34	305	3,412	59	660	49	-	-	-	-	-
May-2006	1.42	235	2,789	71	843	46	-	-	-	-	-
Jun-2006	1.64	285	3,897	121	1,655	48	-	-	-	-	-
Jul-2006	1.88	207	3,238	84	1,314	56	-	-	-	-	-
Aug-2006	1.78	188	2,795	115	1,709	50	-	-	-	-	-
Sep-2006	1.54	226	2,897	94	1,205	56	-	-	-	-	-
Oct-2006	1.39	[illegible]	[illegible]	[illegible]	[illegible]	-	-	-	-	-	-
Nov-2006	1.42	[illegible]	[illegible]	[illegible]	[illegible]	-	-	-	-	-	-
Dec-2006	1.34	[illegible]	[illegible]	[illegible]	[illegible]	-	-	-	-	-	-
Jan-2007	1.32	173	1,905	55	606	62	683	28	306	33	363
Feb-2007	1.31	181	1,978	80	874	56	605	24	257	32	350
Mar-2007	1.34	212	2,366	88	982	54	603	24	268	30	335
Apr-2007	1.40	205	2,393	101	1,179	57	665	27	315	28	327
May-2007	1.45	215	2,561	109	1,314	57	681	25	295	32	386
Jun-2007	1.58	240	3,159	95	1,251	67	875	34	448	33	434
Jul-2007	1.81	239	3,614	195	2,949	58	877	27	408	31	469
Aug-2007	1.78	235	3,494	145	2,156	63	929	33	483	30	446
Sep-2007	1.50	211	2,641	90	1,126	69	857	34	425	35	438
Oct-2007	1.35	226	2,539	66	741	56	629	17	191	32	359
Nov-2007	1.29	226	2,432	97	1,044	59	629	32	344	36	392
Dec-2007	1.32	214	2,355	100	1,101	59	649	27	297	29	319
Jan-2008	1.24	207	2,145	85	881	55	575	18	186	31	321
Feb-2008	1.26	183	1,923	74	778	54	567	18	189	36	378
Mar-2008	1.29	184	1,982	73	786	38	409	16	172	22	237
Apr-2008	1.31	161	1,759	83	907	42	459	21	229	22	240
May-2008	1.50	142	1,776	136	1,701	40	500	24	300	24	300
Jun-2008	1.58	162	2,135	107	1,410	43	567	20	264	24	316
Jul-2008	1.84	175	2,685	98	1,504	48	737	19	292	29	445
Aug-2008	1.83	178	2,717	147	2,244	39	595	19	290	20	305
Sep-2008	1.45	187	2,261	98	1,185	57	689	22	266	35	423
Oct-2008	1.30	237	2,570	98	1,063	70	759	30	325	40	434
Nov-2008	1.36	175	1,985	59	669	53	601	23	261	31	352
Dec-2008	1.38	228	2,624	94	1,082	56	645	21	242	35	403
2005-2008 Average	**1.45**	**255**	**3,068**	**121**	**1,474**	**52**	**658**	**24**	**294**	**30**	**365**

Data not available - interpolated

Yearly Averages	Influent Average Daily Flow (mgd)	Biological Oxygen Demand (BOD_5)		Total Suspended Solids (TSS)		Total Keldahl Nitrogen (TKN)		Organic Nitrogen (Org-N)		Ammonia (NH_3-N)	
		Concentration (mg/L)	Loading (lbs/day)	Concentration (mg/L)	Loading (lbs/day)	Concentration (mg/L)	Loading (lbs/day)	Concentration (mg/L)	Loading (lbs/day)	Concentration (mg/L)	Loading (lbs/day)
2005	1.43	359	4,291	168	2,022	46	-	-	-	-	-
2006	1.47	261	3,146	118	1,415	50	-	-	-	-	-
2007	1.45	215	2,622	102	1,277	60	724	28	337	32	384
2008	1.45	185	2,213	95	1,184	50	592	21	251	29	346

Winter Influent Characteristics

Year	Influent Average Daily Flow (mgd)	Biological Oxygen Demand (BOD_5)		Total Suspended Solids (TSS)		Total Keldahl Nitrogen (TKN)		Organic Nitrogen (Org-N)		Ammonia (NH_3-N)	
		Concentration (mg/L)	Loading (lbs/day)	Concentration (mg/L)	Loading (lbs/day)	Concentration (mg/L)	Loading (lbs/day)	Concentration (mg/L)	Loading (lbs/day)	Concentration (mg/L)	Loading (lbs/day)
2005	1.25	352	3,670	158	1,652	-	-	-	-	-	-
2006	1.32	375	4,138	268	2,951	55	-	-	-	-	-
2007	1.32	185	2,037	70	771	59	645	26	283	33	357
2008	1.30	208	2,262	88	960	56	609	21	229	33	355
Average	1.30	268	2,909	140	1,526	57	621	23	247	33	356

Note: Winter defined as December, January, February.

Summer Influent Characteristics

Year	Influent Average Daily Flow (mgd)	Biological Oxygen Demand (BOD_5)		Total Suspended Solids (TSS)		Total Keldahl Nitrogen (TKN)		Organic Nitrogen (Org-N)		Ammonia (NH_3-N)	
		Concentration (mg/L)	Loading (lbs/day)	Concentration (mg/L)	Loading (lbs/day)	Concentration (mg/L)	Loading (lbs/day)	Concentration (mg/L)	Loading (lbs/day)	Concentration (mg/L)	Loading (lbs/day)
2005	1.75	391	5,741	160	2,379	41	-	-	-	-	-
2006	1.77	227	3,310	107	1,559	51	-	-	-	-	-
2007	1.72	238	3,422	145	2,118	62	894	31	446	31	450
2008	1.75	172	2,512	117	1,719	43	633	19	282	24	356
Average	1.75	257	3,746	132	1,944	50	763	25	364	28	403

Note: Summer defined as June, July, August.

Appendix B:
Table B-2: Wolfe Necke Regional Wastewater Facility Performance Data 2005-2008

Wolfe Neck Regional Wastewater Facility Treated Effluent Wastewater Characteristics

Date	Effluent Average Daily Flow (mgd)[1]	Area Sprayed (acres)	Biological Oxygen Demand (BOD$_5$)		Total Suspended Solids (TSS)		Total Nitrogen (TN)		Total Keldahl Nitrogen (TKN)		Organic Nitrogen (Org-N)		Ammonia (NH_3-N)		Nitrate (NO_3-N)		Total Phosphorus (TP)		pH
			Concentration (mg/L)	Loading (lbs/day)	Concentration (mg/L)	Loading (lbs/day)	Concentration (mg/L)	Loading (lbs/day)	Concentration (mg/L)	Loading (lbs/day)	Concentration (mg/L)	Loading (lbs/day)	Concentration (mg/L)	Loading (lbs/day)	Concentration (mg/L)	Loading (lbs/day)	Concentration (mg/L)	Loading (lbs/day)	
Jan-2005	0.65	230	-	-	-	-	24.6	134	7.09	39	4	23	2.95	16	17.55	96	-	-	-
Feb-2005	0.53	230	-	-	-	-	30.6	135	20.70	92	6	26	14.85	66	9.92	44	-	-	-
Mar-2005	0.97	230	-	-	-	-	30.6	246	25.65	207	5	41	20.60	166	4.95	40	-	-	-
Apr-2005	1.83	230	-	-	-	-	30.9	472	28.00	428	5	83	22.55	345	2.89	44	-	-	-
May-2005	1.98	230	-	-	-	-	31.5	519	29.15	481	5	81	24.25	400	2.33	38	-	-	-
Jun-2005	2.03	230	-	-	-	-	22.1	374	6.43	109	6	102	0.41	7	15.70	265	-	-	-
Jul-2005	1.96	230	-	-	-	-	8.5	137	4.89	79	5	75	0.25	4	3.58	58	-	-	-
Aug-2005	1.86	230	-	-	-	-	14.4	223	10.00	158	9	135	1.52	24	4.17	65	-	-	-
Sep-2005	1.20	230	-	-	-	-	13.1	132	6.55	66	6	62	0.25	3	6.58	66	-	-	-
Oct-2005	1.40	230	-	-	-	-	11.2	130	5.48	64	5	62	0.18	2	5.67	66	-	-	-
Nov-2005	1.78	230	-	-	-	-	12.1	177	4.85	73	6	70	0.17	2	7.10	104	-	-	-
Dec-2005	0.92	230	-	-	-	-	20.7	159	8.95	68	4	32	4.78	37	11.73	90	-	-	-
Jan-2006	0.88	319	36	268	31.3	230	28.1	207	21.89	161	16	120	5.63	41	6.18	46	5.4	40	7.3
Feb-2006	1.46	319	63	771	20.0	243	25.5	309	22.10	268	16	197	5.90	72	3.37	41	4.0	48	7.0
Mar-2006	1.59	319	8	106	9.0	119	30.6	405	28.69	380	24	318	4.66	62	1.91	25	5.0	66	7.7
Apr-2006	0.89	319	10	74	22.0	164	24.8	184	23.03	171	15	108	8.45	63	1.76	13	4.0	30	8.5
May-2006	0.88	319	25	186	43.8	322	31.5	232	29.15	215	24	178	4.90	36	2.33	17	4.2	31	8.6
Jun-2006	1.06	319	17	151	34.0	301	6.0	54	6.04	54	1	5	5.49	49	0.00	-	6.4	57	7.5
Jul-2006	1.95	319	4	65	19.0	310	23.2	378	6.16	100	0	-	6.16	100	17.03	278	7.0	114	7.7
Aug-2006	1.99	319	3	50	23.0	382	17.8	298	9.20	153	2	30	7.40	123	8.60	143	6.0	100	9.3
Sep-2006	1.25	302	8	79	18.0	185	13.7	142	4.10	43	2	20	2.20	23	9.60	100	6.6	69	9.3
Oct-2006	1.24	319	6	61	13.5	139	7.1	73	2.30	24	0	4	1.90	20	4.80	50	6.8	70	9.2
Nov-2006	1.68	273	4	56	11.0	154	6.7	94	2.20	31	0	4	1.90	27	4.50	63	7.0	98	8.9
Dec-2006	1.33	319	4	44	17.0	189	11.1	123	5.70	63	2	24	3.50	39	5.40	60	7.0	78	7.8
Jan-2007	1.37	319	7	75	9.3	105	19.8	226	10.00	114	2	16	8.40	96	9.80	112	6.4	72	7.8
Feb-2007	0.70	319	7	42	25.5	148	26.6	155	15.90	92	1	6	14.80	86	10.70	62	6.6	38	7.9
Mar-2007	1.15	319	8	77	10.0	96	29.0	278	23.20	222	1	8	22.40	215	5.80	56	7.0	67	8.0
Apr-2007	1.55	319	23	298	9.0	116	30.3	392	25.78	334	3	32	23.28	301	4.52	59	7.0	91	7.9
May-2007	1.54	319	62	801	16.0	206	31.8	409	18.50	238	5	69	13.90	179	13.30	171	7.0	89	7.3
Jun-2007	1.69	319	11	151	10.5	148	27.3	384	0.50	7	0	4	0.20	3	26.80	377	7.2	101	8.7
Jul-2007	1.98	319	8	132	13.0	214	22.3	367	3.90	64	4	58	0.40	7	18.38	303	7.0	115	8.1
Aug-2007	1.55	319	5	77	23.0	355	15.7	242	5.20	80	5	69	0.70	11	10.49	162	7.0	108	8.8
Sep-2007	1.47	319	4	49	11.0	135	9.2	113	2.20	27	2	25	0.20	2	6.98	86	7.4	90	8.8
Oct-2007	1.32	230	9	101	14.5	159	8.3	91	1.40	15	1	14	0.10	1	6.90	75	6.9	76	8.7
Nov-2007	1.39	236	5	58	17.0	197	9.4	109	2.77	32	3	31	0.07	1	6.68	77	7.0	81	7.5
Dec-2007	1.33	319	10	111	6.0	67	18.7	208	4.60	51	4	45	0.60	7	14.10	157	7.0	78	7.5
Jan-2008	1.21	307	7	72	13.3	134	18.3	184	10.70	108	3	33	7.50	76	7.60	77	7.4	75	7.4
Feb-2008	1.33	307	6	66	15.0	166	25.2	278	15.30	169	4	43	11.40	126	9.90	110	7.1	79	7.8
Mar-2008	1.34	307	26	292	15.7	175	36.3	404	24.00	267	6	67	17.00	189	12.30	137	7.2	80	7.6
Apr-2008	1.37	307	39	442	19.7	225	29.4	336	23.10	264	4	40	19.40	222	6.30	72	7.2	82	7.7
May-2008	1.49	307	25	310	15.7	195	20.7	257	9.50	118	4	55	5.10	63	11.20	139	7.1	88	7.8
Jun-2008	1.40	307	24	282	13.2	154	20.8	243	3.20	37	3	37	0.10	1	17.60	206	7.1	83	-
Jul-2008	1.32	307	11	119	11.5	127	18.6	205	2.70	30	3	30	0.10	1	15.90	175	7.1	78	-
Aug-2008	1.56	307	9	116	21.3	278	6.7	87	4.10	53	4	53	0.10	1	2.60	34	7.0	91	-
Sep-2008	1.33	307	3	29	21.0	234	10.6	118	7.30	81	7	80	0.20	2	3.30	37	7.1	79	-
Oct-2008	0.97	307	5	44	19.0	153	11.9	98	7.50	61	4	33	3.40	27	4.40	36	7.1	57	-
Nov-2008	0.91	307	5	45	6.7	51	15.4	117	8.00	61	7	56	0.60	5	7.40	56	7.1	54	-
Dec-2008	1.65	307	26	353	13.5	186	14.1	196	4.00	55	2	32	1.70	23	10.10	139	7.6	105	-
2005-2008 Average	**1.39**	**289**	**15**	**168**	**17.0**	**188**	**19.8**	**226**	**11**	**108**	**3**	**39**	**5**	**69**	**10**	**121**	**7**	**82**	**8**

Yearly Averages	Influent Average Daily Flow (mgd)	Area Sprayed (acres)	Biological Oxygen Demand (BOD$_5$)		Total Suspended Solids (TSS)		Total Nitrogen (TN)		Total Keldahl Nitrogen (TKN)		Organic Nitrogen (Org-N)		Ammonia (NH_3-N)		Nitrate (NO_3-N)		Total Phosphorus (TP)		pH
			Concentration (mg/L)	Loading (lbs/day)	Concentration (mg/L)	Loading (lbs/day)	Concentration (mg/L)	Loading (lbs/day)	Concentration (mg/L)	Loading (lbs/day)	Concentration (mg/L)	Loading (lbs/day)	Concentration (mg/L)	Loading (lbs/day)	Concentration (mg/L)	Loading (lbs/day)	Concentration (mg/L)	Loading (lbs/day)	
2005	1.42	230	-	-	-	-	21	237	13	-	-	-	-	-	-	-	-	-	-
2006	1.35	314	16	159	22	226	19	206	13	-	-	-	-	-	-	-	-	-	-
2007	1.44	305	13	164	14	152	21	248	9	106	2	31	7	76	11	141	7	84	8
2008	1.32	307	16	181	15	173	19	210	10	109	4	47	6	61	9	101	7	79	8

Winter Influent Characteristics

Year	Influent Average Daily Flow (mgd)	Area Sprayed (acres)	Biological Oxygen Demand (BOD$_5$)		Total Suspended Solids (TSS)		Total Nitrogen (TN)		Total Keldahl Nitrogen (TKN)		Organic Nitrogen (Org-N)		Ammonia (NH_3-N)		Nitrate (NO_3-N)		Total Phosphorus (TP)		pH
			Concentration (mg/L)	Loading (lbs/day)	Concentration (mg/L)	Loading (lbs/day)	Concentration (mg/L)	Loading (lbs/day)	Concentration (mg/L)	Loading (lbs/day)	Concentration (mg/L)	Loading (lbs/day)	Concentration (mg/L)	Loading (lbs/day)	Concentration (mg/L)	Loading (lbs/day)	Concentration (mg/L)	Loading (lbs/day)	
2005	0.59	230	-	-	-	-	28	135	-	-	-	-	-	-	-	-	-	-	-
2006	1.09	289	50	520	26	237	25	225	18	-	-	-	-	-	-	-	-	-	-
2007	1.13	319	6	54	17	147	19	168	11	96	2	16	9	74	9	78	7	63	8
2008	1.38	310	12	151	12	138	19	217	9	96	3	38	6	58	10	121	7	84	8
Average	**1.11**	**294**	**18**	**200**	**17**	**163**	**22**	**193**	**12**	**107**	**5**	**50**	**7**	**67**	**10**	**86**	**6**	**66**	**8**

Summer Influent Characteristics

Year	Influent Average Daily Flow (mgd)	Area Sprayed (acres)	Biological Oxygen Demand (BOD$_5$)		Total Suspended Solids (TSS)		Total Nitrogen (TN)		Total Keldahl Nitrogen (TKN)		Organic Nitrogen (Org-N)		Ammonia (NH_3-N)		Nitrate (NO_3-N)		Total Phosphorus (TP)		pH
			Concentration (mg/L)	Loading (lbs/day)	Concentration (mg/L)	Loading (lbs/day)	Concentration (mg/L)	Loading (lbs/day)	Concentration (mg/L)	Loading (lbs/day)	Concentration (mg/L)	Loading (lbs/day)	Concentration (mg/L)	Loading (lbs/day)	Concentration (mg/L)	Loading (lbs/day)	Concentration (mg/L)	Loading (lbs/day)	
2005	1.94	230	-	-	-	-	15	245	7	-	-	-	-	-	-	-	-	-	-
2006	1.57	319	8	89	25	331	16	242	7	-	-	-	-	-	-	-	-	-	-
2007	1.84	319	8	120	16	239	22	331	3	51	3	44	0	7	19	281	7	108	8
2008	1.43	307	15	172	15	186	15	179	3	40	3	40	0	1	12	138	7	84	-
Average	**1.72**	**294**	**10**	**127**	**19**	**252**	**17**	**249**	**5**	**45**	**3**	**42**	**0**	**4**	**15**	**209**	**7**	**86**	**8**

Appendix B:
Table B-3: Inland Bays RWF Nitrogen Balance for Alternative 1

Stearns & Wheler, LLC	North Coastal Planning Area Preliminary Engineering Report	April 2009	40284.19
Environmental	Project	Date	Job No.
Engineers and Scientists	Alternative 1 Nitrogen Balance and Percolate Concentration Calculation	JVS	TAY
	Subject	Comp. By	Checked By

Objective:
To determine the total nitrogen concentration in the percolate on a yearly average based on a monthly nitrogen balance for the entire facility. This assumes design conditions of permitted effluent application rates and a corn harvest schedule.

Design Criteria / Assumptions:
According to the Mid-Atlantic Nutrient Management Handbook, grain soybean nitrogen requirements are higher than those of grain corn.
Therefore, corn is used in this sheet to calculate the nitrogen concentration in the percolate.

Wetted Field Area (acres)	319	
Average Effluent Nitrogen Concentration (mg/L)	23	
Nitrogen from Rainfall and Fixation (lbs/ac/yr)	5	assumed per Table 703-2 in the regulations
Corn Planting Date	1-Jun	assumed typical schedule (Sam Walter)
Nitrogen Uptake by Corn (lbs/ac/yr)	150	

Monthly Nitrogen Balance:

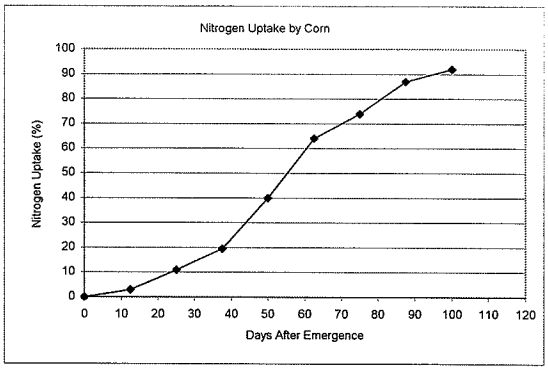
Parameter	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total	Notes
Days	31	28.25	31	30	31	30	31	31	30	31	30	31		
Wetted Field Area (acres)	319	319	319	319	319	319	319	319	319	319	319	319		
Effluent Rate (in/wk)	1.41	1.41	1.41	1.41	1.41	1.41	1.41	1.41	1.41	1.41	1.41	1.41		
Application Rate (mgd)	1.75	1.75	1.75	1.75	1.75	1.75	1.75	1.75	1.75	1.75	1.75	1.75		
Effluent Rate (in/mo)	6.3	5.7	6.3	6.1	6.3	6.1	6.3	6.3	6.1	6.3	6.1	6.3		
Wastewater Volume Applied (Mgal/mo)	54	49	54	53	54	53	54	54	53	54	53	54	639.19	
Precipitation (in/mo)	4.7	4.4	5.6	4.5	5	5.1	6.3	8.2	5.2	5.4	4.6	5.2	64	1
Potential Evapotranspiration, PET (in/mo)	0.1	0.1	0.7	1.8	3.3	4.8	5.5	4.9	3.6	1.9	0.9	0.2	28	2
Percolate (in/mo)	10.9	10.0	11.2	8.8	8.0	6.4	7.1	9.6	7.7	9.8	9.8	11.3	110	
Percolate (Mgal/mo)	94	87	97	76	69	55	61	83	66	85	85	98	954	
Percolate (mgd)	3.0	3.1	3.1	2.5	2.2	1.8	2.0	2.7	2.2	2.7	2.8	3.1		
Total Nitrogen Concentration in Effluent (mg/L)	23.0	23.0	23.0	23.0	23.0	23.0	23.0	23.0	23.0	23.0	23.0	23.0		
Estimated fraction of ammonia in effluent TN	0.3	0.5	0.4	0.4	0.4	0.4	0.3	0.3	0.4	0.1	0.2	0.4		3
Ammonia Concentration in Effluent (mg/L)	7.8	10.5	9.2	8.8	8.4	9.7	7.7	7.4	8.5	1.7	3.7	9.8		
Total Nitrogen Input from Effluent (lbs/ac/mo)	32.6	29.7	32.6	31.6	32.6	31.6	32.6	32.6	31.6	32.6	31.6	32.6	384.4	
Nitrogen from Rainfall and Fixation (lbs/ac/mo)	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	5	
Ammonia Volatilization by Plant (lbs/ac/mo)	0.6	0.7	0.7	0.6	0.6	0.7	0.5	0.5	0.6	0.1	0.3	0.7	6	4
Ammonia Input from Effluent (lbs/ac/mo)	11.0	13.5	13.1	12.1	11.8	13.3	10.9	10.5	11.6	2.4	5.1	13.9	129	
Denitrification by plant (lbs/ac/mo)	6.5	5.9	6.5	6.3	6.5	6.3	6.5	6.5	6.3	6.5	6.3	6.5	77	5
TN after volat., denit., fixation, rain (lbs/ac/mo)	26.0	23.5	25.9	25.1	25.9	25.0	26.0	26.0	25.1	26.4	25.4	25.8	306	
Plant Uptake and Storage (lbs/ac/mo)	8	8	8	8	8	22.5	67.5	43.5	9	7.5	8	8	203	
Nitrogen Leached by Percolate (lbs/ac/mo)	18.5	16.0	18.4	17.6	18.4	2.5	0.0	0.0	16.1	18.9	17.9	18.3	163	
Percolate Nitrogen Concentration (mg/L)	**7.5**	**7.1**	**7.3**	**8.9**	**10.2**	**1.7**	**0.0**	**0.0**	**9.3**	**8.5**	**8.1**	**7.2**	**6.3**	

Summary:

Average Percolate Nitrogen Concentration (mg/L)	6.3
Max Month Percolate Nitrogen Concentration (mg/L)	10.2
Total Nitrogen in Percolate (lbs/yr)	50,300
Effluent Application Rate Yearly Average	1.41

Nitrogen Uptake Rate by Corn[6]:

Days After Emergence	Nitrogen Uptake (%)
0	0
12.5	3
25	11
37.5	19.5
50	40
62.5	64
75	74
87.5	87
100	92



	Jun	Jul	Aug	Sep	Oct
Days	30	31	31	30	31
Days in Growing Season at the end of each Month	30	61	92	122	153
Total Nitrogen Uptake at the end of each Month	15%	60%	89%	95%	100%
Incremental Nitrogen Uptake for each Month	15%	45%	29%	6%	5%

Nitrogen Uptake Rate by Other Crops:

Small Grain Including Barley and Wheat (lbs/ac/yr)	90	cover crop during non-corn growing season
Therefore, Small Grain (lbs/ac/mo)	8	

Notes:
1. 5 year precipitation per Table 702-3 in the Delaware Regulations Governing the Land Treatment of Wastes (1988)
2. Table 702-2 in the Delaware Regulations Governing the Land Treatment of Wastes (1988)
3. Effluent ammonia data were not submitted. This fraction is taken from the Piney Neck RWF data, where ammonia in the effluent was submitted.
4. Assume 5 % of ammonia applied based on example in the Delaware Regulations Governing the Land Treatment of Wastes (1988)
5. Assume 20 % of total N applied based on example in the Delaware Regulations Governing the Land Treatment of Wastes (1988).
6. Based on the Chesapeake Bay Region Nutrient Management Training Manual - USEPA Chesapeake Bay Program.

Appendix B:
Table B-4: Inland Bays RWF Nitrogen Balance for Alternative 2

Stearns & Wheler, LLC	North Coastal Planning Area Preliminary Engineering Report	April 2009	40284.19
Environmental	Project	Date	Job No.
Engineers and Scientists	Alternative 2 Nitrogen Balance and Percolate Concentration Calculation	JVS	TAY
	Subject	Comp. By	Checked By

Objective:
To determine the total nitrogen concentration in the percolate on a yearly average based on a monthly nitrogen balance for the entire facility. This assumes design conditions of permitted effluent application rates and a corn harvest schedule.

Design Criteria / Assumptions:
According to the Mid-Atlantic Nutrient Management Handbook, grain soybean nitrogen requirements are higher than those of grain corn.
Therefore, corn is used in this sheet to calculate the nitrogen concentration in the percolate.

Wetted Field Area (acres)	319	
Average Effluent Nitrogen Concentration (mg/L)	9	
Nitrogen from Rainfall and Fixation (lbs/ac/yr)	5	assumed per Table 703-2 in the regulations
Corn Planting Date	1-Jun	assumed typical schedule (Sam Walter)
Nitrogen Uptake by Corn (lbs/ac/yr)	150	

Monthly Nitrogen Balance:

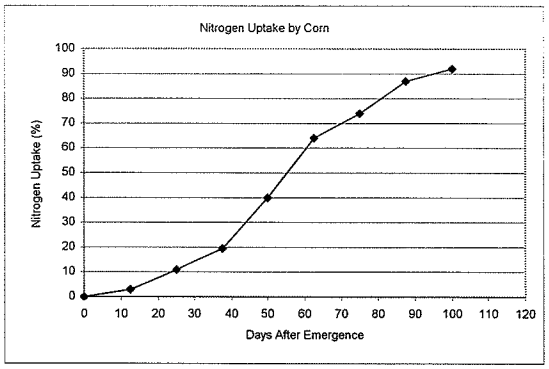
Parameter	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total	Notes
Days	31	28.25	31	30	31	30	31	31	30	31	30	31		
Wetted Field Area (acres)	319	319	319	319	319	319	319	319	319	319	319	319		
Effluent Rate (in/wk)	1.74	1.74	1.74	1.74	1.74	1.74	1.74	1.74	1.74	1.74	1.74	1.74		
Application Rate (mgd)	2.15	2.15	2.15	2.15	2.15	2.15	2.15	2.15	2.15	2.15	2.15	2.15		
Effluent Rate (in/mo)	7.7	7.0	7.7	7.4	7.7	7.4	7.7	7.7	7.4	7.7	7.4	7.7		
Wastewater Volume Applied (Mgal/mo)	67	61	67	65	67	65	67	67	65	67	65	67	785.29	
Precipitation (in/mo)	4.7	4.4	5.6	4.5	5	5.1	6.3	8.2	5.2	5.4	4.6	5.2	64	1
Potential Evapotranspiration, PET (in/mo)	0.1	0.1	0.7	1.8	3.3	4.8	5.5	4.9	3.6	1.9	0.9	0.2	28	2
Percolate (in/mo)	12.3	11.3	12.6	10.1	9.4	7.7	8.5	11.0	9.0	11.2	11.1	12.7	127	
Percolate (Mgal/mo)	106	98	109	88	81	67	74	95	78	97	97	110	1101	
Percolate (mgd)	3.4	3.5	3.5	2.9	2.6	2.2	2.4	3.1	2.6	3.1	3.2	3.5		
Total Nitrogen Concentration in Effluent (mg/L)	8.9	8.9	8.9	8.9	8.9	8.9	8.9	8.9	8.9	8.9	8.9	8.9		
Estimated fraction of ammonia in effluent TN	0.3	0.5	0.4	0.4	0.4	0.4	0.3	0.3	0.4	0.1	0.2	0.4		3
Ammonia Concentration in Effluent (mg/L)	3.0	4.1	3.6	3.4	3.2	3.8	3.0	2.9	3.3	0.6	1.4	3.8		
Total Nitrogen Input from Effluent (lbs/ac/mo)	15.5	14.1	15.5	15.0	15.5	15.0	15.5	15.5	15.0	15.5	15.0	15.5	182.7	
Nitrogen from Rainfall and Fixation (lbs/ac/mo)	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	5	
Ammonia Volatilization by Plant (lbs/ac/mo)	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.1	0.1	0.3	3	4
Ammonia Input from Effluent (lbs/ac/mo)	5.2	6.4	6.2	5.7	5.6	6.3	5.2	5.0	5.5	1.1	2.4	6.6	61	
Denitrification by plant (lbs/ac/mo)	3.1	2.8	3.1	3.0	3.1	3.0	3.1	3.1	3.0	3.1	3.0	3.1	37	5
TN after volat., denit., fixation, rain (lbs/ac/mo)	12.6	11.4	12.5	12.1	12.5	12.1	12.6	12.6	12.1	12.8	12.3	12.5	148	
Plant Uptake and Storage (lbs/ac/mo)	8	8	8	8	8	22.5	67.5	43.5	9	7.5	8	8	203	
Nitrogen Leached by Percolate (lbs/ac/mo)	5.1	3.9	5.0	4.6	5.0	0.0	0.0	0.0	3.1	5.3	4.8	5.0	42	
Percolate Nitrogen Concentration (mg/L)	**1.8**	**1.5**	**1.8**	**2.0**	**2.4**	**0.0**	**0.0**	**0.0**	**1.5**	**2.1**	**1.9**	**1.7**	**1.4**	

Summary:

Average Percolate Nitrogen Concentration (mg/L)	1.4
Max Month Percolate Nitrogen Concentration (mg/L)	2.4
Total Nitrogen in Percolate (lbs/yr)	12,800
Effluent Application Rate Yearly Average	1.74

Nitrogen Uptake Rate by Corn[6]:

Days After Emergence	Nitrogen Uptake (%)
0	0
12.5	3
25	11
37.5	19.5
50	40
62.5	64
75	74
87.5	87
100	92



	Jun	Jul	Aug	Sep	Oct
Days	30	31	31	30	31
Days in Growing Season at the end of each Month	30	61	92	122	153
Total Nitrogen Uptake at the end of each Month	15%	60%	89%	95%	100%
Incremental Nitrogen Uptake for each Month	15%	45%	29%	6%	5%

Nitrogen Uptake Rate by Other Crops:

Small Grain Including Barley and Wheat (lbs/ac/yr)	90	cover crop during non-corn growing season
Therefore, Small Grain (lbs/ac/mo)	8	

Notes:
1. 5 year precipitation per Table 702-3 in the Delaware Regulations Governing the Land Treatment of Wastes (1988)
2. Table 702-2 in the Delaware Regulations Governing the Land Treatment of Wastes (1988)
3. Effluent ammonia data were not submitted. This fraction is taken from the Piney Neck RWF data, where ammonia in the effluent was submitted.
4. Assume 5 % of ammonia applied based on example in the Delaware Regulations Governing the Land Treatment of Wastes (1988)
5. Assume 20 % of total N applied based on example in the Delaware Regulations Governing the Land Treatment of Wastes (1988).
6. Based on the Chesapeake Bay Region Nutrient Management Training Manual - USEPA Chesapeake Bay Program.

APPENDIX C

EDU Data and Projections

Appendix C:
Table C-1: Sussex County North Coastal Planning Area EDU History 2003-2008

District	2003	Annual	%	2004	Annual	%	2005	Annual	%	2006	Annual	%	2007	Annual	%	2008	Annual	%	2009
	EDUs	Growth	Growth	EDUs	Growth	Growth	EDUs	Growth	Growth	EDUs	Growth	Growth	EDUs	Growth	Growth	EDUs	Growth	Growth	EDUs
DBWD	3521	15	0.42%	3,536	10	0.27%	3,546	-14	-0.41%	3,531	19	0.53%	3,550	16	0.44%	3,566	19	0.53%	3,585
DBSSD	3,584	19	0.53%	3,603	7	0.18%	3,609	-12	-0.34%	3,597	18	0.49%	3,615	16	0.43%	3,630	18	0.49%	3,648
HASSD	202	3	1.48%	205	0	0.00%	205	-2	-0.97%	203	2	0.98%	205	2	0.97%	207	0	0.00%	207
WRE	12,918	1,144	8.86%	14,063	986	7.01%	15,048	612	4.07%	15,660	769	4.91%	16,429	692	4.21%	17,121	301	1.76%	17,422
BBSSD	4,008	124	3.10%	4,133	116	2.80%	4,248	43	1.01%	4,291	46	1.08%	4,338	-6	-0.13%	4,332	10	0.23%	4,342
NBE	1,110	-19	-1.70%	1,092	46	4.22%	1,138	39	3.44%	1,177	-41	-3.51%	1,135	4	0.35%	1,139	4	0.32%	1,143
CNE	244	57	23.35%	301	1,235	410.29%	1,536	333	21.68%	1,869	45	2.40%	1,914	21	1.11%	1,936	33	1.72%	1,969
OVE	909	114	12.52%	1,022	123	12.01%	1,145	108	9.40%	1,253	52	4.18%	1,305	37	2.85%	1,342	15	1.09%	1,357
MVE	66	2	3.67%	69	6	8.26%	74	147	197.50%	221	137	61.82%	358	918	256.74%	1,276	700	54.90%	1,976
SBSSD	5,336	288	5.39%	5,623	314	5.59%	5,938	166	2.80%	6,104	32	0.52%	6,136	44	0.72%	6,180	3	0.05%	6,183
FISSD	5,244	147	2.80%	5,391	256	4.75%	5,647	480	8.50%	6,127	434	7.09%	6,561	137	2.10%	6,699	176	2.63%	6,875
HLSSD	297	27	9.09%	324	26	8.02%	350	50	14.28%	400	105	26.18%	505	23	4.52%	528	8	1.57%	536
MCSSD	22	0	0.00%	22	0	0.00%	22	40	181.82%	62	1	1.61%	63	119	188.89%	182	254	139.56%	436
BVESSD	0	0	0.00%	0	0	0.00%	0	85	0.00%	85	94	110.59%	179	3	1.68%	182	7	3.85%	189
SCESSD	0	0	0.00%	0	0	0.00%	0	36	0.00%	36	12	33.33%	48	0	0.00%	48	0	0.00%	48
SOVSSD	0	0	0.00%	0	0	0.00%	0	0	0.00%	0	2	0.00%	2	197	9833.50%	199	115	58.05%	314
JCSSD	0	0	0.00%	0	0	0.00%	0	0	0.00%	0	0	0.00%	0	0	0.00%	0	0	0.00%	0
SCRWF	17,237	740	4.29%	17,977	2,122	11.80%	20,099	1,526	7.59%	21,625	919	4.25%	22,544	1,498	6.64%	24,042	1,328	5.52%	25,370
LNSSD	5,372	384	7.15%	5,756	398	6.92%	6,155	438	7.11%	6,592	438	6.64%	7,030	327	4.65%	7,357	163	2.22%	7,520
ANSSD	0	0	0.00%	0	0	0.00%	0	0	0.00%	0	0	0.00%	0	150	0.00%	150	0	0.00%	150
OOSSD	0	0	0.00%	0	0	0.00%	0	0	0.00%	0	624	0.00%	624	278	44.58%	903	0	0.00%	903
In Bay	5,372	384	7.15%	5,756	398	6.92%	6,155	438	7.11%	6,592	1,062	16.11%	7,654	755	9.87%	8,410	163	1.94%	8,573
DFSSD	928	-37	-3.99%	891	-8	-0.90%	883	17	1.93%	900	135	14.97%	1,035	46	4.44%	1,081	54	4.98%	1,135
ELSSD	0	112	0.00%	112	458	410.01%	569	-6	-1.11%	563	7	1.30%	570	6	1.05%	576	-3	-0.60%	573
GVSSD	0	0	0.00%	0	0	0.00%	0	0	0.00%	0	0	0.00%	0	0	0.00%	0	0	0.00%	0
BLSSD	524	75	14.23%	566	4	0.70%	570	13	2.28%	583	12	2.06%	595	-51	-8.63%	543	8	1.39%	551
TOTAL	**44,287**	**2,455**	**5.47%**	**46,709**	**3,976**	**8.51%**	**50,685**	**2,571**	**5.07%**	**53,256**	**2,942**	**5.52%**	**56,198**	**2,979**	**5.30%**	**59,177**	**1,885**	**3.18%**	**61,062**

Appendix C:

TABLE C-2
EQUIVALENT DWELLING UNIT (EDU) PROJECTION TABLE
TREATMENT AND DISPOSAL

STUDY AREAS	2008 ESTIMATED EXISTING EDUs	2009	2010	2011	2012	2013	2014	2015	2020	2025	2030	2035	2045	BUILDOUT DESIGN (9.)
WEST REHOBOTH														
Existing WRE of DBSSD (Phases I-IV)	17,121	17,635	18,148	18,662	19,176	19,689	20,203	20,716	23,285	25,853	28,421	30,989	36,125	36,929
Northern WR Expansion	126	-	-	-	-	-	-	-	-	-		-	-	1,823
Goslee Creek	1,319	-	-	-	-	-	-	-	-	100	600	1,100	2,100	9,062
Total Potential EDUs to WNRWF	**18,566**	**17,635**	**18,148**	**18,662**	**19,176**	**19,689**	**20,203**	**20,716**	**23,285**	**25,953**	**29,021**	**32,089**	**38,225**	**47,814**
Flow to WNRWF (MGD) - Ex. @ 125 gpd/EDU, Growth @ 125gpd/EDU (6.)	-	*2.2*	*2.3*	*2.3*	*2.4*	*2.5*	*2.5*	*2.6*	*2.9*	*3.2*	*3.6*	*4.0*	*4.8*	*6.0*
Flow to WNRWF (MGD) - Ex. @ 150 gpd/EDU, Growth @ 150gpd/EDU (7.)		***2.6***	***2.7***	***2.8***	***2.9***	***3.0***	***3.0***	***3.1***	***3.5***	***3.9***	***4.4***	***4.8***	***5.7***	***7.2***
Flow to WNRWF (MGD) - Ex. @ 150 gpd/EDU, Growth @ 225gpd/EDU (7.)		*2.7*	*2.8*	*2.9*	*3.0*	*3.1*	*3.3*	*3.4*	*4.0*	*4.6*	*5.2*	*5.9*	*7.3*	*10.8*
ANGOLA NECK STUDY AREA														
Angola Neck Sanitary Sewer District	1,366	150	150	1,571	1,612	1,653	1,694	1,735	1,940	2,145	2,350	2,554	2,646	2,646
Phase II Service Area	-	-	-	-	-	-	-	250	500	750	1,000	1,250	1,750	9,243
Angola Neck Total EDUS	-	150	150	1,571	1,612	1,653	1,694	1,985	2,440	2,895	3,350	3,804	4,396	11,889
Estimated Average Daily Flow (MGD)	-	*0.02*	*0.02*	*0.24*	*0.24*	*0.25*	*0.25*	*0.30*	*0.37*	*0.43*	*0.50*	*0.57*	*0.66*	*1.8*
HERRING CREEK STUDY AREA	902	-	-	-	-	150	175	200	325	450	575	700	825	5,756
Estimated Average Daily Flow (MGD)	-	-	-	-	-	*0.02*	*0.03*	*0.03*	*0.05*	*0.07*	*0.09*	*0.11*	*0.12*	*0.86*
LONG NECK														
Existing Long Neck Sanitary Sewer District including Exp. Area 1	7,357	7,578	7,798	8,019	8,240	8,461	8,681	8,902	10,006	11,109	12,213	13,316	15,523	15,590
Estimated Average Daily Flow (MGD)	-	1.1	1.2	1.2	1.2	1.3	1.3	1.3	1.5	1.7	1.8	2.0	2.3	2.3
OAK ORCHARD														
Existing Oak Orchard Sanitary Sewer District	903	930	957	984	1,011	1,038	1,066	1,093	1,228	1,364	1,499	***1,614***	***1,614***	1,614
Oak Orchard Expansion 1 (8.)	790	-	-	861	885	909	932	956	1,074	1,193	1,311	1,430	1,548	3,789
Oak Orchard Expansion 2	545	-	-	-	-	-	-	165	247	329	410	492	574	3,524
Oak Orchard Total EDUs	2,238	930	957	1,845	1,896	1,947	1,998	2,214	2,549	2,885	3,221	3,536	3,736	8,927
Estimated Average Daily Flow (MGD)	-	*0.14*	*0.14*	*0.28*	*0.28*	*0.29*	*0.30*	*0.33*	*0.38*	*0.43*	*0.48*	*0.53*	*0.56*	*1.34*
Total Potential EDUs to IBRWF	**11,863**	**8,658**	**8,906**	**11,435**	**11,748**	**12,210**	**12,548**	**13,300**	**15,319**	**17,339**	**19,358**	**21,356**	**24,480**	**42,162**
Flow to IBRWF (MGD) - Ex. @ 125 gpd/EDU, Growth @ 125gpd/EDU (6.)	-	*1.1*	*1.1*	*1.4*	*1.5*	*1.5*	*1.6*	*1.7*	*1.9*	*2.2*	*2.4*	*2.7*	*3.1*	*5.3*
Flow to IBRWF (MGD) - Ex. @ 150 gpd/EDU, Growth @ 150gpd/EDU (7.)	-	***1.3***	***1.3***	***1.7***	***1.8***	***1.8***	***1.9***	***2.0***	***2.3***	***2.6***	***2.9***	***3.2***	***3.7***	***6.3***
Flow to IBRWF (MGD) - Ex. @ 150 gpd/EDU, Growth @ 225gpd/EDU (7.)	-	*1.3*	*1.4*	*2.0*	*2.0*	*2.1*	*2.2*	*2.4*	*2.8*	*3.3*	*3.7*	*4.2*	*4.9*	*9.5*
TOTAL EDUs (WNRWF and IBRWF):	**30,429**	**26,292**	**27,054**	**30,097**	**30,923**	**31,900**	**32,751**	**34,017**	**38,604**	**43,291**	**48,379**	**53,446**	**62,706**	**89,976**
Total Flow (MGD) - Ex. @ 125 gpd/EDU, Growth @ 125gpd/EDU (6.)	-	*3.3*	*3.4*	*3.8*	*3.9*	*4.0*	*4.1*	*4.3*	*4.8*	*5.4*	*6.0*	*6.7*	*7.8*	*11.2*
Total Flow (MGD) - Ex. @ 150 gpd/EDU, Growth @ 150gpd/EDU (7.)	-	***3.9***	***4.1***	***4.5***	***4.6***	***4.8***	***4.9***	***5.1***	***5.8***	***6.5***	***7.3***	***8.0***	***9.4***	***13.5***
Total Flow (MGD) - Ex. @ 150 gpd/EDU, Growth @ 225gpd/EDU (7.)	-	*4.0*	*4.2*	*4.9*	*5.1*	*5.3*	*5.5*	*5.8*	*6.8*	*7.8*	*9.0*	*10.1*	*12.2*	*20.2*

1. Constant Growth Rates for EDU projections are assumed as follows:
   a. WRE DBSSD: 3% of Existing EDUs
   b. Goslee Creek: 100 EDUs connect in 2025, growth at 100 EDUs/year
   c. Angola Neck Phase II Service Area: 250 EDUs connect in 2015, growth at 50 EDUs/year
   d. Herring Creek: 150 existing EDUs connect in year 2013, growth at 25 EDUs/year
   e. LNSSD: 3% of Existing EDUs
   f. Oak Orchard Expansion 1: 3% of Existing EDUs
   g. Oak Orchard Expansion 2: 165 EDUs connect in 2011 with growth at 3% of initial connection per year
2. Design estimates based on 20% Open Space and 90% Occupancy rate
3. EDU estimates include a reduction for wetland areas and are based on 4 EDUs per acre
4. Buildout and Design EDUs for Oak Orchard Exp. Area do not include an estimated 2,757 EDUS for the Mountaire Property in Expansion 2, which was determined not to require service.
5. Buildout and Design Calculations for Angola Neck SSD include 215 EDUs for Southern Parcels, even though service was not provided in the ANSSD Facilities Plan.
6. Representative of an Average Daily Flow
7. Representative of a Max. Month Flow
8. Includes EDUs from Exp. Area 1 that are not currently being served by the new OO Expansion Area #1 Sanitary Sewer District.
9. Projected flows based on all EDUs (existing and growth) to be applied at the Growth EDU rate.

APPENDIX D

Rehoboth to Wolfe Neck Conveyance Cost Estimates

TABLE D-1
Alternative 1 - RBSTP Raw WW to WNRWF
FM Alignment Option #1 - Permanent Easement Installation
Cost Estimate

ITEM	UNIT	UNIT COST	QUANTITY	ITEM TOTAL	NOTES
RBSTP to WNRWF Force Main (1.)					
Mobilization (5%)	LS	$165,000	-	$165,000	
30" Force Main - County Roadway Installation	LF	$175	8,000	$1,400,000	
30" Force Main - Permanent Easement Installation	LF	$130	8,200	$1,066,000	Assumes No Road Restoration
Air Release Valves and MH (2.)	EA	$7,000	6	$42,000	
Isolation Valves	EA	$45,000	2	$90,000	
Directional Drill Rehoboth Canal (3.)	EA	$360,000	1	$360,000	
SUBTOTAL				**$3,123,000**	
10% Construction Contingency				$312,300	
SUBTOTAL				**$3,435,300**	
CONSTRUCTION TOTAL				**$3,435,300**	
Project Costs		22%		$755,766	
RBSTP to WNRWF Force Main PROJECT TOTAL				$4,191,100	
RBSTP to WNRWF PROJECT TOTAL				$4,191,100	

Notes:
(1.) 10.2 MGD sized for Ultimate Design
(2.) Assumes 1 ARV per 3,000 feet of FM.
(3.) Cost for directional drill based on similar projects in Sussex County, DE.

TABLE D-2
Alternative 1 - RBSTP Raw WW to WNRWF
FM Alignment Option #2 - Coastal Highway
Cost Estimate

ITEM	UNIT	UNIT COST	QUANTITY	ITEM TOTAL	NOTES
RBSTP to WNRWF Force Main (1.)					
Mobilization (5%)	LS	$280,000	-	$280,000	
30" Force Main - Major Roadway Installation (2.)	LF	$225	14,500	$3,262,500	
30" Force Main - County Roadway Installation	LF	$175	6,500	$1,137,500	
Air Release Valves and MH	EA	$7,000	5	$35,000	
Isolation Valves (3.)	EA	$45,000	2	$90,000	
Directional Drill Rehoboth Canal (4.)	EA	$360,000	1	$360,000	
SUBTOTAL				**$5,165,000**	
10% Construction Contingency				$774,750	
SUBTOTAL				**$5,939,750**	
CONSTRUCTION TOTAL				**$5,939,750**	
Project Costs		22%		$1,306,745	
RBSTP to WNRWF Force Main PROJECT TOTAL				$7,246,500	
RBSTP to WNRWF PROJECT TOTAL				$7,246,500	

Notes:
(1.) 10.2 MGD sized for Ultimate Design
(2.) Refers to portion installed along Coastal Highway (SR 1)
(3.) Assumes 1 ARV per 3,000 feet of FM.
(4.) Cost for directional drill based on similar projects in Sussex County, DE.

TABLE D-3
Alternative 2 - RBSTP Treated Effluent to WNRWF
FM Alignment Option #1 - Permanent Easement Installation
Cost Estimate - DRAFT

ITEM	UNIT	UNIT COST	QUANTITY	ITEM TOTAL	NOTES
RBSTP to WNRWF Force Main (1.)					
Mobilization (5%)	LS	$175,000	-	$175,000	
30" Force Main - County Roadway Installation	LF	$175	10,000	$1,750,000	
30" Force Main - Permanent Easement Installation	LF	$130	8,200	$1,066,000	Assumes No Road Restoration
Air Release Valves and MH (2.)	EA	$7,000	7	$49,000	
Isolation Valves	EA	$45,000	2	$90,000	
Directional Drill Rehoboth Canal (3.)	EA	$360,000	1	$360,000	
SUBTOTAL				**$3,490,000**	
10% Construction Contingency				$349,000	
SUBTOTAL				**$3,839,000**	
CONSTRUCTION TOTAL				**$3,839,000**	
Project Costs		22%		$844,580	
RBSTP to WNRWF Force Main PROJECT TOTAL				$4,683,600	
RBSTP to WNRWF PROJECT TOTAL				$4,683,600	

Notes:
(1.) 10.2 MGD sized for Ultimate Design
(2.) Assumes 1 ARV per 3,000 feet of FM.
(3.) Cost for directional drill based on similar projects in Sussex County, DE.

TABLE D-4
Alternative 2 - RBSTP Treated Effluent to WNRWF
FM Alignment Option #2 - Coastal Highway
Cost Estimate

ITEM	UNIT	UNIT COST	QUANTITY	ITEM TOTAL	NOTES
RBSTP to WNRWF Force Main (1.)					
Mobilization (5%)	LS	$300,000	-	$300,000	
30" Force Main - Major Roadway Installation (2.)	LF	$225	14,500	$3,262,500	
30" Force Main - County Roadway Installation	LF	$175	8,500	$1,487,500	
Air Release Valves and MH	EA	$7,000	5	$35,000	
Isolation Valves (3.)	EA	$45,000	2	$90,000	
Directional Drill Rehoboth Canal (4.)	EA	$360,000	1	$360,000	
SUBTOTAL				**$5,535,000**	
10% Construction Contingency				$830,250	
SUBTOTAL				**$6,365,250**	
CONSTRUCTION TOTAL				**$6,365,250**	
Project Costs		22%		$1,400,355	
RBSTP to WNRWF Force Main PROJECT TOTAL				$7,765,600	
RBSTP to WNRWF PROJECT TOTAL				$7,765,600	

Notes:
(1.) 10.2 MGD sized for Ultimate Design
(2.) Refers to portion installed along Coastal Highway (SR 1)
(3.) Assumes 1 ARV per 3,000 feet of FM.
(4.) Cost for directional drill based on similar projects in Sussex County, DE.

TABLE D-5
ENGINEER'S ESTIMATE OF PROBABLE CONSTRUCTION COST

Project:	Wolfe Neck Headworks Upgrade Alternative 1						**Computed By:**			JVS
Location:	Sussex Co. Delaware						**Checked By:**			TAY
Owner:	Sussex Co.						**Date of Est.:**			5/1/09
Description:	**Alternative 1 WNRWF Headworks (27 mgd)**						**Project No:**			40284.19
	Quantity		Material/Equipment		Subcontract		Labor/Installation			
Description	No. Units	Basis	Per Unit	Total	Per Unit	Total	Man Hours	$/Man Hour	Total	Total Cost
Civil										
Crushed Stone Bedding	253	CY	$15	$3,795	$3	$759	0.25	$38	$2,404	$6,960
Fill (off-site material)	4275	CY	incl.		$10	$42,750	0.4	$38	$15	$42,770
Asphalt Paving	1	LS	$15,000.00	$15,000						$15,000
Structural										
Slab Concrete	119	CY	$700	$82,989						$82,990
Wall Concrete	75	CY	$900	$67,733						$67,730
painting	1	LS	$15,000	$15,000						$15,000
Architectural										
Architectural Building		SF	$150.00		incl.		incl.			
Large Overhead Door	1	EA	$12,000	$12,000			incl			$12,000
Aluminum Grating	540	SF	$35.00	$18,900			0.4	$38	$15	$18,920
Aluminum Stairways	3	RISER	$300.00	$900			1.000	$38	$38	$940
Equipment										
Fine Screens and Screw Wash Compactor	1	LS	$330,000	$330,000					$99,000	$429,000
Screenings Conveyor	1	LS	$20,000	$20,000					$6,000	$26,000
Heat Trace and Insulate Screens and Conveyo	1	LS	$40,000	$40,000					$12,000	$52,000
Slide Gates (48")	6	EA	$14,400.00	$86,400	$1,000	$6,000	120	$38	$4,560	$96,960
Grit Dumpster	1	EA	$5,000	$5,000						$5,000
Bar Rack	1	LS	$5,000.00	$5,000	$500	$500	80	$38	$3,040	$8,540
Hoist Allowance	1	LS	$10,000.00	$10,000	$1,500	$1,500	120.000	$38	$4,560	$16,060
Flow Meter	1	LS	$20,000.00	$20,000						$20,000
Valve Vault	1	LS	$20,000.00	$20,000						$20,000
HVAC		LS	$50,000							
Plumbing	1	LS	$10,000	$10,000						$10,000
Site Work										
3% of Total Cost	1	LS	$28,376	$28,376						$28,376
Electrical										
20% of Total Cost	1	LS	$189,174	$189,174						$189,174
Startup										
2 % of Total Cost	1	LS	$18,917	$18,917						$18,917
Piping										
9 % of Total Cost	1	LS	$85,128	$85,128						$85,128
		Subtotal		$1,084,300		$51,500			$131,600	**$1,267,000**
		General Conditions	**5%**	$54,200	**5%**	$2,600		**5%**	$6,600	**$63,000**
		Subtotal		$1,138,500		$54,100			$138,200	**$1,331,000**
		Overhead	**10%**	$113,900	**10%**	$5,400		**10%**	$13,800	**$133,000**
		Profit	**5%**	$56,900	**5%**	$2,700		**5%**	$6,900	**$67,000**
		Subtotal		$1,309,300		$62,200			$158,900	**$1,530,000**
		Contingency	**10%**	$130,900	**10%**	$6,200		**10%**	$15,900	**$153,000**
		Total Construction Costs		$1,440,000		$68,000			$175,000	**$1,680,000**
		Project Costs	**22%**	$316,800	**22%**	$15,000		**22%**	$38,500	**$370,000**
		TOTAL PROJECT COSTS		$1,757,000		$83,000			$214,000	**$2,050,000**

TABLE D-6
ENGINEER'S ESTIMATE OF PROBABLE CONSTRUCTION COST

Project:	Wolfe Neck Headworks Upgrade Alternative 2						**Computed By:**			JVS
Location:	Sussex Co. Delaware						**Checked By:**			TAY
Owner:	Sussex Co.						**Date of Est.:**			5/1/09
Description:	**Alternative 2 WNRWF Headworks (17 mgd)**						**Project No:**			40284.19
	Quantity		Material/Equipment		Subcontract		Labor/Installation			
Description	No. Units	Basis	Per Unit	Total	Per Unit	Total	Man Hours	$/Man Hour	Total	Total Cost
Civil										
Crushed Stone Bedding	253	CY	$15	$3,795	$3	$759	0.25	$38	$2,404	$6,960
Fill (off-site material)	3450	CY	incl.		$10	$34,500	0.4	$38	$15	$34,520
Asphalt Paving	1	LS	$15,000.00	$15,000						$15,000
Structural										
Slab Concrete	83	CY	$700	$58,100						$58,100
Wall Concrete	62	CY	$900	$55,800						$55,800
painting	1	LS	$15,000	$15,000						$15,000
Architectural										
Architectural Building		SF	$150.00		incl.		incl.			
Large Overhead Door	1	EA	$12,000	$12,000			incl			$12,000
Aluminum Grating	295	SF	$35.00	$10,325			0.4	$38	$15	$10,340
Aluminum Stairways	3	RISER	$300.00	$900			1.000	$38	$38	$940
Equipment										
Fine Screens and Screw Wash Compactor	1	LS	$280,000	$280,000					$84,000	$364,000
Screenings Conveyor	1	LS	$20,000	$20,000					$6,000	$26,000
Heat Trace and Insulate Screens and Conveyo	1	LS	$40,000	$40,000					$12,000	$52,000
Slide Gates (36")	6	EA	$10,000.00	$60,000	$1,000	$6,000	120	$38	$4,560	$70,560
Grit Dumpster	1	EA	$5,000	$5,000						$5,000
Bar Rack	1	LS	$5,000.00	$5,000	$500	$500	80	$38	$3,040	$8,540
Hoist Allowance	1	LS	$10,000.00	$10,000	$1,500	$1,500	120.000	$38	$4,560	$16,060
Flow Meter	1	LS	$20,000.00	$20,000						$20,000
Valve Vault	1	LS	$20,000.00	$20,000						$20,000
HVAC		LS	$50,000							
Plumbing	1	LS	$10,000	$10,000						$10,000
Site Work										
3% of Total Cost	1	LS	$24,025	$24,025						$24,025
Electrical										
20% of Total Cost	1	LS	$160,164	$160,164						$160,164
Startup										
2 % of Total Cost	1	LS	$16,016	$16,016						$16,016
Piping										
9 % of Total Cost	1	LS	$72,074	$72,074						$72,074
		Subtotal		$913,200		$43,300			$116,600	**$1,073,000**
		General Conditions	**5%**	$45,700	**5%**	$2,200		**5%**	$5,800	**$54,000**
		Subtotal		$958,900		$45,500			$122,400	**$1,127,000**
		Overhead	**10%**	$95,900	**10%**	$4,600		**10%**	$12,200	**$113,000**
		Profit	**5%**	$47,900	**5%**	$2,300		**5%**	$6,100	**$56,000**
		Subtotal		$1,102,700		$52,400			$140,700	**$1,296,000**
		Contingency	**10%**	$110,300	**10%**	$5,200		**10%**	$14,100	**$130,000**
		Total Construction Costs		$1,213,000		$58,000			$155,000	**$1,430,000**
		Project Costs	**22%**	$266,900	**22%**	$12,800		**22%**	$34,100	**$314,000**
		TOTAL PROJECT COSTS		$1,480,000		$71,000			$189,000	**$1,740,000**

APPENDIX E

Wolfe Neck Conveyance Cost Estimates

TABLE E-1
WNRWF to IBRWF Cost Estimate
Alignment Option #1 - John J. Williams Highway (SR 24)

ITEM	UNIT	UNIT COST	QUANTITY	ITEM TOTAL	NOTES
WNRWF to IBRWF Force Main					
Mobilization (5%)	LS	$700,000	-	$700,000	
30" Force Main (Major Highway Construction) (1.)	LF	$225	28,750	$6,468,750	
30" Force Main (Intermediate Highway Construction) (2.)	LF	$175	1,700	$297,500	
30" Force Main (County Road Construction) (3.)	LF	$150	28,450	$4,267,500	
Air Release Valves and MH (4.)	EA	$7,000	20	$140,000	
Isolation Valves	EA	$45,000	4	$180,000	
Miscellaneous Jack and Bore of Major Highway	EA	$50,000	5	$250,000	Assumes 5 Road Crossings
Directional Drill Coastal Highway	LS	$300,000	1	$300,000	
Directional Drill Love Creek	LS	$300,000	2	$600,000	
Directional Drill Burton Prong	LS	$300,000	1	$300,000	
SUBTOTAL				**$13,503,750**	
10% Construction Contingency				$1,350,375	
SUBTOTAL				**$14,854,125**	
CONSTRUCTION TOTAL				**$14,854,125**	
Project Costs		22%		$3,267,908	
WNRWF TO IBRWF FM PROJECT TOTAL				$18,122,000	

Notes:
(1.) Refers to the portion of the force main installed in John J. Williams Highway (SR 24)
(2.) Refers to the portion of the force main installed in Beaver Dam Road (SR 23) and Indian Mission Road (SR 5)
(3.) Refers to the portion of the force main installed along County Roads.
(4.) Assumes 1 ARV per 3,000 feet of FM.

TABLE E-2
WNRWF to IBRWF Cost Estimate
Alignment Option #2 - Robinsonville Road (CR 277)

ITEM	UNIT	UNIT COST	QUANTITY	ITEM TOTAL	NOTES
WNRWF to IBRWF Force Main					
Mobilization (5%)	LS	$750,000	-	$750,000	
30" Force Main (Major Highway Construction) (1.)	LF	$225	10,800	$2,430,000	
30" Force Main (Intermediate Highway Construction) (2.)	LF	$175	5,000	$875,000	
30" Force Main (County Road Construction) (3.)	LF	$150	56,800	$8,520,000	
Air Release Valves and MH (4.)	EA	$7,000	25	$175,000	
Isolation Valves	EA	$45,000	4	$180,000	
Miscellaneous Jack and Bore of Major Highway	EA	$50,000	5	$250,000	Assumes 5 Road Crossings
Directional Drill Coastal Highway	LS	$300,000	3	$900,000	
Directional Drill Burton Prong	EA	$300,000	1	$300,000	
SUBTOTAL				**$14,380,000**	
10% Construction Contingency				$1,438,000	
SUBTOTAL				**$15,818,000**	
CONSTRUCTION TOTAL				**$15,818,000**	
Project Costs		22%		$3,479,960	
WNRWF TO IBRWF FM PROJECT TOTAL				$19,298,000	

Notes:
(1.) Refers to the portion of the force main installed in John J. Williams Highway (SR 24)
(2.) Refers to the portion of the force main installed in Beaver Dam Road (SR 23) and Indian Mission Road (SR 5)
(3.) Refers to the portion of the force main installed along County Roads.
(4.) Assumes 1 ARV per 3,000 feet of FM.

TABLE E-3
WNRWF to IBRWF Cost Estimate
Alignment Option #3 - Beaver Dam Road (SR 23)

ITEM	UNIT	UNIT COST	QUANTITY	ITEM TOTAL	NOTES
WNRWF to IBRWF Force Main					
Mobilization (5%)	LS	$680,000	-	$680,000	
24" Force Main (Major Highway Construction) (1.)	LF	$225	7,100	$1,597,500	
24" Force Main (Intermediate Highway Construction) (2.)	LF	$175	28,550	$4,996,250	
24" Force Main (County Road Construction) (3.)	LF	$150	32,950	$4,942,500	
Air Release Valves and MH (4.)	EA	$7,000	23	$161,000	
Isolation Valves	EA	$25,000	4	$100,000	
Miscellaneous Jack and Bore of Major Highway	EA	$50,000	5	$250,000	Assumes 5 Road Crossings
Directional Drill Coastal Highway	LS	$300,000	1	$300,000	
SUBTOTAL				**$13,027,250**	
10% Construction Contingency				$1,302,725	
SUBTOTAL				**$14,329,975**	
CONSTRUCTION TOTAL				**$14,329,975**	
Project Costs		22%		$3,152,595	
WNRWF TO IBRWF FM PROJECT TOTAL				$17,482,500	

Notes:
(1.) Refers to the portion of the force main installed in John J. Williams Highway (SR 24)
(2.) Refers to the portion of the force main installed in Beaver Dam Road (SR 23) and Indian Mission Road (SR 5)
(3.) Refers to the portion of the force main installed along County Roads.
(4.) Assumes 1 ARV per 3,000 feet of FM.

TABLE E-4
Wolfe Neck Transfer Pump Station to IBRWF
Alternative #1 - Raw WW from RBSTP to WNRWF

ITEM	UNIT	UNIT COST	QUANTITY	ITEM TOTAL	NOTES
Mobilization	LS	$125,000	1	$125,000	
Mechanical Pipes, Valves and Fittings	LS	$325,000	1	$325,000	
Electrical/Control Building	LS	$80,000	1	$80,000	Pre-Engineered Building Assumed
Excavation, Dewatering, Sheeting, and Shoring and Installation of Cast In Place Concrete Wetwell and Valve Vault and Hatches	LS	$800,000	1	$800,000	Wetwell sized for 6.9 mgd, assumed total depth of 21'
Mechanical Pumps and Accessories	LS	$350,000	1	$350,000	185 HP Pumps
Electrical, Instrumentation and Controls	LS	$575,000	1	$575,000	Does Not Include Backup Generator
Sitework and Site Piping	LS	$200,000	1	$200,000	No Site Fencing or Paving Included
Station Startup and Testing	LS	$30,000	1	$30,000	
Pump Station Construction Sub-total				**$2,485,000**	
Project Contingency	10%			**$248,500**	
Project Construction Total				**$2,733,500**	
Project Costs	22%			**$601,370**	
Pump Station Project Total				**$3,330,000**	

TABLE E-5
Wolfe Neck Transfer Pump Station to IBRWF
Alternative #2 - Treated Effluent from RBSTP to WNRWF

ITEM	UNIT	UNIT COST	QUANTITY	ITEM TOTAL	NOTES
Mobilization	LS	$110,000	1	$110,000	
Mechanical Pipes, Valves and Fittings	LS	$280,000	1	$280,000	
Electrical/Control Building	LS	$80,000	1	$80,000	Pre-Engineered Building Assumed
Excavation, Dewatering, Sheeting, and Shoring and Installation of Cast In Place Concrete Wetwell and Valve Vault and Hatches	LS	$750,000	1	$750,000	Wetwell sized for 5.4 mgd, assumed total depth of 20'
Mechanical Pumps and Accessories	LS	$320,000	1	$320,000	160 HP Pumps
Electrical, Instrumentation and Controls	LS	$500,000	1	$500,000	Does Not Include Backup Generator
Sitework and Site Piping	LS	$200,000	1	$200,000	No Site Fencing or Paving Included
Station Startup and Testing	LS	$30,000	1	$30,000	
Pump Station Construction Sub-total				**$2,270,000**	
Project Contingency	10%			**$227,000**	
Project Construction Total				**$2,497,000**	
Project Costs	22%			**$549,340**	
Pump Station Project Total				**$3,050,000**	

TABLE E-6
Wolfe Neck Transfer Pump Station to IBRWF
Alternative #3 - County Only flows to IBRWF

ITEM	UNIT	UNIT COST	QUANTITY	ITEM TOTAL	NOTES
Mobilization	LS	$100,000	1	$100,000	
Mechanical Pipes, Valves and Fittings	LS	$200,000	1	$200,000	
Electrical/Control Building	LS	$80,000	1	$80,000	Pre-Engineered Building Assumed
Excavation, Dewatering, Sheeting, and Shoring and Installation of Cast In Place Concrete Wetwell and Valve Vault and Hatches	LS	$700,000	1	$700,000	Wetwell sized for 3.2 mgd, assumed total depth of 19'
Mechanical Pumps and Accessories	LS	$290,000	1	$290,000	100 HP Pumps
Electrical, Instrumentation and Controls	LS	$400,000	1	$400,000	Does Not Include Backup Generator
Sitework and Site Piping	LS	$200,000	1	$200,000	No Site Fencing or Paving Included
Station Startup and Testing	LS	$30,000	1	$30,000	
Pump Station Construction Sub-total				**$2,000,000**	
Project Contingency	10%			**$200,000**	
Project Construction Total				**$2,200,000**	
Project Costs	22%			**$484,000**	
Pump Station Project Total				**$2,680,000**	

TABLE E-7
Cave Neck Road to ANSRWRF Force Main

ITEM	UNIT	UNIT COST	QUANTITY	ITEM TOTAL	NOTES
Cave Neck Rd to PWTP Site FM					
Mobilization (5%)	LS	$460,000	-	$460,000	
24" Force Main (Major Highway Construction) (1.)	LF	$225	21,016	$4,728,600	
24" Force Main (Intermediate Highway Construction) (2.)	LF	$175	1,375	$240,625	
24" Force Main (County Road Construction) (3.)	LF	$150	11,829	$1,774,350	
24" Force Main (Easement Installation) (4.)	LF	$100	8,480	$848,000	
Air Release Valves and MH (5.)	EA	$7,000	15	$105,000	
Isolation Valves	EA	$25,000	4	$100,000	
Miscellaneous Jack and Bore of Major Highway	EA	$50,000	5	$250,000	Assumes 5 Road Crossings
Directional Drill Coastal Highway	LS	$300,000	1	$300,000	
SUBTOTAL				**$8,806,575**	
10% Construction Contingency				$880,658	
SUBTOTAL				**$9,687,233**	
CONSTRUCTION TOTAL				**$9,687,233**	
Project Costs		22%		$2,131,191	
CAVE NECK RD TO ANSRWRF FM PROJECT TOTAL				$11,820,000	

Notes:
(1.) Refers to the portion of the force main installed in Coastal Highway (SR 1)
(2.) Refers to the portion of the force main installed in Beach Highway (SR 16)
(3.) Refers to the portion of the force main installed along County Roads.
(4.) Refers to the portion of the force main installed in Easements west of Union Street Extension (SR 5)
(5.) Assumes 1 ARV per 3,000 feet of FM.

TABLE E-8
WN Transfer PS to Cave Neck Road Force Main

ITEM	UNIT	UNIT COST	QUANTITY	ITEM TOTAL	NOTES
Cave Neck Rd to ANSRWRF FM					
Mobilization (5%)	LS	$365,000	-	$365,000	
24" Force Main (Major Highway Construction) (1.)	LF	$225	10,251	$2,306,475	
24" Force Main (Intermediate Highway Construction) (2.)	LF	$175	4,175	$730,625	
24" Force Main (County Road Construction) (3.)	LF	$150	15,208	$2,281,200	
24" Force Main (Easement Installation)	LF	$100	9,632	$963,200	
Air Release Valves and MH (5.)	EA	$7,000	13	$91,000	
Isolation Valves	EA	$25,000	4	$100,000	
Miscellaneous Jack and Bore of Major Highway	EA	$50,000	1	$50,000	
SUBTOTAL				**$6,887,500**	
10% Construction Contingency				$688,750	
SUBTOTAL				**$7,576,250**	
CONSTRUCTION TOTAL				**$7,576,250**	
Project Costs		22%		$1,666,775	
WN TRANSFER PS TOCAVE NECK RD FM PROJECT TOTAL				$9,240,000	

Notes:
(1.) Refers to the portion of the force main installed in Coastal Highway (SR 1)
(2.) Refers to the portion of the force main installed in Kings Road (SR 9)
(3.) Refers to the portion of the force main installed along County Roads.
(4.) Refers to the portion of the force main installed in Easements from WNRWF to Gills Neck Rd (CR 297).
(5.) Assumes 1 ARV per 3,000 feet of FM.

TABLE E-9
WNRWF to IBRWF Cost Estimate: County Flows Only (Alternative 3)
Alignment Option #3 - Beaver Dam Road (SR 23)

ITEM	UNIT	UNIT COST	QUANTITY	ITEM TOTAL	NOTES
WNRWF to IBRWF Force Main					
Mobilization (5%)	LS	$580,000	-	$580,000	
20" Force Main (Major Highway Construction) (1.)	LF	$200	7,100	$1,420,000	
20" Force Main (Intermediate Highway Construction) (2.)	LF	$150	28,550	$4,282,500	
20" Force Main (County Road Construction) (3.)	LF	$125	32,950	$4,118,750	
Air Release Valves and MH (4.)	EA	$7,000	23	$161,000	
Isolation Valves	EA	$20,000	4	$80,000	
Miscellaneous Jack and Bore of Major Highway	EA	$50,000	5	$250,000	Assumes 5 Road Crossings
Directional Drill Coastal Highway	LS	$250,000	1	$250,000	
SUBTOTAL				**$11,142,250**	
10% Construction Contingency				$1,114,225	
SUBTOTAL				**$12,256,475**	
CONSTRUCTION TOTAL				**$12,256,475**	
Project Costs		22%		$2,696,425	
WNRWF TO IBRWF FM PROJECT TOTAL				$14,950,000	

Notes:
(1.) Refers to the portion of the force main installed in John J. Williams Highway (SR 24)
(2.) Refers to the portion of the force main installed in Beaver Dam Road (SR 23) and Indian Mission Road (SR 5)
(3.) Refers to the portion of the force main installed along County Roads.
(4.) Assumes 1 ARV per 3,000 feet of FM.

TABLE E-10
Alternative 1 - WNRWF to RBSTP
FM Alignment Option #1 - Permanent Easement Installation
Cost Estimate

ITEM	UNIT	UNIT COST	QUANTITY	ITEM TOTAL	NOTES
RBSTP to WNRWF Force Main (1.)					
Mobilization (5%)	LS	$90,000	-	$90,000	
16" Force Main - County Roadway Installation	LF	$100	8,000	$800,000	
16" Force Main - Permanent Easement Installation	LF	$70	8,200	$574,000	Assumes No Road Restoration
Air Release Valves and MH (2.)	EA	$7,000	6	$42,000	
Isolation Valves	EA	$10,000	2	$20,000	
Directional Drill Rehoboth Canal (3.)	EA	$200,000	1	$200,000	
SUBTOTAL				**$1,726,000**	
10% Construction Contingency				$172,600	
SUBTOTAL				**$1,898,600**	
CONSTRUCTION TOTAL				**$1,898,600**	
Project Costs		22%		$417,692	
RBSTP to WNRWF Force Main PROJECT TOTAL				$2,320,000	
RBSTP to WNRWF PROJECT TOTAL				$2,320,000	

Notes:
(1.) 10.2 MGD sized for Ultimate Design
(2.) Assumes 1 ARV per 3,000 feet of FM.
(3.) Cost for directional drill based on similar projects in Sussex County, DE.

APPENDIX F

Inland Bays Regional Wastewater Facility Cost Estimates

STEARNS & WHELER LLC
Environmental Engineers & Scientists

Inland Bays Regional Wastewater Facility Study Phase Estimate of Capital Cost

Table F-1
Cost Summary for Inland Bays Phase 2 Expansion
July 1, 2009

Description	Comparative Cost	Date of Comparative Cost	Date of Analysis	Escalated Cost	Comparative Capacity	Units	This Capacity	Scaled Cost	Cost Plus 5% Mobilization	Estimated Cost
Screening	$513,000	March-09	Mar-09	$513,000	6.50	mgd	6.50	$510,000	$540,000	$540,000
Grit Removal	$1,013,927	Sep-04	Mar-09	$1,186,000	9.00	mgd	5.18	$840,000	$880,000	$880,000
Influent Dist Box	$369,979	Sep-04	Mar-09	$433,000	7.20	mgd	5.18	$350,000	$370,000	$370,000
Biolac Treatment System (Convert Lagoon 2)	$2,050,000	June-07	Mar-09	$2,204,000	2.75	mgd	1.83	$1,710,000	$1,800,000	$1,800,000
Secondary Clarifier Distribution Box	$369,979	Sep-04	Mar-09	$433,000	7.20	MG	5.18	$350,000	$370,000	$370,000
Secondary Clarifiers	$2,437,052	Sep-04	Mar-09	$2,850,000	7.20	MG	1.38	$1,020,000	$1,070,000	$1,070,000
RAS Pump Station	$542,440	Sep-04	Mar-09	$634,000	7.20	MG	2.75	$350,000	$370,000	$370,000
Chlorine Contact Tank	$400,000	Jan-07	Mar-09	$433,000	3.00	mgd	2.39	$380,000	$400,000	$400,000
New Storage Lagoon (45 Day Winter ADF)	$1,283,750	Feb-07	Mar-09	$1,390,000	23.50	MG	60	$2,490,000	$2,610,000	$2,610,000
Irrigation Pumping Station	$569,000	Feb-07	Mar-09	$616,000	0.58	mgd	0.94	$830,000	$870,000	$870,000
Solids Handling System	$4,149,843	Aug-03	Mar-09	$5,260,000	9.00	mgd	5.18	$3,730,000	$3,920,000	$3,920,000
Waste Sludge Holding Lagoon (Convert Lagoon 3)	$617,000	Oct-07	Mar-09	$655,000	3.00	MG	3.00	$660,000	$690,000	$690,000
Cake Storage Building								$350,000	$370,000	$370,000
Administration Building Expansion			Oct-08					$700,000	$740,000	$740,000
Subtotal (rounded)										$15,000,000
General Site Work @ 3% of Subtotal										$450,000
Yard Piping @ 9% of Subtotal										$1,350,000
Electrical/Controls @ 20% of Subtotal										$3,000,000
Startup/Testing @ 2% of Subtotal										$300,000
FM to Spray Field #10										$195,000
Parcel # 10 Spray Field Development										IBRWF
Subtotal (rounded)										$20,300,000
Construction Contingencies @ 10% of Subtotal										$2,000,000
Construction Cost										$22,300,000
Project Costs @ 22% of Construction Cost										$4,900,000
TOTAL PROJECT COST (2009 Dollars)										$27,200,000

Notes:
1. Cost Escallation based on ENR Construction Cost Index
2. Scaled Cost based on formula Cost 2 = Cost 1 * (Flow 2 / Flow 1) ^ (0.62) with flows in mgd units.
3. Cost for screening from Wolfe Neck Regional Study (March 2009), with electrical and contingency costs removed.
4. Cost for Biolac treatment system from January 2007 estimates for Inland Bays RWF.
5. Costs for Screening and Chlorine Contact Tank from WNRWF Expansion Cost Estimate.
6. Costs for irrigation pumping station from Bridgeville WWTP 2007 Upgrade.
7. Costs for influent dist box, grit, sludge handling, clarifiers, return sludge pumping station, and chemical feed system from SCRWF Expansion No. 2 (Bid 2004).
8. Costs for Spray Field Development from January 2009 estimates for Inland Bays RWF for irrigation guns, materials take-off for piping and grading
9. No piles assumed for new structures.
10. Cost for Waste Sludge Holding Lagoon from vendor quote for Emmitsburg WWTP for mixers (October 2007) and material take-off for lagoon liner & concrete
11. Assumptions for Yard Piping, General Site Work, Startup/Testing, and Electrical/Controls based on SCRWF Expansion No. 2 as follows:
    - SCRWF Expansion No. 2 Cost (2004 dollars) – C.O. Falter contract only = $15,201,101
    - Yard Piping for Falter Contract = $1,017,000
    - Site Work for Falter Contract = $316,000
    - Electrical for Falter Contract = $1,500,000
    - Controls for Falter Contract = $1,066,400
    - Startup and Testing for Falter Contract = $209,000
    - C.O. Falter Contract w/o Yard Piping, Sitework, Startup/Testing or Electrical/Controls = $11,092,701
        - Yard Piping as a percentage of raw costs = $1,017,000 / $11,092,701= 9%
        - Site Work as a percentage of raw costs = $316,000 / $11,092,701= 3%
        - Startup/Testing as a percentage of raw costs = $209,000 / $11,092,701= 2%
        - Electrical/Controls as a percentage of raw costs = $2,566,400 / $11,092,701= 23%

STEARNS & WHELER LLC
Environmental Engineers & Scientists

Inland Bays Regional Wastewater Facility Study Phase Estimate of Capital Cost

Table F-2
Cost Summary for Inland Bays Phase 3A Expansion
July 1, 2009

Description	Comparative Cost	Date of Comparative Cost	Date of Analysis	Escalated Cost	Comparative Capacity	Units	This Capacity	Scaled Cost	Cost Plus 5% Mobilization	Estimated Cost
Screening	$513,000	March-09	Mar-09	$513,000	6.50	mgd	6.50	$510,000	$540,000	$540,000
Biolac Treatment System (Convert WAS Lagoon)	$1,060,000	Jun-07	Mar-09	$1,139,000	1.83	mgd	1.83	$1,140,000	$1,200,000	$1,200,000
Secondary Clarifiers	$2,437,052	Sep-04	Mar-09	$2,850,000	7.20	MG	1.38	$1,020,000	$1,070,000	$1,070,000
Chlorine Contact Tank	$400,000	Jan-07	Mar-09	$433,000	3.00	mgd	1.49	$280,000	$290,000	$290,000
New Storage Lagoon (45 Day Winter ADF)	$1,283,750	Feb-07	Mar-09	$1,390,000	23.50	MG	49	$2,190,000	$2,300,000	$2,300,000
Irrigation Pumping Station	$569,000	Feb-07	Mar-09	$616,000	0.58	mgd	1.49	$1,110,000	$1,170,000	$1,170,000
Waste Sludge Holding Lagoons	$970,000	Jan-07	Mar-09	$1,051,000	3.00	mgd	5.18	$1,470,000	$1,540,000	$1,540,000
Subtotal (rounded)										$8,100,000
General Site Work @ 3% of Subtotal										$240,000
Yard Piping @ 9% of Subtotal										$730,000
Electrical/Controls @ 20% of Subtotal										$1,620,000
Startup/Testing @ 2% of Subtotal										$160,000
Cordrey Parcel Spray Field Development										$1,840,000
Subtotal (rounded)										$12,700,000
Construction Contingencies @ 10% of Subtotal										$1,300,000
Construction Cost										$14,000,000
Project Costs @ 22% of Construction Cost										**$3,100,000**
TOTAL PROJECT COST (2009 Dollars)										$17,100,000

Notes:
1. Cost for screening from Wolfe Neck Regional Study (March 2009), with electrical and contingency costs removed.
2. Scaled Cost based on formula Cost 2 = Cost 1 * (Flow 2 / Flow 1) ^ (0.62) with flows in mgd units.
3. Cost for Biolac treatment system from January 2007 estimates for Inland Bays RWF.
4. Costs for Chlorine Contact Tank from WNRWF Expansion Cost Estimate.
5. Costs for irrigation pumping station from Bridgeville WWTP 2007 Upgrade.
6. Costs for influent dist box, grit, sludge handling, clarifiers, return sludge pumping station, and chemical feed system from SCRWF Expansion No. 2 (Bid 2004).
7. Costs for Komet Irrigation Spray Guns from January 2009 estimates for Inland Bays RWF
8. No piles assumed for new structures.
9. Assumptions for Yard Piping, General Site Work, Startup/Testing, and Electrical/Controls based on SCRWF Expansion No. 2 as follows:
   - SCRWF Expansion No. 2 Cost (2004 dollars) – C.O. Falter contract only = $15,201,101
   - Yard Piping for Falter Contract = $1,017,000
   - Site Work for Falter Contract = $316,000
   - Electrical for Falter Contract = $1,500,000
   - Controls for Falter Contract = $1,066,400
   - Startup and Testing for Falter Contract = $209,000
   - C.O. Falter Contract w/o Yard Piping, Sitework, Startup/Testing or Electrical/Controls = $11,092,701
     - Yard Piping as a percentage of raw costs = $1,017,000 / $11,092,701= 9%
     - Site Work as a percentage of raw costs = $316,000 / $11,092,701= 3%
     - Startup/Testing as a percentage of raw costs = $209,000 / $11,092,701= 2%
     - Electrical/Controls as a percentage of raw costs = $2,566,400 / $11,092,701= 23%

APPENDIX G

Cost Sharing Model

Appendix G: Table G-1

Alternative #1A - RAW WASTEWATER FROM REHOBOTH WITH EXCESS PUMPED TO IBWRF

Item No.	Description	Design Criteria (1.)	County Flow Contribution (MGD) (2.)	Rehoboth Flow Contribution (MGD) (2.)	Rehoboth Cost Share
1	RBSTP Pumping Station	3.4 MGD Max Month	0.0	3.4	100%
2A	Force Main to WNRWF (Option #1)	3.4 MGD Max Month	0.0	3.4	100%
5	WNRWF Headworks Upgrades	10 MGD Max Month	6.4	3.6	36.2%
6	WNRWF to IBRWF Transfer Pumping Station	4.6 MGD Max Month	2.1	2.5	54.3%
7	Force Main to IBRWF (Option #3)	4.6 MGD Max Month	2.1	2.5	54.3%
8	IBRWF Phase 2 Upgrades	3.7 MGD Max Month	0.0	1.7	100.0%
9	IBRWF Phase 3 Upgrades	5.2 MGD Max Month	0.7	0.8	53.3%
10	IBRWF Phase 4 Upgrades	7.5 MGD Max Month	0.0	0.0	0.0%

Notes:
(1.) All Design Criteria is for 2030 maximum month except Items 1 and 2A, which are for buildout per the RBWWTP Alternative Discharge Cost Evaluation and Item 5, which incoporates additional 1.5 factor to account for pumped flows.
(2.) Flow contribution for phases 2 through 4 are based on the increase from the previous phase (i.e Phase 1 to 2 is 3.7-2.0=1.7 mgd).

Appendix G: Table G-2

Alternative #1B- RAW WASTEWATER FROM REHOBOTH WITH EXCESS PUMPED TO PRIVATE WTP

Item No.	Description	Design Criteria (1.)	County Flow Contribution (MGD) (2.)	Rehoboth Flow Contribution (MGD) (2.)	Rehoboth Cost Share
1	RBSTP Pumping Station	3.4 Max Month	0.0	3.4	100%
2A	Force Main to WNRWF (Option #1)	3.4 Max Month	0.0	3.4	100%
5	WNRWF Headworks Upgrades	10 MGD Max Month	6.4	3.6	36.2%
6	WNRWF to PWWP Transfer Pumping Station	4.6 MGD Max Month	2.1	2.5	54.3%
8	IBRWF Phase 2 Upgrades	2.9 MGD Max Month	0.9	0.0	0.0%
11B	Force Main to PWWP	4.6 MGD Max Month	2.1	2.5	54.3%
12	PWWP Treatment Capacity	4.6 MGD Max Month	2.1	2.5	54.3%
13	Land/Easements	NA	2.1	2.5	54.3%

Notes:

(1.) All Design Criteria is for 2030 maximum month except Items 1 and 2A, which are for buildout per the RBWWTP Alternative Discharge Cost Evaluation and Item 5, which incorporates additional 1.5 factor to account for pumped flows.

(2.) Capacity of the IBWRF will be 2 mgd after phase 1 is completed.Flow contribution for phases 2 through 4 are based on the increase from the previous phase (i.e. Phase 1 to 2 is 3.7-2.0=1.7 mgd).

Appendix G: Table G-3

Alternative #2A - Treated Effluent FROM Rehoboth Pumped to WNRWF with Excess to IBRWF

Item No.	Description	Design Criteria (1.)	County Flow Contribution (MGD) (2.)	Rehoboth Flow Contribution (MGD) (2.)	Rehoboth Cost Share
1	RBSTP Pumping Station	3.4 Max Month	0.0	3.4	100.0%
2A	Force Main to WNRWF (Option #1)	3.4 Max Month	0.0	3.4	100.0%
3A	Rehoboth Treatment Plant Improvements	3.4 Max Month	0.0	3.4	100.0%
5	WNRWF Headworks Upgrades	6.6 MGD Max Month	6.6	0.0	0.0%
6	WNRWF to IBRWF Transfer Pumping Station	3.6 MGD Max Month	2.1	1.5	41.7%
7	Force Main to IBRWF (Option #3)	3.6 MGD Max Month	2.1	1.5	41.7%
8	IBRWF Phase 2 Upgrades	3.7 MGD Max Month	0.2	1.5	88.2%
13	Land/Easements	-	N/A	N/A	100.0%

Notes:
(1.) All Design Criteria is for 2030 maximum month except Items 1 and 2A, which are for buildout per the RBWWTP Alternative Discharge Cost Evaluation and Item 4, which incoporates additional 1.5 factor to account for pumped flows.
(2.) Capacity of the IBWRF will be 2 mgd after phase 1 is completed.Flow contribution for phase 2 is based on the increase from the previous phase (i.e. Phase 1 to 2 is 3.7-2.0=1.7 mgd).

Appendix G: Table G-4

Alternative #2B - TREATED WASTEWATER FROM REHOBOTH WITH EXCESS PUMPED TO PRIVATE WTF

Item No.	Description	Design Criteria (1.)	County Flow Contribution (MGD) (2.)	Flow Contribution (MGD) (2.)	Rehoboth Cost Share
1	RBSTP Pumping Station	3.4 Max Month	0.0	3.4	100.0%
2A	Force Main to WNRWF (Option #1)	3.4 Max Month	0.0	3.4	100.0%
3A	Rehoboth Treatment Upgrades	3.4 Max Month	0.0	3.4	100.0%
5	WNRWF Headworks Upgrades	6.6 MGD Max Month	6.6	0.0	0.0%
6	WNRWF to ANSWERF Transfer Pumping Station	3.6 MGD Max Month	2.1	1.5	41.7%
8	IBRWF Phase 2 Upgrades	2.9 MGD Max Month	0.9	0.0	0.0%
11A	Force Main to ANSRWF	3.6 MGD Max Month	2.1	1.5	41.7%
12	PWWP Treatment Capacity	3.6 MGD Max Month	2.1	1.5	41.7%
13	Land/Easements	-	2.1	1.5	41.7%

Notes:
(1.) All Design Criteria is for 2030 maximum month except Items 1 and 2A, which are for buildout per the RBWWTP Alternative Discharge Cost Evaluation and Item 4, which incoporates additional 1.5 factor to account for pumped flows.
(2.) Capacity of the IBWRF will be 2 mgd after phase 1 is completed.Flow contribution for phase 2 is based on the increase from the previous phase (i.e. Phase 1 to 2 is 2.9-2.0=0.9 mgd).

Appendix G: Table G-5

Alternative #3 - REHOBOTH OUTFALL ALTERNATIVE WITH COUNTY CONTINUING TO PUMP TO IBWRF

Item No.	Description	Design Criteria (1.)	County Flow Contribution (MGD) (2.)	Rehoboth Flow Contribution (MGD) (2.)	Rehoboth Cost Share
1	RBSTP Pumping Station	3.4 Max Month	0.0	3.4	100%
3A	Rehoboth Treatment Upgrades	3.4 Max Month	0.0	3.4	100%
3B	Rehoboth FM to Ocean Outfall	-	0.0	3.4	100%
3C	Rehoboth Ocean Outfall	-	0.0	3.4	100%
5	WNRWF Headworks Upgrades	6.6 MGD Max Month	6.6	0.0	0.0%
6	WNRWF to IBRWF/PWWP P.S.	2.1 MGD Max Month	2.1	0.0	0.0%
7	Force Main to IBRWF (Option #3)	2.1 MGD Max Month	2.1	0.0	0.0%
8	IBRWF Phase 2 Upgrades	3.7 MGD Max Month	1.7	0.0	0.0%
9	IBRWF Phase 3A Upgrades	5.0 MGD Max Month	1.3	0.0	0.0%
13	Land/Easements	N/A	0.0	0.0	0.0%

Notes:
(1.) All Design Criteria is for 2030 maximum month except Items 1 and 2A, which are for buildout per the RBWWTP Alternative Discharge Cost Evaluation and Item 4, which incoporates additional 1.5 factor to account for pumped flows.
(2.) Capacity of the IBWRF will be 2 mgd after phase 1 is completed.Flow contribution for phase 2 is based on the increase from the previous phase (i.e. Phase 1 to 2 is 3.7-2.0=1.7 mgd).

Appendix G: Table G-6

Alternative #4 - COMBINED REHOBOTH AND COUNTY OCEAN OUTFALL

Item No.	Description	Design Criteria (1.)	County Flow Contribution (MGD)	Rehoboth Flow Contribution	Rehoboth Cost Share
1	RBSTP Pumping Station	3.4 Max Month	0.0	3.4	100.0%
2B	Force Main to Rehoboth (Option #1)	2.1 Max Month	2.1	0.0	0.0%
3A	Rehoboth Treatment Upgrades	3.4 Max Month	0.0	8.3	100.0%
3B	Rehoboth FM to Ocean Outfall	5.4 Max Month	2.1	2.5	54.3%
3C	Rehoboth Ocean Outfall	5.4 Max Month	2.1	2.5	54.3%
4	WNRWF Upgrades	4.4 MGD Max Month	4.4	0.0	0.0%
5	WNRWF Headworks Upgrades	6.6 MGD Max Month	6.6	0.0	0.0%
6	WNRWF to IBRWF/PWWP P.S.	2.1 MGD Max Month	2.1	0.0	0.0%
8	IBRWF Phase 2 Upgrades	2.9 MGD Max Month	0.9	0.0	0.0%
13	Land/Easements	-	0.0	0.0	0.0%

Notes:
(1.) All Design Criteria is for 2030 maximum month except Items 1 and 2A, which are for buildout per the RBWWTP Alternative Discharge Cost Evaluation and Item 4, which incoporates additional 1.5 factor to account for pumped flows.
(2.) Capacity of the IBWRF will be 2 mgd after phase 1 is completed.Flow contribution for phase 2 is based on the increase from the previous phase (i.e. Phase 1 to 2 is 2.9-2.0=0.9 mgd).

Appendix G: Table G-6B

Alternative #4B - COMBINED REHOBOTH AND COUNTY OCEAN OUTFALL

Item No.	Description	Design Criteria (1.)	County Flow Contribution (MGD)	Rehoboth Flow Contribution	Rehoboth Cost Share
1	RBSTP Pumping Station	3.4 Max Month	0.0	3.4	100.0%
2B	Force Main to Rehoboth (Option #1)	4.9 Max Month	2.1	0.0	0.0%
3A	Rehoboth Treatment Upgrades	3.4 Max Month	0.0	8.3	100.0%
3B	Rehoboth FM to Ocean Outfall	8.3 Max Month	4.9	3.4	41.0%
3C	Rehoboth Ocean Outfall	8.3 Max Month	4.9	3.4	41.0%
4	WNRWF Upgrades	4.9 Max Month	4.4	0.0	0.0%
5	WNRWF Headworks Upgrades		6.6	0.0	0.0%
6	WNRWF to IBRWF/PWWP P.S.	4.9 Max Month	2.1	0.0	0.0%
8	IBRWF Phase 2 Upgrades		0.9	0.0	0.0%
13	Land/Easements	-	0.0	0.0	0.0%

Notes:
(1.) All Design Criteria is for buildout maximum month
and Item 4, which incoporates additional 1.5 factor to account for pumped flows.

SUMMARY OF TOTAL CAPITAL COSTS

ALTERNATIVES #1, #2 and Analysis of Private Wastewater Treatment Provider

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		Alternative #1A - Raw Wastewater Pumped to WNRWF				Alternative #1B Private Wastewater Treatment Provider				Alternative #2A - Treated Effluent Pumped to WNRWF				Alternative #2B Private Wastewater Treat		
Item	Description	Table	Design Criteria	Capacity	Total Cost	Table	2030 Design Criteria	2030 Capacity	Total Cost	Table	2030 Design Criteria	2030 Capacity	Total Cost	Table	2030 Design Criteria	2030 Capacity
1	RBSTP Pumping Station	-	3.4 MGD Max Month	10.2 MGD Peak Hour	$3,001,000	-	3.4 Max Month	10.2 MGD Peak Hour	$3,001,000	N/A	3.4 Max Month	10.2 MGD Peak Hour	$900,000	N/A	3.4 Max Month	10.2 MGD Peak Hour
2A	Force Main to WNRWF (Option #1)	D-1	3.4 MGD Max Month	10.2 MGD Peak Hour	$3,123,000	D-1	3.4 Max Month	10.2 MGD Peak Hour	$3,123,000	D-3	3.4 Max Month	10.2 MGD Peak Hour	$3,500,000	D-3	3.4 Max Month	10.2 MGD Peak Hour
2B	Force Main to Rehoboth (Option #1)	-	-	-	-	-	-	-	-					-	-	-
3A	Rehoboth Treatment Upgrades	-	-	-	-	-	-	-	-	-	3.4 Max Month	3.4 Max Month	$2,930,000	-	3.4 Max Month	3.4 Max Month
3B	Rehoboth FM to Ocean Outfall	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
3C	Rehoboth Ocean Outfall	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4	WNRWF Upgrades	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5	WNRWF Headworks Upgrades	D-5	10 MGD Max Month	27.5 MGD Peak Hour	$1,527,571	D-5	10 MGD Max Month	27.5 MGD Peak Hour	$1,527,571	D-6	6.6 MGD Max Month	17.5 MGD Peak Hour	$1,296,572	D-6	6.6 MGD Max Month	17.5 MGD Peak Hour
6	WNRWF to IBRWF/PWWP P.S.	E-4	4.6 MGD Max Month	6.9 MGD Peak Hour	$2,485,000	E-4	4.6 MGD Max Month	6.9 MGD Peak Hour	$2,485,000	E-5	3.6 MGD Max Month	5.4 MGD Peak Hour	$2,270,000	E-5	3.6 MGD Max Month	5.4 MGD Peak Hour
7	Force Main to IBRWF (Option #3)	E-3	4.6 MGD Max Month	6.9 MGD Peak Hour	$13,027,250	-	-	-	-	E-9	3.6 MGD Max Month	5.4 MGD Peak Hour	$13,027,250	-	-	-
8	IBRWF Phase 2 Upgrades	F-1	3.7 MGD Max Month	3.7 MGD Max Month	$20,600,000	(1)	2.9 MGD Max Month	2.9 MGD Max Month	$10,905,882	F-1	3.7 MGD Max Month	3.7 MGD Max Month	$20,600,000	(1)	2.9 MGD Max Month	2.9 MGD Max Month
9	IBRWF Phase 3A Upgrades	F-2	5.2 MGD Max Month	5.2 MGD Max Month	$12,700,000	-	N/A	N/A	N/A	F-2	5.2 MGD Max Month	5.2 MGD Max Month	$12,700,000	-	-	-
10	IBRWF Phase 4 Upgrades	-	7.5 MGD Max Month	7.5 MGD Max Month	$18,852,459		N/A	N/A	N/A	-	6.5 MGD Max Month	6.5 MGD Max Month	$10,655,738	-	-	-
11A	Force Main to Cave Neck Road	-	-	-	-	E-7	4.6 MGD Max Month	6.9 MGD Peak Hour	$6,967,511	-	-	-	N/A	E-7	3.6 MGD Max Month	5.4 MGD Peak Hour
11B	Force Main to ANSWRF	-	-	-	-	E-8	4.6 MGD Max Month	6.9 MGD Peak Hour	$8,736,587	-	-	-	N/A	E-8	-	-
12	PSP Treatment Capacity	-	-	-	-	-	4.6 MGD Max Month	4.6 MGD Max Month	$48,410,902	-	-	-	N/A	-	3.6 MGD Max Month	3.6 MGD Max Month
13	Land/Easements	-	-	-	$11,250,000	-	-	-	$500,000	-	-	-	$11,250,000	-	-	-
14A	10% Contingency	-	-	-	$7,531,628	-	-	-	$3,724,655	-	-	-	$6,494,956	-	-	-
14B	15% Contingency (Ocean Outfall and Rehoboth WWTP Upgrade Only)	-	-	-	-	-	-	-	-	-	-	-	$439,500	-	-	-
15	Engineering and Administration	-	-	-	$18,226,540	-	-	-	$10,628,665	-	-	-	$16,459,084	-	-	-
16	Permitting (5%) Ocean Outfall Only															
	Total Project Cost				**$112,324,447**				**$100,010,774**				**$102,523,100**			

Notes:
(1) Ratio of (2.9-2.0)/(3.7-2.0) * Phase 2 costs used to approximate reduced upgrade.

Flow Split

Year 2030	Max Month Flow (MGD)	Notes
Sussex County		
WNRWF	4.4	
IBRWF	2.9	
Henlopen/Dewey	0.9	38% of flow from RBSTP
Subtotal	8.2	*Sussex County Flow*
City of Rehoboth	1.6	62% of flow from RBSTP
Total	9.8	

% Flow Contributed by Sussex County 84%
% Flow Contributed by City of Rehoboth 16%

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SUMMARY OF TOTAL CAPITAL COSTS

ALTERNATIVES #3 & #4

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		ment Provider	Alt. 3 - Rehoboth Ocean Outfall Alternative (County Uses Inland Bays)				Alt. 4 - Rehoboth Ocean Outfall Alternative (County Uses Rehoboth Ocean Outfall)			
Item	Description	Total Cost	Table	2030 Design Criteria	2030 Capacity	Total Cost	Table	2030 Design Criteria	2030 Capacity	Total Cost
1	RBSTP Pumping Station	$900,000	X	3.4 Max Month	10.2 MGD Peak Hour	$900,000	-	3.4 Max Month	10.2 MGD Peak Hour	$900,000
2A	Force Main to WNRWF (Option #1)	$3,500,000	-	-	-	-	-	-	-	-
2B	**Force Main to Rehoboth (Option #1)**	-	-	-	-	-	E-10	2.1 Max Month	3.2 MGD Peak Hour	$1,726,000
3A	**Rehoboth Treatment Upgrades**	$2,930,000	-	3.4 Max Month	3.4 Max Month	$2,930,000	-	3.4 Max Month	3.4 Max Month	$2,930,000
3B	**Rehoboth FM to Ocean Outfall**	-	-	-	-	$2,560,000	-	-	-	$6,160,000
3C	**Rehoboth Ocean Outfall**	-	-	-	-	$14,800,000	-	-	-	$16,600,000
4	**WNRWF Upgrades**	-	-	-	-	-	-	4.4 MGD Max Month	4.4 MGD Max Month	$21,000,000
5	WNRWF Headworks Upgrades	$1,296,572	D-6	6.6 MGD Max Month	17.5 MGD Peak Hour	$1,296,572	D-6	6.6 MGD Max Month	17.5 MGD Peak Hour	$1,296,572
6	WNRWF to IBRWF/PWWP P.S.	$2,270,000	E-6	2.1 MGD Max Month	3.2 MGD Peak Hour	$2,000,000	-	2.1 MGD Max Month	3.2 MGD Peak Hour	$1,750,000
7	**Force Main to IBRWF (Option #3)**	-	E-9	2.1 MGD Max Month	3.2 MGD Peak Hour	$11,142,250	-	-	-	
8	IBRWF Phase 2 Upgrades	$10,905,882	F-1	3.7 MGD Max Month	3.7 MGD Max Month	$20,600,000	(1)	2.9 MGD Max Month	2.9 MGD Max Month	$10,905,882
9	IBRWF Phase 3A Upgrades	-	F-2	5.0 MGD Max Month	5.0 MGD Max Month	$12,700,000	-	-	-	-
10	IBRWF Phase 4 Upgrades	-	-	-	-	-	-	-	-	-
11A	Force Main to Cave Neck Road	$6,967,511	-	-	-	-	-	-	-	-
11B	Force Main to ANSWRF	$8,736,587	-	-	-	-	-	-	-	-
12	PSP Treatment Capacity	$38,576,359	-	-	-	-	-	-	-	-
13	Land/Easements	$500,000	-	-	-	$0	-	-	-	-
14A	10% Contingency	$3,507,655	-	-	-	$5,119,882	-	-	-	$4,373,845
14B	15% Contingency (Ocean Outfall and Rehoboth WWTP Upgrade Only)	$439,500	-	-	-	$2,659,500	-	-	-	$2,929,500
15	Engineering and Administration	$10,469,816	-	-	-	$16,875,805	-	-	-	$15,525,796
16	Permitting (5%) Ocean Outfall Only					$851,000				$954,500
	Total Project Cost	**$90,999,883**				**$94,435,010**				**$87,052,096**

Notes:
(1) Ratio of (2.9-2.0)/(3.7-2.0) * Phase 2 costs used to

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Rehoboth Capital Costs

Alternative #1A - RAW WASTEWATER FROM REHOBOTH WITH EXCESS PUMPED TO IBWRF

Item No.	Description	Table #	2030 Design Criteria	2030 Capacity	Total Cost	County Costs Share	Rehoboth Cost Share	Rehoboth Cost
1	RBSTP Pumping Station	-	3.4 MGD Max Month	10.2 MGD Peak Hour	$3,001,000	$0	100%	$3,001,000
2A	Force Main to WNRWF (Option #1)	D-1	3.4 MGD Max Month	10.2 MGD Peak Hour	$3,123,000	$0	100%	$3,123,000
5	WNRWF Headworks Upgrades	D-5	10 MGD Max Month	27.5 MGD Peak Hour	$1,527,571	$974,590	36.2%	$552,981
6	WNRWF to IBRWF Transfer Pumping Station	E-4	4.6 MGD Max Month	6.9 MGD Peak Hour	$2,485,000	$1,135,645	54.3%	$1,349,355
7	Force Main to IBRWF (Option #3)	E-3	4.6 MGD Max Month	6.9 MGD Peak Hour	$13,027,250	$5,953,453	54.3%	$7,073,797
8	IBRWF Phase 2 Upgrades	F-1	3.7 MGD Max Month	3.7 MGD Max Month	$20,600,000	$0	100.0%	$20,600,000
9	IBRWF Phase 3 Upgrades	F-2	5.2 MGD Max Month	5.2 MGD Max Month	$12,700,000	$5,926,667	53.3%	$6,773,333
10	IBRWF Phase 4 Upgrades	-	7.5 MGD Max Month	7.5 MGD Max Month	$18,852,459	$18,852,459	0.0%	$0
13	Land/Easements	-	-	-	$11,250,000	$0	100.0%	$11,250,000
14A	10% Contingency	-	-	-	$7,531,628	$3,284,281	56.4%	$4,247,347
15	Engineering/Administration	-	-	-	$18,226,540	$7,947,961	56.4%	$10,278,579
	Total Project Cost				**$112,324,447**	**$44,075,056**		**$68,249,391**

SUSSEX COUNTY COST $44,075,056

Flow Split	Month Flow (MGD)	Notes
WNRWF	4.4	
IBRWF	2.9	
Subtotal	*7.3*	
Henlopen/Dewey	0.9	38% of flow from RBSTP
City of Rehoboth/North Shores	1.6	62% of flow from RBSTP
Total	**9.8**	

User Cost Determination	SPRAY IRRIGATION OPTION SRF 4.4% for 20 years (from S&W March 2009 Report)		SPRAY IRRIGATION OPTION 1/3 SRF @ 4.4% for 20 years & 2/3 RD @ 5% for 40 years	
COSTS DESCRIPTION	Rehoboth + DB, NS & HA	Rehoboth Only	Rehoboth + DB, NS & HA	Rehoboth Only
Annual Capital Cost	$5,201,385	$2,929,420	$4,385,428	$2,469,873
Plant Operations (From Rehoboth March 2009 Report)	$0	$0	$0	$0
Pump Station Maintenance	$100,000	$56,320	$100,000	$56,320
Collection System From Rehoboth March 2009 Report)	$150,000	$138,735	$150,000	$138,735
Sussex County Operations and Maintenance ($5.08/1000 gal)	$2,286,000	$1,287,475	$2,286,000	$1,287,475
Subtotal		$4,411,950		$3,952,403
Projected User Rate for City of Rehoboth		$1,156		$1,036

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Rehoboth Capital Costs

Alternative #1B- RAW WASTEWATER FROM REHOBOTH WITH EXCESS PUMPED TO PRIVATE ANSWERF

Item No.	Description	Table #	2030 Design Criteria	2030 Capacity	Total Cost	County Share	Rehoboth Cost Share	Rehoboth Cost
1	RBSTP Pumping Station	-	3.4 Max Month	10.2 MGD Peak Hour	$3,001,000	$0	100%	$3,001,000
2A	Force Main to WNRWF (Option #1)	D-1	3.4 Max Month	10.2 MGD Peak Hour	$3,123,000	$0	100%	$3,123,000
5	WNRWF Headworks Upgrades	D-5	10 MGD Max Month	27.5 MGD Peak Hour	$1,527,571	$974,103	36.2%	$553,468
6	WNRWF to PWWP Transfer Pumping Station	E-4	4.6 MGD Max Month	6.9 MGD Peak Hour	$2,485,000	$1,134,457	54.3%	$1,350,543
8	IBRWF Phase 2 Upgrades	(1)	2.9 MGD Max Month	2.9 MGD Max Month	10,905,882	10,905,882	0.0%	$0
11B	Force Main to PWWP	E-7	4.6 MGD Max Month	6.9 MGD Peak Hour	$15,704,098	$7,169,262	54.3%	$8,534,836
12	PWWP Treatment Capacity	E-8	4.6 MGD Max Month	4.6 MGD Max Month	$48,410,902	$22,100,629	54.3%	$26,310,273
13	Land/Easements	-	-	-	$500,000	$228,261	54.3%	$271,739
14A	Contingency	-	-	-	$3,724,655	$2,041,197	**45.2%**	**$1,683,459**
15	Engineering & Administration	-	-	-	$10,628,665	$5,824,753	**45.2%**	**$4,803,913**
	Total Project Cost				**$100,010,774**	**$50,378,543**		$49,632,231

Notes:
(1) Ratio of (2.9-2.0)/(3.7-2.0) * Phase 2 costs used to approximate reduced upgrade.

SUSSEX COUNTY COST	$50,378,543

Flow Split to PWWP	Max Month Flow	Notes
WNRWF (4.4-2.3)	2.1	45.7%
Rehoboth	2.5	54.3%
Subtotal	*4.6*	
Henlopen/Dewey	0.9	38% of flow from RBSTP
City of Rehoboth/North Shores	1.6	62% of flow from RBSTP
Total	**7.1**	

User Cost Determination	Private Option		Private Option	
	SRF 4.4% for 20 years (from S&W March 2009 Report)		1/3 SRF @ 4.4% for 20 years & 2/3 RD @ 5% for 40 years	
COSTS DESCRIPTION	Rehoboth + DB, NS & HA	Rehoboth Only @ 56.32%	Rehoboth + DB, NS & HA	Rehoboth Only @ 56.32%
Annual Capital Cost	$3,782,544	$2,130,329	$3,189,165	$1,796,138
Pump Station O&M	$100,000	$56,320	$100,000	$56,320
Collection System From Rehoboth March 2009 Report)	$150,000	$138,735	$150,000	$138,735
Artesian Disposal @ 2 MGD Minimum ($6.84/1000 gal)	$4,993,200	$2,812,170	$4,993,200	$2,812,170
Sussex County O&M ($1.21/1000 gal)	$544,500	$306,662	$544,500	$306,662
Subtotal		$5,444,217		$5,110,025
Projected User Rate for City of Rehoboth		$1,427		$1,339

Appendix G: Table G-10

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Capital Costs

Alternative #2A - Treated Effluent FROM Rehoboth Pumped to WNRWF with Excess to IBRWF

Item No.	Description	Table #	2030 Design Criteria	2030 Capacity	Total Cost	County Share	Rehoboth Cost Share	Rehoboth Cost
1	RBSTP Pumping Station	N/A	3.4 Max Month	10.2 MGD Peak Hour	$900,000	$0	100%	$900,000
2A	Force Main to WNRWF (Option #1)	D-3	3.4 Max Month	10.2 MGD Peak Hour	$3,500,000	$0	100%	$3,500,000
3A	Rehoboth Treatment Plant Improvements				$2,930,000	$0	100%	$2,930,000
5	WNRWF Headworks Upgrades	D-6	6.6 MGD Max Month	17.5 MGD Peak Hour	$1,296,572	$1,296,572	0.0%	$0
6	WNRWF to IBRWF Transfer Pumping Station	E-5	3.6 MGD Max Month	5.4 MGD Peak Hour	$2,270,000	$1,324,167	41.7%	$945,833
7	Force Main to IBRWF (Option #3)	E-9	3.6 MGD Max Month	5.4 MGD Peak Hour	$13,027,250	$7,599,229	41.7%	$5,428,021
8	IBRWF Phase 2 Upgrades	F-1	3.7 MGD Max Month	3.7 MGD Max Month	$20,600,000	$2,430,800	88.2%	$18,169,200
9	IBRWF Phase 3 Upgrades	F-2	5.2 MGD Max Month	5.2 MGD Max Month	$12,700,000	$12,700,000	0.0%	$0
10	IBRWF Phase 4 Upgrades	-	6.5 MGD Max Month	6.5 MGD Max Month	$10,655,738	$10,655,738	0.0%	$0
13	Land/Easements	-	-	-	$11,250,000	$0	100.0%	$11,250,000
14A	10% Contingency	-	-	-	$6,494,956	$3,600,651	44.6%	$2,894,305
14B	15% Contingency (Ocean Outfall and Rehoboth WWTP Upgrade Only)	-	-	-	$439,500	$0	100.0%	$439,500
15	Engineering/Administration	-	-	-	$16,459,084	$8,713,574	47.1%	$7,745,509
	Total Project Cost				**$102,523,100**	**$48,320,731**		**$54,202,369**

SUSSEX COUNTY COST $48,320,731

Flow Split		Notes
WNRWF	4.4	
IBRWF	2.9	
Subtotal	*7.3*	
Henlopen/Dewey	0.9	38% of flow from RBSTP
City of Rehoboth/North Shores	1.6	62% of flow from RBSTP
Total	**9.8**	

User Cost Determination	SPRAY IRRIGATION OPTION		SPRAY IRRIGATION OPTION	
	SRF 4.4% for 20 years (from S&W March 2009 Report)		1/3 SRF @ 4.4% for 20 years & 2/3 RD @ 5% for 40 years	
COSTS DESCRIPTION	Rehoboth + DB, NS & HA	Rehoboth Only	Rehoboth + DB, NS & HA	Rehoboth Only
Annual Capital Cost	$4,130,841	$2,326,490	$3,482,823	$1,961,526
Plant Operations (From Rehoboth March 2009 Report)	$1,590,000	$895,488	$1,590,000	$895,488
Collection System From Rehoboth March 2009 Report)	$150,000	$138,735	$150,000	$138,735
Sussex County Operations and Maintenance ($2.00/1000 gal)	$900,000	$506,880	$900,000	$506,880
Subtotal		$3,867,593		$3,502,629
Projected User Rate for City of Rehoboth		$1,014		$918

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Rehoboth Capital Costs

Alternative #2B - TREATED WASTEWATER FROM REHOBOTH WITH EXCESS PUMPED TO PRIVATE ANSWERF

Item No.	Description	Table #	2030 Design Criteria	2030 Capacity	Total Cost	County Costs	Rehoboth Cost Share	Rehoboth Cost
1	RBSTP Pumping Station	N/A	3.4 Max Month	10.2 MGD Peak Hour	$900,000	$0	100%	$900,000
2A	Force Main to WNRWF (Option #1)	D-3	3.4 Max Month	10.2 MGD Peak Hour	$3,500,000	$0	100%	$3,500,000
3A	Rehoboth Treatment Upgrades				$2,930,000	$0	100%	$2,930,000
5	WNRWF Headworks Upgrades	D-6	6.6 MGD Max Month	17.5 MGD Peak Hour	$1,296,572	$1,296,572	0.0%	$0
6	WNRWF to PWWP Transfer Pumping Station	E-5	3.6 MGD Max Month	5.4 MGD Peak Hour	$2,270,000	$1,323,410	41.7%	$946,590
8	IBRWF Phase 2 Upgrades	(1)	2.9 MGD Max Month	2.9 MGD Max Month	$10,905,882	$10,905,882	0.0%	$0
11A	Force Main to PWWP	E-7	3.6 MGD Max Month	5.4 MGD Peak Hour	$15,704,098	$9,155,489	41.7%	$6,548,609
12	PWWP Treatment Capacity	-	3.6 MGD Max Month	3.6 MGD Max Month	$38,576,359	$22,490,017	41.7%	$16,086,342
13	Land/Easements	-	-	-	$500,000	$291,500	41.7%	$208,500
14A	10% Contingency	-	-	-	$3,507,655	$2,297,285	39.6%	$1,210,370
14B	15% Contingency (Ocean Outfall and Rehoboth WWTP Upgrade Only)	-	-	-	$439,500	$0	100.0%	$439,500
15	Engineering & Administration	-	-	-	$10,469,816	$6,328,423	39.6%	$4,141,393
	Total Project Cost				**$90,999,883**	**$54,088,580**		**$36,911,303**

Notes:
(1) Ratio of (2.9-2.0)/(3.7-2.0) * Phase 2 costs used to approximate reduced upgrade.

SUSSEX COUNTY COST	$54,088,580

Flow Split to ANSWERF	Max Month Flow	Notes
WNRWF (4.4-2.3)	2.1	45.7%
Rehoboth	2.5	54.3%
Subtotal	*4.6*	
Henlopen/Dewey	0.9	38% of flow from RBSTP
City of Rehoboth/North Shores	1.6	62% of flow from RBSTP
Total	**7.1**	

User Cost Determination	Private Option		Private Option	
	SRF 4.4% for 20 years (from S&W March 2009 Report)		1/3 SRF @ 4.4% for 20 years & 2/3 RD @ 5% for 40 years	
COSTS DESCRIPTION	Rehoboth + DB, NS & HA	Rehoboth Only @ 56.32%	Rehoboth + DB, NS & HA	Rehoboth Only @ 56.32%
Annual Capital Cost	$2,813,064	$1,584,318	$2,371,770	$1,335,781
Treatment Plant O&M From Rehoboth March 2009 Report)	$1,590,000	$895,488	$1,590,000	$895,488
Collection System From Rehoboth March 2009 Report)	$150,000	$138,735	$150,000	$138,735
Artesian Disposal @ 2 MGD Minimum ($6.84/1000 gal)	$4,993,200	$2,812,170	$4,993,200	$2,812,170
Sussex County O&M	$0	$0	$0	$0
Subtotal		$5,430,711		$5,182,174
Projected User Rate for City of Rehoboth		$1,423		$1,358

Appendix G: Table G-12

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Rehoboth Capital Costs

Alternative #3 - REHOBOTH OUTFALL ALTERNATIVE WITH COUNTY CONTINUING TO PUMP TO IBWRF

Description	Table #	2030 Design Criteria	2030 Capacity	Total Cost	County Cost	Rehoboth Cost Share	Rehoboth Cost
RBSTP Pumping Station	N/A	3.4 Max Month	10.2 MGD Peak Hour	$900,000	$0	100%	$900,000
Rehoboth Treatment Upgrades	-	3.4 Max Month	3.4 Max Month	$2,930,000	$0	100%	$2,930,000
Rehoboth FM to Ocean Outfall	-	-	-	$2,560,000	$0	100%	$2,560,000
Rehoboth Ocean Outfall	-	-	-	$14,800,000	$0	100%	$14,800,000
WNRWF Headworks Upgrades	D-6	6.6 MGD Max Month	17.5 MGD Peak Hour	$1,296,572	$1,296,572	0.0%	$0
WNRWF to IBRWF/PWWP P.S.	E-6	2.1 MGD Max Month	3.2 MGD Peak Hour	$2,000,000	$2,000,000	0.0%	$0
Force Main to IBRWF (Option #3)	E-9	2.1 MGD Max Month	3.2 MGD Peak Hour	$11,142,250	$11,142,250	0.0%	$0
IBRWF Phase 2 Upgrades	F-1	3.7 MGD Max Month	3.7 MGD Max Month	$20,600,000	$20,600,000	0.0%	$0
IBRWF Phase 3A Upgrades	F-2	5.0 MGD Max Month	5.0 MGD Max Month	$12,700,000	$12,700,000	0.0%	$0
Land/Easements	-	-	-	$0	$0	0.0%	$0
10% Contingency	-	-	-	$5,119,882	$4,773,882	6.8%	$346,000
15% Contingency (Ocean Outfall and Rehoboth WWTP Upgrade Only)				$2,659,500	$0	100.0%	$2,659,500
Engineering & Administration	-	-	-	$16,875,805	$11,552,795	31.5%	$5,323,010
Permitting (5%) Ocean Outfall Only				$851,000	$0	100.0%	$851,000
Total Project Cost				**$94,435,010**	**$64,065,500**		**$30,369,510**

SUSSEX COUNTY COST $64,065,500

Flow Split	Max Month Flow	Notes
WNRWF (4.4-2.3)	2.1	45.7%
Rehoboth	2.5	54.3%
Subtotal	*4.6*	
Henlopen/Dewey	0.9	36.0%
City of Rehoboth/North Shores	1.6	64.0%
Total	**7.1**	

User Cost Determination	Outfall Option Rehoboth Only		Outfall Option Rehoboth Only	
	SRF 4.4% for 20 years (from S&W March 2009 Report)		1/3 SRF @ 4.4% for 20 years & 2/3 RD @ 5% for 40 years	
COSTS DESCRIPTION	Rehoboth + DB, NS & HA	Rehoboth Only @ 56.32%	Rehoboth + DB, NS & HA	Rehoboth Only @ 56.32%
Annual Capital Cost	$2,314,504	$1,303,529	$1,951,421	$1,099,040
Plant Operations (From Rehoboth March 2009 Report)	$1,590,000	$895,488	$1,590,000	$895,488
New O&M	$150,000	$84,480	$150,000	$84,480
Collection System From Rehoboth March 2009 Report)	$150,000	$138,735	$150,000	$138,735
Sussex County Operations and Maintenance ($2.00/1000 gal)	$0	$0		$0
Subtotal		$2,422,232		$2,217,743
Projected User Rate for City of Rehoboth		$635		$581

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Rehoboth Capital Costs

Alternative #4 - COMBINED REHOBOTH AND COUNTY OCEAN OUTFALL

Item No.	Description	Table #	2030 Design Criteria	2030 Capacity	Total Cost	County Cost	Rehoboth Cost Share	Rehoboth Cost
1	RBSTP Pumping Station	-	3.4 Max Month	10.2 MGD Peak Hour	$900,000	$0	100%	$900,000
2B	Force Main to Rehoboth (Option #1)	E-10	2.1 Max Month	3.2 MGD Peak Hour	$1,726,000	$1,726,000	0%	$0
3A	Rehoboth Treatment Upgrades	-	3.4 Max Month	3.4 Max Month	$2,930,000	$0	100.0%	$2,930,000
3B	Rehoboth FM to Ocean Outfall	-	-	-	$6,160,000	$2,812,174	54.3%	$3,347,826
3C	Rehoboth Ocean Outfall	-	-	-	$16,600,000	$7,578,261	54.3%	$9,021,739
4	WNRWF Upgrades	-	4.4 MGD Max Month	4.4 MGD Max Month	$21,000,000	$21,000,000	0.0%	$0
5	WNRWF Headworks Upgrades	D-6	6.6 MGD Max Month	17.5 MGD Peak Hour	$1,296,572	$1,296,572	0.0%	$0
6	WNRWF to IBRWF/PWWP P.S.	-	2.1 MGD Max Month	3.2 MGD Peak Hour	$1,750,000	$1,750,000	0.0%	$0
8	IBRWF Phase 2 Upgrades	(1)	2.9 MGD Max Month	2.9 MGD Max Month	$10,905,882	$10,905,882	0.0%	$0
13	Land/Easements	-	-	-	$0	$0	0.0%	$0
14A	10% Contingency	-	-	-	$4,373,845	$3,949,063	9.7%	$424,783
14B	15% Contingency (Ocean Outfall and Rehoboth WWTP Upgrade Only)				$2,929,500	$1,136,739	9.7%	$1,792,761
15	Engineering & Administration	-	-	-	$15,525,796	$11,474,032	26.1%	$4,051,764
16	Permitting (5%) Ocean Outfall Only				$954,500	$435,750	54.3%	$518,750
	Total Project Cost				**$87,052,096**	**$64,064,474**		**$22,987,623**

Notes:
(1) Ratio of (2.9-2.0)/(3.7-2.0) * Phase 2 costs used to approximate reduced upgrade.

SUSSEX COUNTY COST	$64,064,474

Flow Split to Outfall	Max Month Flow	Notes
WNRWF (4.4-2.3)	2.1	45.7%
Rehoboth	2.5	54.3%
Subtotal	*4.6*	
Henlopen/Dewey	0.9	38% of flow from RBSTP
City of Rehoboth/North Shores	1.6	62% of flow from RBSTP
Total	**7.1**	

User Cost Determination	Outfall Option Rehoboth and Sussex		Outfall Option Rehoboth and Sussex	
	SRF 4.4% for 20 years (from S&W March 2009 Report)		1/3 SRF @ 4.4% for 20 years & 2/3 RD @ 5% for 40 years	
COSTS DESCRIPTION	Rehoboth + DB, NS & HA	Rehoboth Only @ 56.32%	Rehoboth + DB, NS & HA	Rehoboth Only @ 56.32%
Annual Capital Cost	$1,751,920	$986,681	$1,477,091	$831,898
Plant Operations (From Rehoboth March 2009 Report)	$1,590,000	$895,488	$1,590,000	$895,488
New O&M	$150,000	$84,480	$150,000	$84,480
Collection System From Rehoboth March 2009 Report)	$150,000	$138,735	$150,000	$138,735
Sussex County Operations and Maintenance ($2.00/1000 gal)	$0	$0	$0	$0
Subtotal		$2,105,384		$1,950,601
Projected User Rate for City of Rehoboth		$552		$511

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Rehoboth Capital Costs

Alternative #4B - COMBINED REHOBOTH AND COUNTY OCEAN OUTFALL

Item No.	Description	Table #	2030 Design Criteria	2030 Capacity	Total Cost	County Cost	Rehoboth Cost Share	Rehoboth Cost
1	RBSTP Pumping Station	-	3.4 Max Month	10.2 MGD Peak Hour	$900,000	$0	100%	$900,000
2B	Force Main to Rehoboth (Option #1)	E-10	2.1 Max Month	3.2 MGD Peak Hour	$1,726,000	$1,726,000	0%	$0
3A	Rehoboth Treatment Upgrades	-	3.4 Max Month	3.4 Max Month	$2,930,000	$0	100.0%	$2,930,000
3B	Rehoboth FM to Ocean Outfall	-	-	-	$6,160,000	$3,636,627	41.0%	$2,523,373
3C	Rehoboth Ocean Outfall	-	-	-	$16,600,000	$9,800,000	41.0%	$6,800,000
4	WNRWF Upgrades	-	4.4 MGD Max Month	4.4 MGD Max Month	$21,000,000	$21,000,000	0.0%	$0
5	WNRWF Headworks Upgrades	D-6	6.6 MGD Max Month	17.5 MGD Peak Hour	$1,296,572	$1,296,572	0.0%	$0
6	WNRWF to IBRWF/PWWP P.S.	-	2.1 MGD Max Month	3.2 MGD Peak Hour	$1,750,000	$1,750,000	0.0%	$0
8	IBRWF Phase 2 Upgrades	(1)	2.9 MGD Max Month	2.9 MGD Max Month	$10,905,882	$10,905,882	0.0%	$0
13	Land/Easements	-	-	-	$0	$0	0.0%	$0
14A	10% Contingency	-	-	-	$4,373,845	$4,031,508	7.8%	$342,337
14B	15% Contingency (Ocean Outfall and Rehoboth WWTP Upgrade Only)				$2,929,500	$1,470,000	7.8%	$1,459,500
15	Engineering & Administration	-	-	-	$15,525,796	$12,235,650	21.2%	$3,290,146
16	Permitting (5%) Ocean Outfall Only				$954,500	$563,500	41.0%	$391,000
	Total Project Cost				**$87,052,096**	**$68,415,739**		**$18,636,357**

SUSSEX COUNTY COST $68,415,739

Flow Split to Outfall	Max Month Flow	Notes
WNRWF (4.4-2.3)	4.9	59.0%
Rehoboth	3.4	41.0%
Subtotal	*8.3*	
Henlopen/Dewey	0.9	38% of flow from RBSTP
City of Rehoboth/North Shores	1.6	62% of flow from RBSTP
Total	**10.8**	

User Cost Determination	Outfall Option Rehoboth and Sussex		Outfall Option Rehoboth and Sussex	
	SRF 4.4% for 20 years (from S&W March 2009 Report)		1/3 SRF @ 4.4% for 20 years & 2/3 RD @ 5% for 40 years	
COSTS DESCRIPTION	Rehoboth + DB, NS & HA	Rehoboth Only @ 56.32%	Rehoboth + DB, NS & HA	Rehoboth Only @ 56.32%
Annual Capital Cost	$1,420,304	$799,915	$1,197,496	$674,430
Plant Operations (From Rehoboth March 2009 Report)	$1,590,000	$895,488	$1,590,000	$895,488
New O&M	$150,000	$84,480	$150,000	$84,480
Collection System From Rehoboth March 2009 Report)	$150,000	$138,735	$150,000	$138,735
Sussex County Operations and Maintenance ($2.00/1000 gal)	$0	$0	$0	$0
Subtotal		$1,918,618		$1,793,133
Projected User Rate for City of Rehoboth		$503		$470

Running Compilation of Board of Commissioners' Workshop and Regular Meeting Agenda Items and Portions of Approved Meeting Minutes Relating to Wastewater Discharge Alternative Discussions beginning June 16, 2008

June 16, 2008

Agenda:

"Public discussion of the requirement for the City to remove its wastewater discharge from the Lewes-Rehoboth Canal, the events to date, the existing operation of the plant, the involvement of Sussex County, and possible funding sources including the State Revolving Fund."

Minutes of the June 16, 2008 meeting regarding this agenda item:

Mayor Cooper called for public discussion of the requirement for the City to remove its wastewater discharge from the Lewes-Rehoboth Canal, the events to date, the existing operation of the plant, the involvement of Sussex County, and possible funding sources including the State Revolving Fund.

Commissioner Mills presented photographs for orientation purposes of where the wastewater treatment facilities are located with respect to the City.

Ms. Mable Granke, 1013 Scarborough Avenue Extended, asked if the level of treatment is tertiary because it is important that the level of purity in the water is recognized. Mr. Stenger said that currently it is tertiary.

Mr. Bob Stenger, Wastewater Department, presented an historical narrative of the wastewater treatment facilities. (Copy attached.) He noted that the Service area for the plant is the City of Rehoboth Beach, North Shores, Henlopen Acres and Dewey Beach. There are 11.5 full-time and three part-time employees in the Wastewater Department; and duties include operations and maintenance of the treatment plant and seven wastewater pumping stations, maintenance of approximately 20 miles of wastewater collection lines, land application of bio-solids, and electrical & maintenance support for other City departments. The plant is a high rate secondary treatment system with advanced treatment for nitrogen and phosphorous. The wastewater design flow is 3.4 Million Gallons per Day (MGD), and the

average annual flow is 1.3 MGD with a seasonal flow range of 0.6 MGD to 3.2 MGD. In the Bio-solids Program, 85 acres of farmland is leased approximately five miles south of Milford, DE where subsurface injection is provided. Approximately 2.4 million gallons of bio-solids are transported and applied per year which is approximately 170 dry tons per year. The plant was built in 1935 with a major upgrade in 1959. In 1975, there was an area-wide management plan with a proposal to treat the area from Broadkill to Indian River Inlet. In 1980, the City of Rehoboth Beach entered into an agreement to upgrade the treatment facilities. Mr. Stenger was hired in June 1986; and in 1987, the current facility was started up which replaced the original primary treatment plant. DNREC held a public hearing for a permit amendment in August 1990 to set performance based nitrogen limits and cap the total amount of nitrogen discharged annually. A feasibility assessment for biological nutrient removal was completed by Virginia Polytechnic Institute in June 1991 and was sponsored by DNREC. The recommendations from the study were for nitrogen removal and to accomplish that, the City needed an automated system to control the dissolved oxygen level. A consent order was issued in 1993, requiring nutrient reductions below 1989 levels by 1998. An upgrade for biological nutrient removal was completed in 1994 in the amount of $250,000.00 which included the installation of variable frequency drives to control output of blowers and a programmable logic controller to manage operations. The American Littoral Society and Sierra Club filed a law suit in August 1996 against EPA for failure to establish TMDL's for water quality limited segments. In 1997, the upgrade for chemical phosphorous removal, disinfection improvements and bio-solids storage was completed in the amount of $2,600,000 which included chemical facilities for phosphorous removal, a chlorination/de-chlorination facility, and an aerated bio-solids storage tank. In July 1997, the ruling on the suit by the American Littoral Society and Sierra Club was that EPA had to establish a TMDL for the Inland Bay if DNREC failed to do so by December 1998. In August 1998, DNREC's TMDL required the systematic elimination of point sources, and the City of Rehoboth Beach objected to complete elimination. A public hearing was held on September 2, 1998 regarding total maximum daily loading, and this was formally proposed by DNREC. On September 25, 1998, the City of Rehoboth Beach filed comments to DNREC on the proposed TMDL plan, suggesting that the zero standard was impractical and not feasible; the TMDL process was rushed; and the science was questionable to support the zero discharge requirement. The final TMDL was published in the Delaware Register on December 1, 1998, and the City filed an appeal of the TMDL order with the State Environmental Appeals Board of which DNREC objected. On December 30, 1998, the City filed a complaint for relief with the Superior Court in case the Environmental Appeals Board lacked jurisdiction over the City's appeal. The Superior Court ruled that the Environmental Appeal Board had jurisdiction in February 2000, and the decision was appealed by DNREC. The Supreme Court dismissed the State's appeal in May 2000. From June 2000 through June 2002, negotiations between the City and DNREC began, to find a settlement to resolve the City's TMDL concerns and avoid litigation. At that time, the City was involved in discussions with Lewes, Sussex County and DNREC on regional solutions. On June 17, 2002, the Commissioners voted on a consent order. In August 2002, a planning study grant funded by DNREC, was received to identify the most practical alternative for disposal of treated effluent which involved the City, Sussex County and the City of Lewes. The planning grant options were rapid infiltration beds, land application, deep well injection and ocean outfall. In December 2002, a consent order was executed between the City and DNREC to resolve the TMDL issue, and a timeline was

developed to allow the City sufficient time to work through the process and finalize the alternative, funding and construction, etc. The consent order was to be triggered by the issuance of the permit, which was issued in October 2005. In December 2002, Stearns & Wheler presented its outline for a regional wastewater effluent disposal study, identified viable alternatives for Rehoboth Beach itself, Rehoboth Beach and Sussex County, and a potential regional solution. Options were evaluated, and capital and user fee costs were estimated. The draft report of the effluent disposal study was submitted in October 2004, and the permit was signed in October 2005 which triggered the consent order timeline to begin. In March 2008, the effluent disposal study was prepared by Stearns & Wheler and was to be completed for *elimination in fact*. In March 2009, the City needs to identify funding sources, and an action plan must be submitted by September 2009. By June 2010, design should be started with completion in June 2011. The project should be bid in January 2012 with construction starting in June 2012. In December 2014, the project must be complete. On November 6, 2007, a public meeting was held to give the public an opportunity to comment on the Stearns & Wheler report. Artesian Water Company, Tidewater Utilities and Sussex County were present.

Commissioner Mills reiterated that the storm drains have their own piping system which is eventually drained into the ocean or the canal, and the wastewater goes through a piping system to the sewage treatment plant which is then filtered and processed resulting in two bi-products: 1. Bio-solids. 2. Effluent. Mr. Stenger noted that there is no technology available in wastewater treatment to achieve zero nutrients.

Public Comment:

1. Mr. John Gauger, 304 Laurel Street, did not understand why Sussex County does not want to go regional and he wondered what Lewes has done, since it has opened a new plant. Mr. Stenger said that the main problem for Rehoboth is that it discharges to the inland bays. The City of Lewes discharges only about 10% of its effluent into the inland bays, and its impact is significantly less. Commissioner Kuhns said that in regard to going regional, approximately seven municipalities from the west side of Sussex County of which some own their own treatment plants, are thinking about what they want to do.
2. Mr. Leon Galitzen, 104 Newcastle Street, said that other municipalities and other countries are mixing their wastewater to the point where it is re-circulated back into the useful drinking water through mixture and processing. In the long term, it might be the only solution anyone really has. Mayor Cooper said that the groundwater has more nitrates in it than the City's discharge.
3. Mr. D. C. Kuhns, , and consultant to Tidewater Utilities, said the point of fact is that eight states are completely reclaiming their water and putting it back into the groundwater. The technology exists to do this, and it is inevitably the direction where this is headed.

Mayor Cooper said that before there was a TMDL process, the City was told that a lot of what the City called inadequacies would be worked out in the Pollution Control Strategies

(PCS) process; and it would take about 18 months. The PCS process was supposed to be adopted in 2001 and has yet to be adopted.

Commissioner Mills noted some of the alternative options in partnering with the County: 1. Ocean outfall. 2. Land application with Artesian Water Company for a regional solution. 3. Land application where the City would send its effluent to the County's land and let the County operate the spray irrigation. Mayor Cooper said that this option was not available when the study came about. Commissioner Mills mentioned that the County took a vote and decided to use its own 2,100 acres for land application and not join in with the City on a regional solution. The City lost the County's partnership on regional outfall, but the City could still partner with the County if it sends the effluent to the Inland Bays facility.

Commissioner McGuiness asked if Mr. Izzo, Sussex County engineer, has forwarded any figures to the Commissioners in regard to partnering with the City with sending the effluent to the Inland Bays facility. Mayor Cooper said that the County needs to define the parameters of what would be expected with its system. Commissioner Mills thought that the County may be waiting for a Request for Proposal (RFP) and then respond to that.

Commissioner Kuhns said that one of the things which precipitated the County in making its decision or taking a vote, is the City; and the other is, as stated by Mr. Izzo, that by mid-July the County needs to make a decision on the Angola project which involves putting in a force main from Wolf Neck through Angola towards the Inland Bays facility. Commissioner Kuhns has since spoken with the County, and he thought that the County is very interested in being a part of the RFP process.

Mayor Cooper mentioned that the Clean Water Advisory Council's standard interest rate is 90% of the bond yield which can be adjusted down from there to make it more appealing if necessary, if monies can be borrowed from Council. He thought that the City is in the neighborhood of 3%, but the monies can only be used for City owned facilities. Discussion ensued as to the responsibilities of and the availability of monies from the Clean Water Advisory Council.

Commissioner Mills noted that the Stearns & Wheler report will be reviewed in detail at the July 7, 2008 Workshop Meeting.

July 7, 2008 Workshop Meeting

Agenda:

"Public discussion of the 2005 report concerning alternate wastewater discharge methods prepared by Stearns & Wheler, the criteria for assessing the various methods, the advisability of the City continuing to treat wastewater, status of the process to develop an RFP for land application alternatives from outside vendors, planning future discussions and related matters."

Minutes of the July 7, 2008 meeting regarding this agenda item:

Mayor Cooper called for public discussion of the 2005 report concerning alternate wastewater discharge methods prepared by Stearns & Wheler, the criteria for assessing the various methods, the advisability of the City continuing to treat wastewater, status of the process to develop an RFP for land application alternatives from outside vendors, planning future discussions and related matters.

Commissioner Mills said that the objective of the study was to identify the most cost effective and technically feasible solutions for the City and a regional solution. The approach was to look at five discharge alternatives: Land application, rapid infiltration beds, deep well injection, shallow well injection and ocean outfall. The regional solution was solely ocean outfall at that time. The summary including costs for land purchase was approximately $61,000,000 for Rehoboth alone. The cost for rapid infiltration beds including land purchase was $53,000,000.00. The disadvantages outweighed the advantages for shallow and deep well injections. The cost was $112,000,000.00 for the deep well injection including land acquisition. The advantages and disadvantages were equal for the ocean outfall. The proposed route of the pipe for ocean outfall would be from the wastewater treatment plant down State Road, crossing over to Columbia Avenue and then to Henlopen Avenue, and then discharging out from Deauville Beach to the ocean. The cost for Rehoboth Beach only was $36,000,000.00, and the regional solution cost was $66,000,000.00. The regional solution with Sussex County has been eliminated. The evaluating criteria was: Public acceptance, environmental impacts, costs etc. Sussex County's conclusion was to eliminate spray irrigation because land was not available, rapid infiltration beds, both deep and shallow well injection. The recommended alternative in the 2005 report was ocean outfall. The regional solution was also a positive, but has since been eliminated. The main changes from the 2005 report to today is that there are three alternatives which involved spray irrigation. Sussex County will not be partnering with Rehoboth in the regional ocean outfall project.

Commissioner Kuhns commented that the Commissioners need to look at all of the variables, and in looking forward, a financial advisor would be able to help on the cost side. The financial advisor working with the engineer could put together the variables as the Commissioners are moving forward into the Request for Proposal (RFP) process. More information should be obtained from the people who can provide the services or alternative solution to the City's wastewater problem.

Commissioner Mills said that one alternative presented by Artesian Water Company is that it would take the City's raw sewage.

Mayor Cooper and City Solicitor Mandalas met with Mr. Rip Copithorn of Stearns & Wheler last week, and Mr. Copithorn felt that he can have the RFP ready to put in the providers' hands by July 23, 2008. Once the information has been received from potential vendors, then this information would be incorporated in with the information that is developed by the City's engineers on ocean outfall, and what the City will get from the County. Estimated costs will be requested from contractors for ocean outfall, but there is no RFP process for it. Three companies have been contacted and are willing to assess an

estimated cost of building an outfall. The other vendors are turn-key in regard to land application.

Commissioner Coluzzi said that contractors who could potentially build an outfall solution will have information, and the City has internal information of what it takes for the City to operate the treatment plant, revenues, etc.

Mayor Cooper noted that there would be a meeting to go over any questions as the City is going forward to put together the proposal, and that would come a week after the final advertisement.

Commissioner Mills would like to see the RFP prior to it going out and follow along with the ocean outfall process as well.

Commissioner Kuhns said that the Commissioners will need projections of the City costs that will be passed onto its users. The parameters need to be set for both methods, and the Commissioners need to have an open and fair process for the people of Rehoboth.

Mayor Cooper noted that the RFP has been structured for the vendor to build the pipeline for land application, and the City would build the pipeline for ocean outfall. Commissioner Mills asked if the City would be getting a price for ocean outfall at approximately the same timeframe as a price for land application. Mayor Cooper said the costs should come in close together. A lot of time will be spent by the engineers to sort through it and adjust it for inflation.

Commissioner Coluzzi asked in regard to the option for the City to build a pipeline to the County to take part in the County's land-based application, if the City is looking at owning the pipeline. She asked if that will be similar with ocean outfall in terms of talking with vendors, etc. to build the pipeline. Mayor Cooper thought that the County would want Rehoboth to own the pipeline. Any solution which involves the County will be an estimate of what it will cost to build the pipe, etc. Discussion ensued as to the comparison of the alternatives and the timelines.

Mr. Ron Graeber from DNREC will give a presentation at the August 4, 2008 Workshop Meeting in regard to land-based application. Mr. William Ullman, College of Marine Sciences, will give a presentation at the July 21, 2008 Regular Meeting in regard to ocean outfall from a scientific perspective. Commissioner Mills will contact Mr. Peter Hanson to speak about the permitting process from a regulatory standpoint, as well as someone from the Delaware Farm Bureau to talk about the water on July 21, 2008.

Public Comment:

1. Ms. Mable Granke, 1013 Scarborough Avenue Extended – suggested that someone should be contacted who operates an ocean outfall, and Chris Basin of the Inland Bays is knowledgeable in regard to ocean outfall.

2. Mr. Brian Carbon, Artesian Water Company suggested that in regard to the RFP, Rehoboth could be the vendor and complete the process the same as other vendors for ocean outfall.
3. Mr. D.C. Kuhns, Rehoboth Avenue, and consultant for Tidewater, can provide names of three contractors who will bid on ocean outfall as a turn-key bid. He asked if the City has done forensic accounting to see whether or not money is currently being made on user fees from the wastewater treatment system or if other areas of the City are being subsidized. Commissioner Kuhns said that a financial planner can do the forensic accounting.
4. Ms. Carol Everhart, Rehoboth Beach/Dewey Beach Chamber of Commerce requested visual aids so everyone in the audience can see what is being talked out.

July 21, 2008 Regular Meeting

Agenda:

"Public discussion concerning alternate wastewater discharge methods including discussion with Dr. William Ullman of the University of Delaware, College of Marine and Earth Sciences, regarding scientific perspectives on ocean outfall and land application methods, presentation of information related to other area wastewater outfalls, planning future discussions and related matters."

"Review the Request for Proposals (RFPs) that has been developed by the City's engineer, Stearns & Wheler, to solicit proposals from outside vendors for the disposal of the City's wastewater by way of land application."

Minutes of the July 21, 2008 meeting regarding this agenda item:

Mayor Cooper called for public discussion concerning alternate wastewater discharge methods including discussion with Dr. William Ullman of the University of Delaware, College of Marine and Earth Sciences, regarding scientific perspectives on ocean outfall and land application methods, presentation of information related to other area wastewater outfalls, planning future discussion and related matters.

The following representatives were in attendance:

1. Mr. John Schneider, representative of the Watershed Assessment Section of the Division of Water Resources, was in attendance. His group was responsible for the Total Maximum Daily Load (TMDL) that is requiring the removal of the discharge in

the Canal. Mr. Schneider's concern is about the water quality impact regardless of the direction for an alternative. He also represented Mr. Peter Hanson, Manager of Service Water Discharges Section who is responsible for the existing permit which the City has on discharge into the Canal. Mr. Hanson will be responsible for the permit if the City chooses the ocean outfall alternative.

2. Mr. Craig Shirey, Program Manager of the Fisheries Section of the Division of Fish and Wildlife. One of his responsibilities is fish kill coordinator, and he is interested in seeing the findings of the amount of nutrients fund in the aquatic system.
3. Ms. Laura Herr, Manager of the Wetlands and Subaqueous Land Section, is responsible for enforcing the State Wetland laws and the Underwater Land Farm and Subaqueous Land Act. If the City were to pursue an outfall option, in addition to the NTBS permit that would actually look at water quality issues associated with the discharge, authorization would also be needed from her office to the extent that the actual infrastructure might impact wetlands or underwater ways. To the extent that the outfall goes out into the ocean beyond the mean low water line, a public underwater way and State subaqueous land is being constructed which the State holds in trust for all citizens of Delaware. An environment and a public interest review would be looked at in addition to other reviews.
4. Ms. Sarah Cooksey is in charge of the Delaware Coastal Management Program, and her role would be to coordinate government departments in regard to ushering the permits through.
5. Mr. David Baker, Sussex County executive.
6. Mr. Michael Izzo, Sussex County engineer.
7. Mr. Rip Copithorn, Stearns & Wheler engineer.
8. Mr. Bob Stenger, Director of City of Rehoboth Wastewater Treatment.

Dr. William Ullman, Professor of the University of Delaware, College of Marine Studies, gave his presentation. He has spent the past 19 years studying problems of nutrients in the inland bay system, and more recently studying the activities in the watersheds. Dr. Ullman said that ocean outfall is scientifically the best solution, and it gets nutrients out of the watershed. The problem with the inland bays watershed and for all of Sussex County is that nutrients are being brought in from the outside, and those nutrients are not being exported as fast as they are being brought in. Getting nutrients out of the watershed over time will reduce the level of nutrients in the watershed, and that will be best for the inland bays. This is an opportunity for the City of Rehoboth and Sussex County to participate in taking those nutrients and pump them offshore now rather than waiting 50 years for the natural process to do that. Dr. Ullman distributed facts about Rehoboth Beach's wastewater discharge. Along with the water that comes out of the wastewater even with all of the treatments which are done, there are still trace amounts of residual nitrogen and phosphorous found in the water.

Since 2002, Rehoboth is discharging approximately 750 kilograms of phosphorous and 800 kilograms of nitrogen a year. When he looks at the issue of disposal, the problem with discharging into the inland bays is that the inland bays are not particularly well flushed and the nutrients stay around for a long time. If the wastewater is being discharged offshore, that wastewater is being diluted by water the size of the Delaware Bay from Lewes, DE to Cape

May, NJ. The outfall pipe would be located in the ebb waters and close to the flow channels of the Delaware Bay. Permits will be required, and the wastewater will need to be treated to the best possible treatment level that the City can do. Nobody will notice the discharge from ocean outfall.

Ms. Lori Marmonte, Marine Biologist on faculty at Delaware Tech, Georgetown, DE, understood that Dr. Ullman's perception is that the water that will be discharged out of the effluent pipe will be entrained or brought into the outflow of Delaware Bay. She voiced concern that there is an eddy off the coast of Rehoboth, and the effluent would be discharged directly into it, and the proposed locations of the inshore and offshore pipes would be in the worst possible location. She also voiced concern that there has not been any discussion about viral and bacteria loading and things that cannot be addressed by the current level of treatment. This would be the ideal situation for viruses to be spread to people through water contact. Dr. Ullman said that the effluent will be entrained into all of the water of Delaware Bay. He could not address the bacterial loading.

Mr. Hoyte Decker, 214 Laurel Street, asked what the diameter of the eddy is to circumvent running the pipe further out to sea, north or south, etc., and what the mechanism would be to continue with the outflow selection. Dr. Ullman said that the eddy formed due to existence of a shoal on the western side of a channel, and he is not clear that the eddy has any effect at all.

Commissioner Barbour asked what the advantages are to the ocean environment by discharging. Dr. Ullman said that there are not enough nutrients to make a difference.

Dr. Littleton, 300 Laurel Street, requested clarification that the level of purity of what the City is currently discharging into Rehoboth Bay is not a recommendation to degrade the ocean outfall. Mayor Cooper said that there would be no effort to lessen the treatment.

Commissioner Coluzzi asked in regard to land type solutions if eventually those nutrients will flow to the bay, and if Dr. Ullman's estimate is 50 years for the nutrients to reach the inland bays. Dr. Ullman said confirmed, and he said that the nutrients will come out by riparian boundaries of streams, the coastal riparian boundaries, the inland bays where there is seepage and offshore. If spray irrigation is located closer to the inland bays, the nutrients will have a shorter time that they travel through the groundwater system. Fifty years is the median value for a smaller watershed in this area.

Ms. Linda Kauffman, 206 Laurel Street, asked in regard to spray irrigation if there is a filtering process that dilutes the nutrients in the water. Dr. Ullman said that dilution occurs in the groundwater system; and if spray irrigation is used in an area where plants are grown, harvested and shipped out of the area, the nutrients are moved out of the watershed. The downside of spray irrigation is that plants are not grown at all times of the year so there are certain times of the year when there is wastewater going through the groundwater fairly rapidly without the opportunity for plants to remove it. Riparian

boundaries also have an opportunity to take out the nutrients closer to the discharge pathway.

Mr. Joe Marmonte, Watershed Outreach Program, voiced concern that the wastewater is not being provided to farmers who may need the nutrients and that the aquifer is being replenished. Dr. Ullman said that it rains approximately 44 inches on average per year, and 12 inches makes it into the groundwater. As an example, it would take 17,800 years to run out of groundwater in the Rehoboth Bay watershed if there is no rain. In regard to nitrogen, it is better for a farmer to use the groundwater for irrigation rather than using spray irrigation. Most of the farms in Sussex County have higher levels of nitrogen in the groundwater. There is no place in Delaware where there are deficiencies in phosphorous.

Mr. Jay Lagree, 7 Prospect Street, asked if quality of the groundwater is improved when effluent is pumped into spray irrigation. Mayor Cooper said yes as it relates to nitrogen. Dr. Ullman said that the phosphorous levels would be slightly high than they have been.

Mr. Izzo mentioned that if economics justifies ocean outfall, then it is a better way to go for Rehoboth. One alternative is not better than another. Spray irrigation is a wastewater disposal operation, not a system for the farmers' needs.

Dr. Ullman referenced the Executive Summary from the Stearns & Wheler report, and he agreed with everything about ocean outfall except that the groundwater recharge is at least zero, not ambient.

Ms. Cooksey asked what the secondary cumulative impacts of the non-point sources and development, etc. would be if the ocean outfall is not capped at the existing flow. Dr. Ullman said that the ocean discharge would be a very small effluent discharge compared to any of the systems along the East Coast. He hoped that if Rehoboth would pursue ocean outfall, it would put in a pipe larger than 24 inches. In the area of the Delaware Bay where the pipe would be located, it is an area that is well flushed and well mixed.

Mr. Copithorn spoke about a study and modeling of ocean currents and circulation of treated effluent. In regard to land application, the concentration of nitrogen is diluted but it still reaches the bays, streams, etc.

Mr. Hoyte Decker asked if there are any available options to partner with Sussex County on a wastewater alternative. Commissioner Mills said that recently the County voted to not partner with Rehoboth on the regional outfall solution. The County will be using spray irrigation. The County still has an interest to work with Rehoboth because one third of their users are under Rehoboth's system. Mr. Baker noted why the County decided not to partner with Rehoboth was because of cost.

Commissioners Mills proposed that Mr. Ron Graeber attend the August 4, 2008 Workshop Meeting to talk about land application; and that a Special Workshop Meeting should be held on a Saturday in late September 2008 to further discuss these issues.

Ms. Linda Kauffman noted that the Rehoboth Beach Homeowners' Association is surveying the homeowners to give their opinion on this issue based on environment, costs, etc., and she will present the information at the next meeting. She asked at what point the City will get cost associated to the two options. Commissioner Mills thought that this issue would be addressed under the next agenda item

Mayor Cooper called for the review of the Request for Proposals (RFPs) that has been developed by the City's engineer, Stearns & Wheler, to solicit proposals from outside vendors for the disposal of the City's wastewater by way of land application.

Mayor Cooper noted that Mr. Copithorn drafted the RFP.

Mr. Copithorn said that what is trying to be accomplished is to compare ocean outfall with land application in terms of cost. In regard to land application, Tidewater Utilities and Artesian Water Company have invited the City into the process. The cost determined and submitted with the RFP would be a legally binding cost. In order to get the permitting for ocean outfall, the City needs to spend $300,000.00 to $500,000.00 on permit studies. The contractors will not come forward and give a committed price. This would be a design/build contract. The philosophy is to get a leap on the costs of the land application side which is the subject of this RFP, and the approach on the ocean outfall side is to send the conceptual design as it stands now to approximately four contractors. Those contractors will either offer an up-to-date cost based on their experience or for a fee, based on a cost which has documentation and their credibility behind it. It would not be a legally binding cost.

Commissioner Kuhns said that a RFP would be sent out for the land application and have a legally binding cost which they would submit vs. the ocean outfall which would include risks and ballpark figures. The permitting process will take the line share of the time between now and the City's deadline whereas the construction, from the Stearns & Wheler report, is 1.5 years. The permitting process is where all the risk is. Mr. Copithorn said that receiving a cost for land application based on this RFP would still allow the City the decision making. Commissioner Kuhns said, at some point in time because one third of the City's users are with the County and there is a regional solution, that there is only one solution from the County's perspective which would be spray irrigation. At some point in time, the County Council may decide that it will pay one third of the costs in regard to ocean outfall. Mr. Izzo said that in regard to Dewey Beach, the County will participate with Rehoboth in the ocean outfall project. Commissioner Kuhns asked if the County would consider answering the RFP. Mr. Dave Baker said that the County is not set up to provide a system in the way that contractors are capable. Currently, estimates are available with using the County's spray land. The County could do a comparison for the City.

Commissioner Mills asked if the City would want to get a set price for the third land application alternative which is to partner with the County. Mayor Cooper said that it still would be an estimate. Mr. Izzo said that the County would be needed on the current operational data to present a more detailed estimate. Commissioner Mills suggested that Mr. Copithorn should work with Mr. Izzo on a more detailed estimate.

Ms. Mable Granke, 1013 Scarborough Avenue Extended, asked in regard to the RFP if Rehoboth will have control over the wastewater system or if Rehoboth will be relinquishing control of the operations of the wastewater plant. Mayor Cooper said that currently it is structured that the City would build a pump station, and ten feet outside of the City's property the County would pick the effluent up with a pipe from there, which would be under the County's control.

Commissioner Mills asked what the timeline is for getting pricing for ocean outfall. Mr. Copithorn would make it coincide with the land application pricing timeline. Mayor Cooper said that September 17, 2008 is listed in the RFP.

Ms. Linda Kauffman asked if capital costs, maintenance, future maintenance, etc. are being looked at in the RFP. Mr. Copithorn said that the evaluation will consider the capital costs and annual costs.

Mr. Copithorn will work with Mayor Cooper in responding to the County's suggestions. Mayor Cooper will provide the final RFP to the Commissioners when it is completed.

August 4, 2008 Workshop Meeting

Agenda:

"Public discussion concerning alternative wastewater discharge methods including discussion with Mr. Ron Graeber and other representatives of DNREC regarding land application as a method of discharge, permitting and other DNREC areas of interest; planning future discussion and related matters."

"Status of Request for Proposals (RFPs) that has been developed by the City's engineer, Stearns and Wheler, to solicit proposals from outside vendors for the disposal of the City's wastewater by way of land application."

"Review and discuss methods for calculating the cost for various methods of disposing of the City's wastewater effluent."

Minutes of the August 4, 2008 meeting regarding this agenda item:

Mayor Cooper called for public discussion concerning alternate wastewater discharge methods including discussion with Mr. Ron Graeber and other representatives of DNREC,

regarding land application as a method of discharge, permitting and other DNREC areas of interest, planning future discussions and related matters.

Commissioner Mills noted that the Wastewater Treatment Study by Stearns & Wheler and an Executive Summary is currently available online on the City website. Audio recordings of portions of the Mayor and Commissioners Meetings are also available online.

Governmental representatives in attendance were: Mr. Ron Graeber, Program Manager of the Large Systems Branch in the Groundwater Discharge Section within the Division of Water Resource, Mr. Mike Izzo, Sussex County Engineer, Mr. John Schneider, DNREC, Professional Ullman, University of Delaware College of Marine Science and Ms. Doris Hamilton, DNREC. Also in attendance was Mr. Bob Stenger of the Rehoboth Beach Wastewater Treatment Plant.

Mr. Ron Graeber gave his presentation and noted that the beneficial re-use of reclaimed water through spray irrigation is sensible. His group is responsible for permitting all large and community wastewater systems that have any type of land-based discharge. Spray irrigation is a sensible wastewater management option and promotes recycling and re-use in its truest form. Wastewater is re-used through a controlled application onto a vegetative land surface. The loading rate is limited so that there is no runoff, no ponding or pooling, and no percolating on the site. The water percolates through the ground into the water table. The nutrients in the reclaimed water are balanced with the needs of the crops. Wastewater has to be treated before it can be recycled and re-used. The level of wastewater treatment depends on how the water is going to be re-used. There are three levels of treatment which are identified in the Division of Water Resources' regulations: Restricted public access sites, limited public access sites and unlimited public access sites. The benefits of spray irrigation are: Promotes local recharge of the aquifer, reduces the demands on the aquifer, keeps the water in the watershed, helps to maintain open space by preserving agricultural lands, benefits the farmers by reducing overall operating costs, reduces or eliminates the need to import nutrients into the watershed, provides an alternative to surface water discharges, and helps to protect surface water quality. The primary beneficial re-use is by land application onto agricultural sites. The agricultural application provides water for irrigation, provides supplemental nitrogen and promotes fertigation. The reclaimed water is tested, and the nutrient application rates are based on the crop needs. Water re-use is available during drought restrictions, and the nutrients can be applied during crop growth. There are two types of agricultural re-use: 1. Dedicated agricultural site. The reclaimed water is applied year-round, and storage is required. The reclaimed water cannot be applied during periods when the temperature is freezing or when there is rainfall. Storage would be used at those times. All of these sites have monitoring wells around them. Buffers are established to property lines and service water to control aerosols. Public access is restricted on these dedicated sites, and secondary treatment is required. Approximately 125 to 150 acres per 1M gallons of wastewater would be required. 2. Voluntary agricultural re-use sites. The activities would be controlled by the farm manager. Almost any kind of crop can be grown. The only prohibition would be crops that are consumed raw before processing. These systems would require advanced treatment to meet tertiary treatment levels for unlimited public access. If that criteria would be met, the buffers could be reduced to the minimum

necessary to control aerosols. Public access would not be restricted because of the high level of treatment involved. This could be a process encouraged in areas under agricultural (AG) preservation. In 2005, the Department of Natural Resources and Environmental Control and the Delaware Department of Agriculture signed a memorandum of understanding, encouraging spray irrigation on lands under AG preservation provided that this is used for production of conventional crops and provided that tertiary treatment is provided. The Delaware House of Representatives passed a resolution on July 1, 2008 establishing a Spray Irrigation Preservation Task Force. The goal of this task force is the preservation of agricultural land, to preserve and improve groundwater quality and resources, and to improve the overall farming economy. This task force will be reporting to the General Assembly by early 2009. Currently, there are 24 permitted facilities in the State, and Sussex County operates three regional spray irrigation facilities within the Inland Bays basin. An additional 2,000 acres of land was recently purchased to expand its spray irrigation system. There are more than 3,000 acres of land currently permitted for spray irrigation. There are more than 200 drip irrigation systems throughout the State. In 2007, more than 650,000 pounds of nitrogen was reclaimed and more than 200,000 pounds of phosphorous to be re-used on agricultural settings. TMDL's are important, and these are sites that are still maintained under agriculture. Farming will continue with an additional benefit. In addition, the nutrients that are supplied by the wastewater are being re-used and recycled all to those farms. The nutrient rates are limited, and are applied in small quantities. The best way to control phosphorous from entering into the bays is to control or reduce erosion and runoff. When a site is converted to spray irrigation, the first that is done is to establish a vegetative buffer to help stabilize the land and significantly help to reduce the amount of phosphorous which could be lost. The buffer eliminates surface water discharges, and wastewater runoff is not allowed to enter surface waters or streams. The potential impacts from spray irrigation of reclaimed water onto the groundwater are significant improvements in groundwater quality and promote a local recharge of the aquifer. The application rates do not promote mounding which is when the water table rises, comes close to the surface, changes flow directions, etc. because a big hydraulic load is put on it. Because of the low hydraulic loading rates, that does not occur on spray irrigation sites. Rapid infiltration basins are being looked at for community wastewater disposal systems, and the hydraulic loading rate from those can be significant enough to cause mounding. The question is if spray irrigation is suitable for Rehoboth Beach. The City of Rehoboth Beach has seasonal flows and is perfect for agricultural application because farmers need the water much more in the spring and summer than in the fall and winter. The wastewater treatment plant provides a high quality effluent so the level of wastewater treatment is sufficient for meeting the unrestrictive public access criteria. There would be needs for storage of reclaimed water during a period of time when equipment is down for service, during August thunderstorms, etc. The availability of agricultural land from a standpoint of location and cost is the single most detrimental issue for spray irrigation for the City of Rehoboth Beach. Other beneficial options which could be considered: nurseries for horticultural uses, contracting to recreational areas for use of reclaimed water, offering reclaimed water to golf courses at a reduced or free price, etc. The future of reclaimed water is an option to eliminate surface water discharges, can be used for wetland restoration or wetland creation, can be experimented with production of greenhouse and ornamental vegetation use, and can be returned to residential wants as gray water re-use.

Mayor Cooper asked what is seen in the way of permit applications. He sensed that a number of rapid infiltration basin (RIB) systems going in. Mr. Graeber confirmed and noted that in residential community development settings there is a preference for rapid infiltration basins.

Commissioner Mills liked the thought of water re-use with the treated effluent being used in residences for use in toilets. He recommended that the County should take the initiative and require that future developments start to put in a third pipe system.

Commissioner Coluzzi asked in regard to wetland restoration and creation if what is trying to be done is to get the wastewater out of the wetlands and inland bay area. Mr. Graeber said that so many of the non-tidal wetlands have been lost, and that is one of the reasons why the surface waters are endangered.

Public Comment:

1. Mr. John Gauger, 304 Laurel Street, asked how the storage lagoons do not leach water back into them. Mr. Graeber said that the storage lagoons have to be lined, and monitoring wells are required around the lagoons.
2. Ms. Lorraine Zellers, 308 Stockley Street, asked in regard to spray irrigation, where the water goes if the land is barren in the winter. She also asked how long the permitting process takes. Mr. Graeber said that the farmer would be under a consent order. The monitoring wells are monitored, and it is verified that there is no discharge if that causes and exceeds drinking water standards for groundwater. By good management and having staff in the field on a regular basis, would keep those problems from occurring. The permitting process is a multi-step process which takes from 6 months to 1 ½ years.
3. Ms. Mable Granke, 1013 Scarborough Avenue Extended, asked who will have control of Rehoboth Beach's wastewater system, who will be determining the rate payment and what the plans are for alternative sites when crops are being harvested. Mr. Graeber said that storage is available and irrigation is done on other portions of the field. In spray irrigation within the same season, there is no long term accumulation of nutrients in the soil profile. The two primary nutrients of concern are nitrogen and phosphorous. Treated effluent is a balanced fertilizer. Annual soil testing is required. Phosphorous is controlled by controlling erosion and runoff by establishing vegetative buffers. No increase in phosphorous at the groundwater monitoring wells is seen.

Mayor Cooper asked what the demand is for additional water by the crops in Sussex County. Mr. Graeber said that it is dependent upon when there is rainfall and how much.

Mayor Cooper called for the status of the Request for Proposals (RFPs) that has been developed by the City's engineer, Stearns & Wheler, to solicit proposals from outside vendors for the disposal of the City's wastewater by way of land application.

Mr. Gregory Ferrese noted that the Request for Proposals will be advertised on August 5, 2008 with a mandatory pre-proposal meeting on August 19, 2008.

Mayor Cooper called for the review and discussion of methods for calculating the cost for various methods of disposing of the City's wastewater effluent.

Commissioner Mills noted that the viable options for disposing of the City's wastewater effluent are land application by spray irrigation and ocean outfall. Two vendors have expressed an interest in regard to spray irrigation. There is also an option of partnering with Sussex County in regard to spray irrigation. Mr. Mike Izzo, Sussex County Engineer, will be working with Stearns & Wheler to pinpoint a price in partnering with the County. The RFP process that will be advertised will help in pinpointing the price for the two vendors. Pricing also needs to be pinpointed for ocean outfall. Commissioner Mills has researched and identified an ocean outfall project currently being installed in Seattle, Washington, and the scale of its outfall project is $28,000,000.00. Commissioner Mills will have an RFP for design/build in hand at the end of this week with a list of engineers and contractors that had bid on the Seattle, Washington project and ones who he had spoken with. Commissioner Mills will forward this information to Mr. Rip Copithorn of Stearns & Wheler.

Mayor Cooper said that one thing to keep in mind is if there are capital costs involved and how those costs are funded.

August 18, 2008 Regular Meeting

Agenda:

"Public discussion concerning alternate wastewater discharge methods, funding, permitting, status of Request for Proposals from outside vendors for the disposal of the City's wastewater by way of land application, other areas of interest; planning future discussions and related matters."

Minutes of the August 18, 2008 meeting regarding this agenda item:

Mayor Cooper called for public discussion concerning alternate wastewater discharge methods, funding, permitting, status of Request for Proposals (RFP's) from outside vendors for the disposal of the City's wastewater by way of land application, other areas of interest; planning future discussions and related matters.

DNREC representatives in attendance were: Mr. John Schneider, Ms. Sarah. Cooksey, Mr. Ron Graeber and Mr. Greg Pope. Speakers were: Ms. Heather Sheridan, Director of Environmental Services for Sussex County Engineering Department and Mr. Loran George, District Manager, South Coastal Wastewater Facility in Sussex County. Also in attendance was Mr. Bob Stenger of the Rehoboth Beach Wastewater Treatment Plant.

Commissioner Mills noted that the Wastewater Treatment Study by Stearns & Wheler is currently online on the City website. Audio recordings of portions of the Mayor and Commissioners Meetings are also available online.

Ms. Heather Sheridan, Director of Environmental Services for Sussex County. The South Coastal Wastewater Facility started processing in 1976, and the outfall was constructed in 1977. The outfall is a 30 inch steel extending offshore approximately 1.25 miles between Middlesex and Sea Colony. Most of the pipe is buried with seven offshore manholes. The pipe transitions to a 24 inch Y-pipe with forty (40) 4-inch diffuser ports. The insurance is approximately $84,000.00 per year. An outside engineering firm is usually contracted in the amount of $3,000.00 to check the cathodic protection once a year. According to the discharge permit, the system is to be robotically inspected within the five-year timeframe. An underwater diving team is hired to check out the system. In fiscal year 2007, TMJ Marine of New Jersey did an inspection, videotaped the inspection and checked all the manholes. It was found that 20 bonding wires for cathodic protection were broken off, which were repaired. In previous years, there have not been any problems. The cathodic protection consists of a steel pipe with concrete and zinc protection. The system is hydraulically designed for 22M gallons per day. Currently, the output is approximately 4.5M gallons per day in the summer. The Town of Selbyville also discharges approximately 2M gallons per day, and it pays a percentage of the maintenance cost per year. The lifetime of the outfall may be approximately 40 years. This is the only ocean discharging facility in the State of Delaware, and there are three spray irrigation plants in Sussex County.

Commissioner Coluzzi had heard that spray irrigation is applied only when it is needed, and there is a large storage tank to hold the effluent discharge. She asked if there is improvement in crop yield because of spray irrigation. Ms. Sheridan confirmed that there is a requirement for 60 days storage based on the design of the plant. Wolf Neck has a 68M gallon pond to store it. Spraying is done on loblolly pines, plants, etc. and having water on the plants is beneficial vs. having no water on the plants. There are nutrients, but sometimes farmers may have to supplement it.

Commissioner McGuiness asked if there will be viral and bacterial loads with the ocean outfall. Ms. Sheridan said that testing for bacteria is done, and there has never been a problem at Blue Water Beach.

Commissioner Dennis Barbour asked if there is a screening for bacteria before the effluent is discharged, and if any studies have been done on the issue of antibiotics and effluent. Ms. Sheridan said that the South Coastal facility has an activated sludge process similar to what Rehoboth has at its treatment plant. The nutrients are broken down, and chlorine is added. It is rare that there are any upsets. She did not know of any studies that have been done in regard to the issue of antibiotics and effluent.

Commissioner Mills asked if any environmental studies have been done before 1977 and since then to compare water quality. Ms. Sheridan did not know.

Ms. Linda Kauffman, 206 Laurel Street asked if it is standard for outfalls to extend 1.25 miles offshore, and she asked how often the underwater diving typically takes place and what the contract was for it. Ms. Sheridan thought that it is based on studies depending on the shoreline, shoals mixing, etc. The permit is for five years, and the contract was in the amount of $65,000.00.

Ms. Nancy Meadows, 506 Newcastle Street, asked which system is cheapest to build and operate in over a 20-year period. Ms. Sheridan said that spraying plants is cheaper depending on the cost of the land and the actual building of the treatment plant for spraying plants or lagoons. The outfall is very expensive. The operating costs at Wolf Neck and South Coastal are approximately the same for the operations and maintenance cost per gallon treated.

Commissioner Kuhns asked where the South Coastal plant is located, and if the pipe was located over City land, County land, etc. Ms. Sheridan said that the plant is located 2.5 miles inland from Bethany, and the 30 inch pipe is located approximately five feet underground and is approximately four miles long. Easements were needed for private property. She will forward the construction process information and the plans which show the pipe, to the Commissioners.

Ms. Linda Kauffman asked, based on today's dollars, if it would cost approximately $1,000,000.00 every ten years for maintenance. Ms. Sheridan agreed.

Mr. John Schneider, DNREC, said that there is no plant in the State of Delaware or nationally that he knows of which treats for pharmaceuticals. Some plants accidentally treat pharmaceutical, personal care products, etc. breakdowns. There is a reason to be concerned but that is across the board no matter what the disposal method is. The US Geological Survey has laboratory capabilities for testing, and some work has been done in Pennsylvania.

Commissioner Mills had spoken with Mr. Charles Freeland, Department Manager of Ocean City in regard to its ocean outfall. Ocean City discharges approximately 4,000 feet out into the ocean using a 30 inch concrete pipe which was installed in 1968. The pipe was completely buried under the ocean floor at that time, and by the 1990's, it was complete exposed. In 1996-97, rehabilitation costing $1,600,000.00 was done to cover the exposed concrete pipe with stone and concrete matting and new breakaway diffusers were installed. Annual inspections are performed. The concrete pipe is expected to have a life expectancy of another 8-10 years, which would be 50 years since installation in 1968.

Commissioner Mills has received comments on the Request for Proposal (RFP) from Mr. Ron Graeber of DNREC. Those comments have been forwarded to Stearns & Wheler. At the September 2, 2008 Workshop Meeting, representatives from DNREC will be present to speak on the permitting process. Commissioner Mills has received a design/build RFP from North County, Washington, and a copy will be forwarded to Stearns & Wheler.

Mayor Cooper noted that the RFP was advertised last week, and there is a mandatory pre-proposal meeting in the Commissioners Room on August 19, 2008 at 9:00 a.m. Mr. Rip

Copithorn of Stearns & Wheler will be conducting the meeting. The Clean Water Advisory Council has a brief item on its agenda, and the meeting will be held at the Rusty Rudder, Dewey Beach on August 20, 2008. Mr. Greg Pope will be giving a presentation to update the Clean Water Advisory Council on the results of this meeting and keep it abreast of the progress for a solution.

September 2, 2008 Workshop Meeting

Agenda:

"Public discussion concerning alternate wastewater discharge methods, funding, permitting, including a presentation and discussion with representatives of DNREC concerning permitting issues, status of Request for Proposals (RFP's) from outside vendors for the disposal of the City's wastewater by way of land application, other areas of interest; planning future discussions and related matters."

Minutes of the September 2, 2008 meeting regarding this agenda item:

Mayor Cooper called for public discussion concerning alternate wastewater discharge methods, funding, permitting, including a presentation and discussion with representatives of DNREC concerning permitting issues, status of Request for Proposals (RFP's) from outside vendors for the disposal of the City's wastewater by way of land application, other areas of interest; planning future discussions and related matters.

Commissioner Mills noted that the Wastewater Treatment Study by Stearns & Wheler and an Executive Summary is currently available online on the City website. Audio recordings of portions of the Mayor and Commissioners Meetings are also available online.

DNREC representatives in attendance were: Ms. Sarah Cooksey, Mr. Ron Graeber, Mr. Greg Pope, Ms. Laura Herr, Mr. Terry Deputy, Mr. Peder Hanson and Mr. John Schneider. Also in attendance was Mr. Mike Izzo of the Sussex County Engineering Department.

Mr. Peder Hanson, Environmental Program Manager for the Surface Water Discharging Section in the Division of Water Resources at DNREC, said that his section is responsible for issuing NTDS permits. The difficult portion of the ocean outfall permitting will be permitting the outfall itself. The permits necessary to construct the pipeline, involve engineering in making sure that the pipeline will be able to discharge in a matter in which it will meet water quality standards. The limits part of the permit, are expected not to be any different than those currently with the wastewater treatment plant. In regard to the issuance of the final MDPES permit, the location of the discharge will be the only thing that will change. It is not expected that there would be nutrient limits until the end of the NTDS permit for ocean outfall. DNREC will be holding the City to the same level of treatment that it currently has, but the City will not have a nutrient permit.

Ms. Linda Kauffman, Laurel Street asked if there is federal permitting that is required for ocean outfall, and who would get involved with that permitting. Mr. Hanson said that federal permitting is required, and the federal agencies that are in charge of issuing permits would be involved.

Ms. Laura Herr, Manager of the Wetlands and Subaqueous Lands Section in the Division of Water Resources, said that the two permits or authorizations that the City is mostly likely to need would be a Subaqueous Lands Permit and possibly a Wetlands Permit, although it is unlikely that a State Wetlands Permit would be required. A Subaqueous Lands Permit is required when someone proposes to place fill or structures in, on, over or under subaqueous lands which are the underwater lands whether they are tidal or non-tidal. The City would need some type of authorization pursuant to the Subaqueous Lands Act. In regard to the Wetlands Act and the alignment of the ocean outfall, it is not as likely that an authorization would be needed. The State does regulate the tidal wetlands, and those are depicted on a set of maps that are based on aerial photography. That is how the jurisdictions are determined. The aerial photography has a line which is superimposed on the map which shows where the State jurisdiction is. The only activities that would not require authorization, are activities that include directional boring under a non-tidal stream or ditch, or directional boring under a State regulated well without affecting that well. A Subaqueous Lands Permit would be required even if crossing under a tidal waterway. The same application would cover the Wetlands and Subaqueous Lands authorizations. A complete application would include the application form and a narrative that would address all of the regulatory considerations. In addition, it would include the engineering and design drawings for the project. Once the application is received, the process is to do a preliminary review to determine if the application is complete. When the application is complete, a public notice is published in two newspapers. The public notice period is 20 days to allow for public comment. Any public comment is provided to the applicant for response. During the public notice period, the Department can also receive requests for a public hearing. A public hearing can also be held if the Secretary deems that it is in the public interest to do so. In the process where there is no public hearing and public comments have been received, an evaluation is done with coordination from other experts within the Department and a decision is made. In the event of a public hearing, the Hearing Officer will publish a second public notice, and additional testimony from the public can be entered into the record. As a result, a Hearing Officer's report is submitted to the Secretary who then makes the ultimate decision about the project.

Mr. D.C. Kuhns, Rehoboth Avenue, asked if DNREC will require studies under an environmental impact report for land-based applications or ocean outfall. Ms. Herr said that all the considerations would need to be addressed regardless whether it would be ocean outfall. In regard to the regulatory considerations, public use impacts are included as well as environmental considerations. Studies will potentially be required. The water quality aspect is looked at under environmental considerations. The Department first looks to see that the applicant's objectives can be realized by avoiding impacts to waters or wetlands; for unavoidable impacts, that the project has been designed to minimize the scope of those impacts; and finally, for any avoidable impacts, there is

some mitigation or compensation proposed to offset those losses. Water quality, effects on shellfish, beds on finfish, etc. are looked at under the environmental considerations. Impact to surface or ground water hydrology is looked at for spray irrigation. The first step is to figure out where the State regulated waters and wetlands are, once an alternative is chosen.

Mr. Kuhns asked if there has ever been an environmental study done on ocean outfalls in Delaware. Mr. Hanson said that one was done for the South Coastal outfall.

Ms. Herr said that the Army Corp of Engineers has jurisdiction under Section 10 of the Rivers and Harbors Act of 1899, and is involved in the review of an individual permit which would be required for the ocean outfall. She was not sure if the Army Corp of Engineers is involved with spray irrigation, depending upon whether any site modification would be necessary. The Army Corp of Engineers would be involved if there is filling of ditches that contains wetlands. DNREC coordinates very closely with the Army Corp of Engineers. A permit processing meeting is held at DNREC on the third Thursday of every month. Any prospective applicant can come, at the conceptual stage, to present a project and receive informal feedback from the Army Corp of Engineers, EPA, DNREC, etc. The Army Corp of Engineers' permitting process consists of only construction. Ms. Herr was not sure if there is a permitting process for EPA. Mr. John Schneider said that the MDPES program is delegated from EPA, and it will be involved as DNREC issues the NTDS permit.

Mayor Cooper asked if the City holds any subaqueous lands permits. Ms. Herr said that the City holds a permit for the stormwater outfalls.

Mr. Ron Graeber, Program Manager of Large Systems Branch and Groundwater Discharges Section, gave his presentation in regard to the steps for permitting wastewater spray irrigation. These steps are found in the Guidance and Regulations Governing the Land Treatment of Waste, and these regulations are available on the Division of Water Resources website. The permitting process for spray irrigation consists of: 1. Letter of Intent is submitted which identifies the potential applicant, where the spray irrigation site might be, and details on the design flow rate. 2. Submittal of a Site Selection Evaluation Report which provides information on the soil on the site. 3. Submittal of the Design Development Report which contains detailed information on the site including scaled drawings with two foot elevations; detailed Soil Investigation Report that will identify the depth of the seasonal high water table; conductivity tests performed to determine the rate at which water can permeate through the soils and what kind of hydraulic loading the site can accommodate; detailed hydraulic evaluations performed to determine if mounding is going to impact the groundwater flow or flow of the water table; details of the wastewater treatment facility; vegetative management plan which details the nitrogen and the nutrient loading for that site on a month-to-month basis. 4. After the approval of the Design Development Report, plans and specifications are submitted which need to be detailed blueprints of biddable quality, and will be compared against the Design Development Report. 5. After approval of the plans and specifications, the Application can be submitted which provides zoning documentation. 6. The public notice will be drafted and will be advertised in two newspapers with a public comment period of 15 days. A public hearing will be held if a meritorious request is made.

The applicant is responsible for paying the cost of the advertisement. 7. A Trust Indenture or a Certificate of Public Needs and Convenience is provided by the Public Service Commission. A Trust Indenture is not required for a municipality or political subdivision. It is an agreement between the developer and a political organization such as a county or municipality, and DNREC which provides a fall-back in the event that the utility will go bankrupt. The Public Service Commission requires all wastewater utilities that will be serving more than 50 people to obtain a CPCN for that area. 8. After the public notification period, a permit will be drafted. Quite often, there will be a schedule of compliance in the permit that has dates for specific activities to be accomplished, and there may be some negotiation about those dates. 9. Following those negotiations, a final permit is issued and sent to the facility owner. 10. Construction can be initiated and begun. During construction and before the system is put in operation, a Plan of Operations Management must be provided to the Department and approved before the applicant can commence spray irrigation at the design flows. 11. After the system construction is completed, a startup inspection will be performed to verify that the system is constructed as designed, verify that all components are properly operating. 12. After verification, a Certificate of Completion of Construction is issued. 14. Operating at design flow can begin, and sampling requirements are initiated.

Commissioner Mills said that the City's alternatives for land application are to go through a vendor or to partner with the County, and he asked what the City's involvement would be in going through the process. Mr. Graeber said that the permit would be issued to the utility that would be managing the site. The utility would have a contract with the City, and DNREC would not be part of the contract between the utility and the City. DNREC's permit would be with the utility.

Ms. Sarah Cooksey is in charge of the Coastal Zone Management Program at DNREC and is with the Division of Soil and Water Conservation. The main objective of Coastal Zone Management is to protect and develop, and where possible restore and enhance the resources of the nation's coasts. This program encouraged States to voluntarily develop plans on managing their resources. Delaware's coastal zone involves the entire state. The most important regulatory program is federal consistency which requires that federal activities which have reasonably foreseeable coastal effects much comply with the Coastal Zone Management Program policies. Regarding the federal activities, a lot of work is done with the Army Corp of Engineers, U.S. Coast Guard, EPA, Federal Energy Regulatory Commission (FERC), Department of Interior, Minerals Management Service and Federal Aviation Administration (FAA). The National Oceanic & Atmospheric Administration (NOAA) in the Department of Commerce is a federal partner. The process consists of: 1. Applicant must submit a Statement of Consistency. 2. Applicant must submit an Analysis of Effects. 3. Public comment period similar to the Wetlands and Subaqueous Lands Section. 4. Specific timelines for review. 5. A decision is required in 180 days. The Coastal Zone Management Program will be involved if ocean outfall is decided on as the wastewater alternative and may be involved if federal funding is required. The Army Corp of Engineers will require an individual permit for that.

Commissioner Mills asked what is involved with the timeline for getting permits in regard to DNREC. Ms. Cooksey said that her program has an internal deadline of 90

days once the completed application is received. She expected that it will take 180 days for the ocean outfall. Any appeal is forwarded to the Department of Commerce. Mr. Hanson said that after the public hearing in regard to the MDPES portion of the permitting process, it would be approximately six to nine months. Any permit that the Department issues is appealed by either party to the Environmental Appeals Board. If there is a meritorious request for a hearing, a public hearing will be held. The Secretary can also schedule a hearing if it is in the interest of the public. A tentative determination is required during the public notice period. Commissioner Mills asked if December 31, 2014 is a firm date for the mandate that the City stop discharging into the Canal. Mr. Hanson said there is a provision in the consent decree that the deadline could be extended for an equivalent amount of time if there are issues which are outside of the City's control. Commissioner Mills asked if the permitting process could be started for ocean outfall, while the City is waiting for an analysis of whether it will pursue ocean outfall or land application. Ms. Herr thought that this would be wise to start the process. Commissioner Mills asked if there is a possibility that the City could upgrade the wastewater treatment facility to continue to discharge into the Canal. Mr. Schneider said that the waste load allocation for nitrogen and phosphorous is zero which is a regulation by the State to implement water quality standards.

Ms. Linda Kauffman, 206 Laurel Street, asked when the citizens will know which wastewater alternative will be decided upon and the criteria used to make that decision. Mayor Cooper said that once the RFP's and the information from the engineer in regard to ocean outfall have been received, the engineer will prepare a document. The decision will be based on everything in that document.

Mr. Mike Izzo of Sussex County said that whatever decision is made, the Commissioners needs to make it in consideration of the funding guidelines and funding cycles of the State Revolving Fund. Mr. Terry Deputy of DNREC said that the City will be informed of deadlines. He or Mr. Greg Pope of DNREC will be at all the City's meetings on this issue. Mayor Cooper voiced concern that there may be no money in the State Revolving Fund for this project. Mr. Deputy said that the interest rate on last loan which closed at market rates was 3.9%.

Ms. Kauffman asked why there is no RFP for ocean outfall. Mayor Cooper said that the Commissioners must go through part of the permit process and know what the terms are of the permit in order to give the design builders the parameters under which they would be designing and building. The engineers will go out to three contractors who are versed in ocean construction and would be bidders on this project. Discussion ensued regarding the design build process.

Mayor Cooper said that September 5, 2008 is the cutoff date for questions and clarifications. He spoke with Mr. Rip Copithorn of Stearns & Wheler, and as of last week there were no inquiries. The RFP's are due back on September 24, 2008. Mayor Cooper hoped to have the estimates from the ocean outfall contractors at the same time. It will be necessary for Mr. Copithorn to pull all of the information together into one document to be ready by mid-October 2008. Commissioner Mills said that the RFP

documents for land based application and the ocean outfall documents should be opened concurrently or revealed to the public concurrently.

Ms. Mable Granke, 1013 Scarborough Avenue, commented that with the ocean outfall alternative, the City would have control of the system; and with spray irrigation, the City would not have control once the effluent leaves the plant and would not have control with what the vendor could do in the future in terms of increasing costs. Mr. Izzo said that the County does not have an escalating rate, it is a flat rate.

September 15, 2008 Regular Meeting

Agenda:

"Public discussion concerning alternate wastewater discharge methods, funding, permitting, including a discussion with a representative of Stearns & Wheler, the City's consulting engineer, status of Request for Proposals from outside vendors for the disposal of the City's wastewater by way of land application, other areas of interest; planning future discussions and related matters."

Minutes of the September 15, 2008 meeting regarding this agenda item:

Mayor Cooper called for public discussion concerning alternate wastewater discharge methods, funding, permitting, including a discussion with a representative of Stearns & Wheler, the City's consulting engineer, status of Request for Proposals (RFP's) from outside vendors for the disposal of the City's wastewater by way of land application, other areas of interest; planning future discussions and related matters.

DNREC representatives in attendance were: Mr. John Schneider, Mr. Ron Graeber, Mr. Fred Pope and Ms. Sarah Cooksey. Also, in attendance was Mr. Michael Izzo, Sussex County Engineering Department.

Commissioner Mills noted that the Wastewater Treatment Study by Stearns & Wheler is currently online on the City website. Audio recordings of portions of the Mayor and Commissioners Meetings are also available online.

Mr. Rip Copithorn of Stearns & Wheler provided a brief update in regard to the Request For Proposal (RFP) to consider land application and getting additional costs on ocean outfall. He focused on some of the background and what has transpired with the ocean outfall and what might be the next step if ocean outfall is selected as an alternative. The RFP was issued to invite utility service providers to respond and offer their services in taking either the treated or the untreated wastewater from the City of Rehoboth Beach. The deadline to submit proposals was September 25, 2008. Questions that were received, deserve consideration. The answers to those questions will be addressed by an addendum. At the same time, Stearns & Wheler is working with ocean outfall contractors. The intent is for

those contractors to provide a cost for building the conceptual outfall. Land applications will be compared to an ocean outfall. The location of the proposed ocean outfall, if it is built, is based on previous studies and mixing studies. Ways of optimizing the design were looked at. The location alternatives were based on what was suggested in the Le Cato studies, and it was suggested that 6,000 feet offshore would be a good distance. The dilution would require the understanding of the currents in the Delaware Bay at different depths, seasons, etc. A mixing model was developed by the University of Delaware with velocities and currents. An opportunity was taken in using the model to optimize the design of the diffuser. The structural aspects of building the outfall were looked at, and Stearns & Wheler worked with various ocean outfall contractors in developing a cross-section which shows how the 24 inch pipe would be buried approximately five feet below the sea bed. The trench would be deeper that that, and the pipe would be laid and backfilled with structural backfill. Ballast rock and armor rock would be placed on top to weight it down and for structural protection. The length of pipe from the shore to the end of the outfall would be 6,000 feet, and the diffuser would extend beyond 6,000 feet. In pursuing ocean outfall, a site study should be done. He presented the proposed route for the piping from the treatment plant to Deauville Beach. Federal and State agencies will be watching this project very closely, and this will be subjected to strict reviews and approvals. There will be a number of regulations which will be imposed. The Corp of Engineers will have a clearinghouse responsibility for this project. The first step would be to file nationwide and individual permits. An environmental assessment comes into play at that point. Cost issues will be looked at also. Environmental impact assessments and studies will be done. EPA has the National Permit Discharge Systems of which the City of Rehoboth Beach Wastewater Treatment Plant currently has a permit, and the Beach Protection Act. The US Fish and Wildlife will look at endangered species. DNREC administers the NTDS permit. The Environmental Recreational Ecological Sense of waters regulation will not permit any backsliding. Saltwater Conservation will be looking at sediment erosion control, etc. The Corp of Engineers will require a study of the number of environmental impacts, etc. The potential impact of the ocean outfall on water quality and public health needs to be determined. The impacts on the wastewater treatment plant for either ocean outfall are that the filtering would need to be upgraded and a pump station would be needed. In regard to spray irrigation, the plant at its best performance meets the groundwater standard, but additional upgrades may be required if the groundwater standard changes. The ultimate deadline is December 2014 to be in compliance.

Commissioner McGuiness said that the pump station needs to be upgraded regardless of what option the City goes with.

Ms. Linda Kauffman asked a series of questions. 1. Has the City determined what criteria could be used in selecting ocean outfall vs. spray irrigation? Mr. Copithorn said that cost is part of it. The City will at least know the basis of the costs for construction. Cost is not the only issue. There are also environmental issues. The parameters have not been addressed to date. When the Commissioners prepare costs, Ms. Kauffman assumed that there will be a list of engineering fees, capital costs, annual operation and maintenance costs, engineering costs, project administration, legal and fiscal costs; and those same costs would be evaluated based on the City's engineering costs, operating costs, maintenance costs. Mr.

Copithorn confirmed and said that each one will be a line item. 2. Is the ocean outfall pipe encased in concrete? Mr. Copithorn said that it is not, and encasing the pipe in concrete is very rigid construction. The pipe diameter is very large, and the advantage would be that the pipe is flexible and corrosion resistant. 3. When will the criteria and matrix be established? Mr. Copithorn was anticipating it would be once the proposals and costs have been received. 4. Is it an unfair advantage to the people with ocean outfall that they already know what the competitor is? Mr. Copithorn said that the land application people compete against land application. The ocean outfall people are not submitting a bid. A contract will not be offered based on their costs. The City and citizens will be in charge in making the decision for an alternative.

Ms. Dottie Cirelli, Newcastle Street asked how the pipe would laid in the street for the ocean outfall project. Mr. Copithorn said that the pipe would be laid in the right-of-ways, and there would be a narrow cut. The contractors would be required to close up the excavation and to put temporary paving over it or to put metal sheets over it. There would be no long term construction.

Commissioner Zellers asked how long after permitting would the actual construction take for ocean outfall. Mr. Copithorn said that it would be one winter season.

Mr. Walter Brittingham, 123 Henlopen Avenue, said that the State representatives explicitly explained that several different permitting parts can go forward at the same time, but one part does not go after the other.

Commissioner Mills said that the RFP's for land application are due on September 25, 2008. The Commissioner would like to get pricing for ocean outfall at the same time. A third option was to price out partnering with the County on land application. Mr. Mike Izzo said that there are no additional funds. He would have to present a cost proposal to the County Council on September 24, 2008. Mr. Izzo will forward the proposal to Commissioner Mills and Mayor Cooper for discussion.

Commissioner Mills will tentatively schedule a Special Workshop Meeting to be held on November 1, 2008 from 8:30 a.m. – 12:30 p.m. with DNREC, Sussex County, Mr. Copithorn, etc. He would like to be a member of the evaluation team.

Commissioner Coluzzi suggested that it should be a summary type presentation to put on the City website for people to have an understanding of this issue.

Commissioner Kuhns said that it is important to show the presentation physically to as many people as possible.

Mr. Rip Copithorn will forward a matrix of issues and a place to start to Mayor Cooper. Commissioner Kuhns suggested this issue should be discussed at the November 3, 2008 Workshop Meeting.

Ms. Linda Kauffman said that the Rehoboth Beach Homeowners' Association had received 50 responses to a survey of the residents on this issue. She read the percentages of the responses.

October 6, 2008 Workshop Meeting

Agenda:

"Public discussion concerning alternate wastewater discharge methods, funding, permitting, including a discussion with a representative of the Delaware Public Service Commission concerning its authority and the regulation of privately owned utilities, status of Request for Proposals (RFP's) from outside vendors for the disposal of the City's wastewater by way of land application, other areas of interest; planning future discussions and related matters."

Minutes of the October 6, 2008 meeting regarding this agenda item:

Mayor Cooper called for public discussion concerning alternate wastewater discharge methods, funding, permitting, including a discussion with a representative of the Delaware Public Service Commission concerning its authority and the regulation of privately owned utilities, status of Request for Proposals (RFP's) from outside vendors for the disposal of the City's wastewater by way of land application, other areas of interest; planning future discussions and related matters.

DNREC representatives in attendance were: Mr. Terry Deputy, Ms. Sarah Cooksey, Mr. Greg Pope and Mr. John Schneider.

Mr. Dave Bonar, Government Services Administrator for the Public Service Commission gave his presentation. Approximately three years ago, the Delaware General Assembly sought to give the Public Service Commission regulatory authority over privately held wastewater treatment facilities in the State of Delaware. The Commission was charged with regulating costs and setting rates for privately held wastewater treatment facilities which would include facilities that handle 50 or more houses in the State of Delaware. It is designed for companies such as Artesian Water Company and Tidewater Utilities, and others that are currently expanding their wastewater treatment facilities. He understood the problems that the Commissioners are facing as elected officials, and also the problems the Commission faces as a regulatory agency in seeing that the City Commissioners are served properly and see that the City Commissioners have the proper information by which they can make decisions on which avenue to take.

Commissioner Stan Mills had forwarded an outline and questions of what the City Commissioners are reviewing in regard to wastewater alternatives.

Mr. Kevin Nielson, Regulator Policy Administrator and Chief Engineer for the Public Service Commission, is familiar with wastewater treatment, and he designed the rules and regulations by which the Public Service Commission operates. If the City continues to own the wastewater collection system and uses another vendor as to the treatment, then the Commission would not regulate the rates on them so long as the City's administration maintains those rates. If the City continues to collect and treat sewage and the vendor is only receiving it, the Commissioner would not regulate the rates. It is customary that the Commission does not become involved if the customer is a municipality, but if a customer is a customer directly with Artesian or Tidewater, etc., then the Commission would regulate rates, but if The customer of the utilities would be involved, no the municipalities. If the City sells the treatment facility to the vendor, the Commission would be involved, and the vendor would need to come before the Commission for rate changes.

Commissioner Paul Kuhns said with the position that the City currently has, in looking forward the City would probably never sell the facility itself. Artesian and Tidewater, etc. do not set the fees. The City sets the fees, and there would be a contract. Mr. Bonar said that the question is whether the City wants to maintain the control it will have over the rates. If the City is sending out bills, it has regulatory authority over the rates.

Mr. Nielson said that the Commission has expertise in setting rates. Mayor Cooper asked as a public service issue whether it be wastewater or electric, etc., if the Commission gets involved with the engineering side of it. Mr. Nielson said that the Commission would involve an engineer if customers are experiencing problems with their service, etc. Generally the operation is left up to the municipality or vendor, so if money is needed to be spent on the operation, it is left to the municipality or the vendor, and they are permitted to make a return on their investment. Mr. Bonar said that the returns range from between 6.5% to 11%.

Mayor Cooper asked in regard to the filing of a rate case if it is expensive and reimbursable. Mr. Nielson said that reimbursement can be asked for in regard to the next case. Mr. Bonar said that the consumer pays for every utility issue. The utility user pays the cost because the Commission bills the company, and the company in turn bills the consumer for any regulatory proceeding that takes place. The Commission is funded by gross receipts on the utilities' regulated gross sales. Every complaint that results in a request by the Commission to regulate a utility is paid by the rate payer and ultimately the customer. The Commission consists of staff which examines, audits and reviews the proposed action of the regulatory utility. The staff makes recommendations to a hearing examiner. The hearing examiner writes the final report to the Commission incorporating the committee's, utility's and consultant's testimonies. The hearing examiner makes a recommendation to the Commission which votes in a public forum whether it supports the staff's or utility's side of the matter. Mr. Nielson explained the procedure for getting out of the wastewater business and turning it over to a contractor. The City of Rehoboth has a service area; and under the Certificate of Public Convenience and Necessity (CPCN) rules, the City would need to relinquish that which would allow the private utility to obtain a CPCN for that area. The current rates would probably be reviewed. The City could relinquish the CPCN for the area within the municipal boundaries. Mr. Bonar said that part of the problem would be with the Dewey Beach, North Shores and Henlopen Acres areas, in negotiating a contract. Mr.

Nielson said that if the City decides to sell its facilities, there may not be an issue. Mayor Cooper, as he has understood the legislation and the law, is that the City could only invite the utility to serve in the areas within the City's boundaries. Dewey Beach, Henlopen Acres and North Shores would be a huge issue because he thought that the utility could serve those areas unless it has a CPCN.

Mr. John Schneider said that the CPCN gives the utility the right to serve a geographic area. They have properties that are certified. The CPCN is where the utility's customers are located. The treatment area of facilities may not need a CPCN even though it is part of the system because it is not serving customers in that specific location.

Ms. Sarah Cooksey asked where the Commission has approved a traditional system which is a community with wastewater treatment and spray irrigation. Mr. Nielson said there is a development and treatment at Milton, DE. Of the CPCN's, there are approximately 24 or more sites. Mayor Cooper commented that a developer who wants to develop his property approaches the Commission and asks them to come in to provide that service. DNREC has primary jurisdiction on treatment facilities and the Commission holds the purse strings. Ms. Cooksey asked if the customers can opt out. Mr. Nielson said that with wastewater, there is no provision. In a municipality, the customers do not have control of that, but once there is a CPCN the landowners have to sign for that. Once the CPCN is there, it runs with the land.

Mr. Greg Pope asked that with the Town of Milton privatizing its facilities, if it no longer bills the residents. Mr. Nielson thought that is what Milton is doing.

Ms. Mable Granke, 1013 Scarborough Avenue Extended asked if the County needs a CPCN for its facilities. Mr. Nielson said that the County must provide the Commission with its service territories. After that, if the County expands its service territories, it has to provide notice to the Commission. Mayor Cooper said that the Commission does not regulate the municipalities or the counties, but it needs to know where they service. Mr. Bonar said that the municipalities in the State of Delaware are required to notify the Commission if they expand their boundaries. Ms. Granke said that if the City is considering partnering with the County, then the City and the County would control the situation. Mr. Nielson concurred.

Commissioner Mills noted that a public workshop will be held on November 1, 2008 from 9:00 a.m. to 12:00 p.m. in the Fire Hall to give the public an additional opportunity to meet the speakers, hear presentations and allow for more questions and answers. He proposed that a mailing should be sent out to the property owners and residents in the City. Questions, concerns and comments can be forwarded to wastewater@cityofrehoboth.com, and those will be compiled and forwarded to the Commissioners. Commissioner Mills would like to work with City Manager Gregory Ferrese on approving the language for the mailing and sending it out, and then do a formal invitation to finalize all of the speakers. The consensus of the Commissioners was to move forward with the mailings and invitations. The deadline has changed from September 24, 2008 to October 9, 2008 at 1:30 p.m. in regard to the Request For Proposal (RFP). The Commissioners have not discussed what happens after the deadline for the RFP: 1. Evaluation team needs to be set, and Commissioner Mills would like to be on the team. 2. Oral presentations and discussions of

all of these procedures that the Commissioners have not set a timeline for. 3. Status on costing out the ocean outfall and costing out partnering with the County. Bids are due for the land application on October 9, 2008 at 1:30 p.m. Mayor Cooper had discussed this issue with City Solicitor Glenn Mandalas, and they have not arrived at a proposal. Much of this hinges on what is received. He did not see this as something that is a traditional bid, and this will be more complex. City Solicitor Mandalas said the point is that until the Commissioners see what comes in, it is difficult to anticipate how it gets evaluated; and he suggested waiting until October 9, 2008 to see.

Mayor Cooper will set up an evaluation team, but he wants to see if there is actually something to evaluate.

October 20, 2008 Regular Meeting

Agenda:

"Public discussion concerning alternate wastewater discharge methods, funding, permitting, including presentations by representatives of DNREC: Jennifer Volk – "Regulatory Basis for the Elimination of the City's Discharge", Maria Sadler – "Coastal Construction Permitting Requirements" and Sergio Huerta, MD – "Pharmaceuticals and Other Emerging Contaminants", status of Request for Proposals from outside vendors for the disposal of the City's wastewater by way of land application, other areas of interest; planning future discussions and related matters."

Minutes of the October 20, 2008 meeting regarding this agenda item:

Mayor Cooper called for public discussion concerning alternate wastewater discharge methods, funding, permitting, including presentations by representatives of DNREC: Jennifer Volk – "Regulatory Basis for the Elimination of the City's Discharge", Maria Sadler – "Coastal Construction Permitting Requirements" and Sergio Huerta, MD – "Pharmaceuticals and Other Emerging Contaminants", status of Request for Proposals (RFP's) from outside vendors for the disposal of the City's wastewater by way of land application, other areas of interest; planning future discussions and related matters.

Commissioner Mills noted that the Wastewater Treatment Study by Stearns & Wheler is currently online on the City website. Audio recordings of portions of the Mayor and Commissioners Meetings are also available online. Recently the wastewater@cityofrehoboth.com email address was established for this topic. A Workshop Meeting will be held on November 1, 2008 at the Fire Department from 8:30 a.m. – 12:30 p.m. A mailing was sent to the property owners in the City regarding the wastewater workshop and communications.

DNREC representatives in attendance were: Mr. John Schneider, Mr. Greg Pope, Ms. Maria Sadler and Ms. Jennifer Volk, Department of Environmental Resources. Mr. Huerta was not in attendance.

Speakers were: Ms. Jennifer Volk, Ms. Maria Sadler.

Also in attendance was Mr. Bob Stenger of the Rehoboth Beach Wastewater Treatment Plant.

Ms. Jennifer Volk, Department of Natural Resources and Environmental Controls Watershed Assessment Section, noted that her department working on testing the water quality in the State. The Clean Water Act is a federal act which requires each state to submit a Watershed Assessment Report and a list of waters not meeting standards to the Environmental Protection Agency (EPA) every two years. Water quality standards have two components: 1. Designated uses. 2. Water quality criteria. Too many nutrients in the water such as nitrogen and phosphorous, offsets the balance between photosynthesis and respiration so that there is too little dissolved oxygen in the water. Whenever there are impaired waterways, a Total Maximum Daily Load (TMDL) must be developed which is the maximum amount of a pollutant which can enter the water and still meet the set standards. TMDL = WLA (waste load allocation from point sources) + LA (load allocation from non-point sources) + MOS (margin of safety). Based on TMDL modeling data from 1988-1990, the sources of pollution to the Inland Bays Watershed regarding nitrogen are 78% from atmospheric deposition, 16% from non-point sources and 6% from point sources; and the sources of pollution regarding phosphorous are 69% atmospheric deposition, 31% non-point sources and 0% from point sources. Because of all of these sources of pollution, TMDL's were developed in the Inland Bays Watershed in 1998 for the Rehoboth and Indian River Bays, and Indian River and in 2005 for the Little Assawoman Bay and all the streams and rivers that join into the bigger bodies of water. Both sets of regulations say that all the point sources must be eliminated and large reductions in the non-point sources. In regard to point sources, pollution control strategy consists of systematic elimination and water quality trading available as an option. The three point source facilities remaining are the Lewes Wastewater Treatment Plant, Millsboro Wastewater Treatment Plant and Rehoboth Beach Wastewater Treatment Plant. When looking at all the point sources in the Inland Bays Basin as a whole, an 83% reduction needed for nitrogen and 89% reduction needed for phosphorous has been achieved, but the three remaining facilities will need to be looked at to see how their discharges will be handled. There has been significant progress in regard to the non-point sources, and most of the reductions have come from agriculture and wastewater practices. While all of the alternative disposal options for the Rehoboth facility are expensive, the pros and cons of each option must be considered because a point source should not be turned into a non-point source. PCS regulations were signed by the Secretary of the Department of Natural Resources and will be in effect November 11, 2008. The pollution control strategy as a whole includes voluntary and regulatory components. The regulatory components specifically look at how to establish a buffer as land use changes, how to better treat stormwater from new developments, and how to improve the maintenance and performance of on-site wastewater treatment systems or septic systems. The establishment of a buffer will be required for all new major subdivisions, and all new activities will require a site or major subdivision plant. A 100 foot buffer will be required in all primary waters, and a 60 foot buffer will be required in all secondary waters. The buffers can be reduced if the new development plan is combined with advanced stormwater options,

and there is a management plan. The buffers will exist in community open space and will be the responsibility of homeowners associations to manage them. Pollution reduction actions for stormwater include vegetated stormwater collection areas, and preserving and creating forested areas. The pollution control strategy also calls for improved maintenance and performance of septic systems. The performance standards will vary depending on the size of the system, where it is located, and how old the system is. Any properties located within 1,000 feet of tidal waters and tidal wetlands will be required to have advanced treatment of the septic systems within 60 days after the regulations are published.

Chairman Littleton asked if the City as a municipality or the owner of the land is required to maintain buffer zones. Ms. Volk said that the City or would be required to maintain buffer zones if it owns the land. Buffer zones are only required when land is developed in a new subdivision or commercial development, and a water feature is located on the Department of Natural Resources' map. Mayor Cooper noted that the majority of the City is not located in the Inland Bays Watershed.

Ms. Maria Sadler, Division of Soil and Water Conservation, Beach Preservation Section and Shoreline Clean Water Management Section, discussed what the permitting requirements would be for the construction of the pipeline going out into the ocean for the wastewater outfall structure. The regulations governing beach protection and the use of beaches are the regulations which require that the City, etc. would obtain permits prior to any construction, and the authorization for those regulations and the Beach Preservation Act which is located in Title7, Chapter 68 of the Delaware Code. Under those regulations, a permit is required from the Division prior to any construction of a structure or facility in any beach, sea or development line. The definition of beach is the area which extends from the mean high water line of the Atlantic Ocean landward 1,000 feet and seaward 2,500 feet. If the ocean outfall were chosen as the alternative, the structure would be located at Deauville Beach. A permit would be required from the Army Corps of Engineers and the Division of Water Resources Wetlands Section for the outfall pipe extending 6,000 feet into the ocean. Under the regulations governing beach protection and the use of beaches, Sections 4.03 and 4.04 would be addressed regarding the construction of the pipeline. In regard to the procedures for processing the application for the structure, the public is involved in the process. Public notices are advertised in a newspaper locally and of statewide publication, and the public is given 15 days to comment. Notices are also mailed to adjacent property owners. The application is available for public inspection. At the end of 20 days if no comments have been received and the plans have been reviewed, the approval could be issued. If there is a hearing request or there are many comments, then the hearing would be scheduled and advertised. After the hearing would be held, a report would be issued by the hearing officer; and then a decision is made on the application. Specific information that would be reviewed during the application process or comments received by the Division, would be the effect of the proposed construction on the shoreline, beach erosion, flooding, any potential damage to the property in which the pipeline would be constructed such as leveling the dune, the effects on adjacent properties, any design modifications that would need to be made in order to mitigate impact of the proposed construction, and any other factors that the Division determines relevant to the application. The City may want to contact the Army Corps of

Engineers regarding the project because the area of Deauville Beach is in the taper section for the nourishment project.

Mr. Hoyte Decker, Laurel Street, asked if the content of the hearing officer's report is a summary or a decision. Ms. Sadler said that the hearing officer would make a decision with at least his legal opinion on whatever issue is brought up in the hearing. Mr. John Schneider, DNREC, said that the hearing officer makes a recommendation to the secretary.

Mr. D.C. Kuhns, Rehoboth Avenue asked if the ocean outfall is direct drilled to the exit in the ocean, will this project still come under Ms. Sadler's purview. Ms. Sadler said that it would if the outfall falls within the area defined as beach and is within the 1,000 feet or 2,500 feet. If the direct drilling would enter the ground lambert [sic] [should be "landward" – Stan Mills] of the DNREC building line, then something may be done with a letter of approval.

Mayor Cooper said that all of the DNREC permits with subaqueous lands could probably go forward at once with one hearing where all of these issues would be talked about at one time. Ms. Sadler recommended this procedure to be done.

Commissioner Mills asked what DNREC considers as a buffer zone. Ms. Volk said that the regulations does not have any specific requirements for vegetation. Basically, it would be a no mow zone. A foot path or walk path can be a certain percentage of impervious surface, but the buffer would need to be wider to compensate for that impervious surface.

Mayor Cooper said that the RFP's for outside vendors to propose to the City to accept its wastewater either in a treated or untreated fashion and dispose of it, were due on October 8, 2008. The City received one submission from Artesian Resources. It is clear that the RFP is not responsive to the request, and it does not set out the information necessary to make a decision. There is no information on user fees. What Artesian Resources is proposing is a three-way project between Artesian, Sussex County and the City of Rehoboth Beach which the County would be heavily involved in. It is proposed that the City build a force main to the Wolf Neck treatment facility, and all of its raw waste would go there. In exchange, the County would build a force main from its main pump station on Route 1 to the Artesian facility, northwest of Milton, DE. The County would divert some of all of its flow to the facility in exchange. Mayor Cooper was in attendance at a meeting which was held on October 14, 2008 between the County and Artesian. It was stated in the Artesian proposal that the cost would be at least $48,000,000.00 for the City to send its untreated waste to Artesian. Artesian is not willing to spend that money. This is an estimate of costs, not a proposal. The alternative that Artesian is suggesting would cost $45,000,000.00 which $15,000,000.00 would be absorbed by Artesian, and the County and the City would absorb $30,000,000.00 as part of the project. The City would be dealing with the County and not directly with Artesian; and without the County, there is no proposal.

Commissioner Mills voiced concern that he was not notified about the October 14, 2008 meeting and was not provided a copy of the proposal.

Mr. Hoyte Decker, Laurel Street asked if the proposal suggested an arrangement that would involve the County. He also asked if the meeting with the County officials and Artesian had to do with this response to the RFP. Mr. Decker voiced concern that he has a right to access the RFP, and the public has the right to be involved in that sort of meeting or at least be present at the meeting. Mayor Cooper said that Artesian had approached the County prior to the submission of the RFP. Artesian thought that there is an opportunity to service the needs of the City and to service the County's needs in regard to expansion and future growth. Artesian knowing that it had to involve the County, approached the County for the County to look at this as an alternative not only to the City but also for the County's future needs in the West Rehoboth sewer district. Discussion ensued as to public involvement in meetings.

Mr. George Phillips of Artesian, said that his company held a meeting with Sussex County Council during the last month. At that meeting, Artesian provided an outline of its proposal and discussed the fact that it felt that a cooperative effort between the County, Rehoboth and Artesian was the right direction in moving forward. Sussex County Council directed the County engineer to meet with representatives of Artesian and asked them to invite representatives of the City to be there. There were public meetings with Sussex County.

Commissioner Kuhns asked if the Commissioners will not do any more proposals and automatically proceed with the ocean outfall. Mayor Cooper said no and the County wants to move fairly quickly through this proposal from Artesian. He has talked to the County on several occasions about going to the Inland Bays facility, and has gotten no direct answer. It is Mayor Cooper;s intention to forward a letter to the County in the next few days in regard to this issue. His sense is that the County is doing nothing in regard to an estimate to move forward with Rehoboth partnering with the County at the Inland Bays facility. Verbally, there have been no commitments. Commissioner Kuhns said that if there is some fashion for Rehoboth to build a pipe to Wolf Neck and have the County build a long pipe to where Artesian's property is, it might be financially feasible relative to the County's original proposal. He hoped that this could be expanded with the County and Artesian because the $45,000,000.00 could be divided three ways.

Commissioner Mills said that Mr. Mike Izzo was asked to figure out pricing for the partnership with the County and the City, and he asked if Mr. Izzo should complete his estimate. Commissioner Kuhns concurred that the estimate should be completed. The Commissioners are still waiting for the ocean outfall cost estimates and the County/Rehoboth partnership estimate. From what the County put on the table in the past in regard to spray irrigation, that partnership seemed expensive; but if a different scenario with the Wolf Neck facility is done involving the County, Rehoboth and Artesian, it seems from a monetary perspective that it is financially attractive.

Commissioner Mills asked what the status is with the cost estimates from Mr. Rip Copithorn in regard to ocean outfall. Mayor Cooper said that Mr. Copithorn has one cost estimate and expects another by the middle of next week. The prices that Mr. Copithorn is working on with contractors is only the outfall portion, and they are looking at it not only from what it would cost to construct the outfall but to give their input as to cost saving ways to construct it that might be different than has been proposed. There would also be an estimate of what it would cost in regard to the force main and getting it to the outfall, the pump station and pumping the effluent to the ocean, etc. Mr. Copithorn will prepare a report, and it will be possible for the Commissioners to have the report by October 31, 2008.

November 3, 2008 Workshop Meeting

Agenda:

"Public discussion concerning alternate wastewater discharge methods, funding, permitting, status of Request for Proposals (RFP's) from outside vendors for the disposal of the City's wastewater by way of land application, other areas of interest; planning future discussions and related matters."

Minutes of the November 3, 2008 meeting regarding this agenda item:

Mayor Cooper called for public discussion concerning alternate wastewater discharge methods, funding, permitting, status of Request for Proposals (RFP's) from outside vendors for the disposal of the City's wastewater by way of land application, other areas of interest; planning future discussions and related matters.

Commissioner Stan Mills reported that the Wastewater Workshop was held on November 1, 2008 in the Fire Hall. Local officials in attendance included: Senator Bunting; Mr. Dave Baker and Mr. Mike Izzo, Sussex County; ten DNREC representatives; a representative from the University of Delaware, College of Marian and Earth Studies; Mr. Bob Stenger; and a representative from Stearns & Wheler. Discussion involved a reiteration of prior presentations which had been held at the Commissioners' meetings. The Spray Irrigation Task Force which is a State appointed committee to promote and facilitate water reuse by farmers and to encourage municipalities to send effluent to the farmers. Representative Greg Hastings is the chair of that committee, and a report will be due on January 15, 2009 regarding spray irrigation use by farmers. Mr. Bob Stickels of the Clean Water Advisory Council (CWAC) had emphasized the need for the City Commissioners to seek funding through the State Department of Economic Development. Commissioner Mills, City Manager Gregory Ferrese and Mayor Cooper attended a meeting with Sussex County and Artesian Water Company on October 30, 2008 regarding a proposal for the City to partner with the County and Artesian Water Company. Mr. Izzo was also in attendance.

Mayor Cooper said that the County is the center point in the proposal, but if the County's terms are too restrictive and there is no interest in the proposal, this alternative may not be done.

Commissioner Paul Kuhns was in attendance at the Wastewater Workshop. At some point in the near future, the Commissioners will need to make a decision on which alternative is going to be used. Currently, there is no other alternative, outside of ocean outfall, unless the County, Artesian Water Company and the City agree to something. If the ocean outfall alternative is chosen and is up and running in two years, the lowest cost to the City is approximately $15,000,000.00 if the Artesian/County partnership works. Mr. Rip Copithorn of Stearns & Wheler had projected $30,000,000.00. A referendum should be considered to increase the City's borrowing limitations. Once all of the information has been received regarding the ocean outfall estimates, the Commissioners should ask for specifics to be able to go to State funding in regard to loans. This project would be a high priority program for the State, but the City will still need to borrow monies and will probably qualify for low interest loans. In March 2009, the City should know where the funding will be coming from.

Mayor Cooper referred to the Charter and the borrowing of money. What is traditionally and what is contemplated by the City Charter is that the Commissioners would put forward a project with estimated costs and the amount of money to be borrowed, and then it will go to referendum. He would certainly want to go to referendum to get the voters of the City to approve the borrowing of monies. Of the $30,000,000.00 to $35,000,000.00, the County would be responsible for approximately 40% of the cost.

Commissioner Kuhns said that the Commissioners need to start talking out how to raise the money and pay for the project. This would be a perfect time to bring in the City's financial advisor. Mayor Cooper said that if the Clean Water Advisory Council can make the money available, the process would cost less and would be more straight forward than to go out on the bond market to get the City rated and pay those various fee amounts.

Commissioner Kathy McGuiness asked when the Commissioners will be ready to present a plan to the Clean Water Council. Mayor Cooper said that when he and City Manager Gregory Ferrese had initiated the consent order, it was negotiated for two years to study the issue and establish an alternative. Once the Commissioners determine there is a viable solution, then time will be needed to see if it is affordable. The Commissioners need to decide on an alternative when they have enough information, and move forward on it.

Commissioner Pat Coluzzi did not think there should be any future speakers. Currently the Commissioners have to wait on the County regarding the partnership with Artesian, and a deadline needs to be set in regard to how long to wait on the County, for the spray irrigation option. If it is not an option, there is no point in talking more about spray irrigation. She was not sure having additional speakers until the Commissioners know what the County is going to do is worth the time.

Mayor Cooper said that if the County staff feels the Artesian proposal would be that there is going to be a $45,000,000.00 project to take the City's waste in West Rehoboth to the

Wolf Neck plant, the County would in turn build a pipeline from its pump station on Route 1 near the Exxon Staiton outside of Lewes to Milton. Artesian would put $15,000,000.00 in the total project. The County staff has indicated that it feels there is nothing in the first round to benefit the County i.e. West Rehoboth; and its expense would be entirely upon the City of Rehoboth Beach which would be $30,000,000.00. Artesian is planning a 2,000,000 gallon per day capacity for the City/County which would be a minimum, and it would be at $6.84 per 1,000 due to Artesian each year whether the waste is sent as much to there or not. The view of the County staff is that this would be the responsibility of the City until the County would be in a position to need the capacity. Mayor Cooper sensed that from talking with Mr. Dave Baker and Mr. Mike Izzo of Sussex County is the County feels to develop those costs, they need engineering work done by its consultants. There is no money on the County side to do that so the City may have to fund the it. Mr. Baker had received a quote for the engineering work, but no copy of the proposal has been forwarded to the City.

Commissioner Mills thought that the only options are to either partner with the County or ocean outfall. Commissioner Mills recommended that he and Mayor Cooper talk to Sussex County Council. Mayor Cooper had written a letter to be forwarded to the Council.

November 17, 2008 Regular Meeting

Agenda:

"Public discussion concerning alternate wastewater discharge methods, funding, permitting, other areas of interest; planning future discussions and related matters."

Minutes of the November 17, 2008 meeting regarding this agenda item:

Mayor Cooper called for public discussion concerning alternate wastewater discharge methods, funding, permitting, other areas of interest; planning future discussions and related matters.

Mayor Cooper said the Commissioners have agreed that there will not be any presentations unless something comes up.

Commissioner Mills said that Mr. Rip Copithorn of Stearns & Wheler will be presenting the costs in regard to the outfall before the end of the year 2008.

Commissioner Coluzzi noted that on November 3, 2008, a letter was sent to Mr. Finley Jones, President of Sussex County Council regarding the partnership with the City and the County to allow the City to send effluent to the Inland Bays facility. Mayor Cooper mentioned that the County needs to decide what the parameters. The County Engineer will be meeting with the County Administrator on November 18, 2008 in regard to what the

County will recommend. The County staff recommended that the Council should address the letter.

Commissioner Mills said that a Clean Water Advisory Committee Meeting was held this morning, and Mr. Terry Deputy, Finance Director with DNREC was present. Mr. Deputy is willing to speak to the Commissioners about funding availability through the Clean Water Advisory Council. Commissioner Mills requested that this presentation should be placed on the agenda for a future meeting.

December 1, 2008 Workshop Meeting

Agenda:

"Public discussion concerning alternate wastewater discharge methods, funding, permitting, other areas of interest; planning future discussions and related matters."

Minutes of the December 1, 2008 meeting regarding this agenda item:

Mayor Cooper called for public discussion concerning alternate wastewater discharge methods, funding, permitting, other areas of interest; planning future discussions and related matters.

Commissioner Stan Mills noted that Mr. Terry Deputy of DNREC has agreed to give a presentation on funding and funding options at the December 15, 2008 Regular Meeting. The County is in the process of asking for a planning grant to cost out a partnership with it and sending the City's effluent to one of the County's treatment plants.

Mayor Cooper has not received a response from Mr. Finley Jones, Sussex County regarding the partnership with the City and the County. Mayor Cooper has spoken with Mr. Mike Izzo, County Engineer, regarding the partnership and costs. Mayor Cooper said that the County has had conversations with the State in getting a grant to fund the County's portion, and he thought that the City's portion should be funded if a grant is being sought.

Commissioner Mills noted that the partnership issue has been placed on the agenda for the Clean Water Advisory Council meeting to be held on December 17, 2008. He had spoken with Mr. Izzo about a cost benefit analysis regarding raw sewage vs. treated sewage. Additional conversations with Mr. Izzo might be appropriate. It has been indicated that planning grants are available.

Mayor Cooper had heard secondhand information that the State would be willing to front the money with the idea that there would be a project at some point; and at that point, the planning money would be received with no interest.

Commissioner Mills said that the vendors' Request For Proposal (RFP) has not been received to date for the ocean outfall alternative. Mayor Cooper said that Mr. Rip Copithorn is ready at anytime with the pricing for all plant upgrades, new pumping stations, ocean outfall, etc.

Commissioner Paul Kuhns suggested that Mr. Copithorn be present at the December 15, 2008 Regular Meeting to give a presentation in regard to pricing the ocean outfall.

December 15, 2008 Regular Meeting

Agenda:

"Public discussion concerning alternate wastewater discharge methods, funding, permitting, other areas of interest; a presentation on funding options by Mr. Terry Deputy of DNREC; planning future discussions and related matters."

Minutes of the December 15, 2008 meeting regarding this agenda item:

Mayor Cooper called for public discussion concerning alternate wastewater discharge methods, funding, permitting, other areas of interest; a presentation on funding options by Mr. Terry Deputy of DNREC; planning future discussions and related matters.

Mr. Terry Deputy gave his presentation and provided information on funding options. He is with the Department of Natural Resources and Environmental Control Division of Water Resources Financial Assistance Branch. The purpose of this presentation was to provide the City with an overview of the Delaware Water Pollution Control Revolving Loan Fund (WPCRLF); to provide an overview of possible wastewater user rates and other cost variables taken from the Stearns & Wheler Report; and to be a resource to the City once a wastewater disposal option is selected. Mr. Deputy provided an overview of the Clean Water State Revolving Fund. In 1987, Federal grant assistance for construction of wastewater facilities was replaced with a revolving loan fund program. Communities are required to repay wastewater infrastructure loans, thereby providing a source of finds for future loans. In 1990, the Delaware Water Pollution Control Revolving Loan Fund program was created. The Clean Water Advisory Council is charged with evaluating, establishing and recommending strategies, plans and procedures to ensure the long term provision of adequate wastewater facilities in Delaware. Mr. Deputy presented an overview of the complete process of the Delaware Water Pollution Control Revolving Load Funding. Each year with DNREC a new funding cycle starts with the solicitations of notices of intent. With the 2010 notice of intent, the City needs to resubmit its proposed wastewater project. A project priority list and development intended use plan are prepared. The project priority list is a

ranking of projects based on water quality criteria and the readiness to proceed. The City of Rehoboth project will probably be the No. 1 ranked project. An intended use plan is prepared based on the projects and available funding which is presented to the Clean Water Advisory Council at a public hearing, and is submitted to the Environmental Protection Agency. Applications are solicited from the project priority list. The timeline from the notice of intent to the project priority list is approximately eight months. The Application is received from the City, and a financial/engineering review is done. The engineering documents are approved, and an environmental determination is issued. A loan analysis with recommendations is prepared. The financial recommendation is presented to the City before it is presented to the Clean Water Advisory Council for approval. A binding commitment is entered into with the City which details the scope of the project, loan assistance and timing. The project plans and specifications are submitted to DNREC for approval. The project is authorized to be bid. The City holds a pre-bid meeting, bid opening and bidder selection. The bid documents are reviewed and approved. Significant cost changes are reviewed. The City closes the loan agreement with DNREC and awards the project contract. The City is on a loan disbursement schedule and holds a preconstruction conference. Project construction begins, and the City begins loan disbursement requests. Disbursements are reviewed and payment is authorized. The City notifies DNREC of the project completion, and DNREC conducts the final inspection. The initiation of operation date is established, and the City begins the loan repayment. After one year, the City certifies the performance of the project. Mr. Deputy presented a hypothetical annual cost per user.

Mayor Cooper said that there are four political subdivisions for which a median household income is going to be available - City of Rehoboth Beach, Town of Henlopen Acres, Town of Dewey Beach and Sussex County. Mr. Deputy said that DNREC will take a look at how those subdivisions will contribute to the project, the EDU's for residential, the median household income for each of those communities. Averaging may having to be done to get to a reasonable number that is acceptable to everybody involved. The purpose of Mr. Deputy's office is to provide the best financing possible. Mayor Cooper said that the interest rate is critical, and he was concerned about how to plan to be able to lock in at a good interest rate. Mr. Deputy said that the rate is locked in 10 days prior to the loan closing and is based on 90% of the municipal bond yield. The standard of 1.5% for median household income is an existing standard. His office plans to address affordability at the next Clean Water Advisory Council meeting. The user rates in the State will be looked at in detail, and recommendations will be made to the Clean Water Advisory Council. Mr. Deputy will have a determination in February 2009.

Commissioner Coluzzi said that a portion of the loan could be a four-year loan as opposed to 20 years. Mr. Deputy said that the USDA has loan assistance. This portion of the loan will help to reduce the costs to the users of the project. USDA monies are paid at the end of the project. Interim financing may be needed or the entire project may be funded through the State Revolving Fund; and have the USDA buy out a portion of the loan at the end of the project.

Ms. Linda Kauffman, Laurel Street, asked if the potential loan amount is for 100% or if there are matching City funds. Mr. Deputy said that the loan amount through the State

Revolving Fund can be for 100% financing, and the life of the loan can be extended to 30 years if needed. The life of the USDA loan goes to 40 years. Ms. Kauffman asked how the communities' needs are ranked. Mr. Deputy said that the ranking is based on water quality data and readiness to proceed.

Commissioner Barbour asked in regard to median household income, if the households that are not full-time residents are excluded from calculating the interest rate. Mr. Deputy noted that all household incomes according to the census are included in the calculations.

Mr. Mike Izzo of Sussex County said that project costs are eligible. Mr. Deputy said that all costs associated with the project are eligible for funding. An invoice for incurred costs can be submitted at the loan closing, and a check will be forwarded to the City for those costs.

Mayor Cooper said that for the City to get permits, it will need to front money before being reimbursed over the life of the loan. Mr. Deputy said that a short term planning and design loan for initial planning design is the only money that can be gotten once it is approved. Mayor Cooper asked if there is an origination fee. Mr. Deputy said that there are no origination fees, but there are lawyers' fees which are approximately $2,000.00.

Ms. Kauffman asked if there is a requirement that a funding plan needs to be put forth before March 2009. Commissioner Mills said that in Mr. Rip Copithorn's presentation at the first workshop had that timeline for funding sources to be lined up.

DNREC and Sussex County representatives in attendance were: Mr. John Schneider of DNREC and Mr. Mike Izzo of Sussex County.

Commissioner Mills gave a presentation. He had met with Mr. Mike Izzo prior to the meeting in regard to the alternatives which have been studied in the past and present. The

Commissioners' objective is the selection of alternate discharge because there is a deadline of December 30, 2014 on the consent order. Four alternatives have been identified for consideration through discussions with the City, County and DNREC. They are: Land application, rapid infiltration beds, subsurface injection and ocean outfall. Rapid infiltration beds have been eliminated from consideration. Shallow and deep well injections were rejected. Spray irrigation onto land purchased/owned by the City was rejected. Stearns & Wheler is developing estimates regarding ocean outfall.

The option of spray irrigation via a vendor was eliminated. Spray irrigation via partnering with Sussex County and sending the City's raw waste or treated wastewater to County facilities for spray irrigation is currently being addressed by seeking funding the Clean Water Advisory Council to perform engineering and costing analyses. Spray irrigation via three-way partnership with outside vendor, Sussex County and the City is under consideration. Ocean outfall via sending raw waste or treated wastewater to the South Coastal facility was an option that had been looked in 1990. Commissioner Mills asked what other alternatives

had been considered in the past, and if any alternatives have been overlooked. Mayor Cooper said that he had participated in a study by Professor Gallagher regarding wetlands and lands around the Lewes treatment plant. Commissioner Mills identified viable alternatives as of today as ocean outfall, land application by Sussex County, and possibly land application by an outside vendor. The next steps are to pursue pricing of each alternative, determine user fees, identify funding, and debate the merits of each alternative. Commissioner Mills had spoken with Mr. Deputy at the last Clean Water Advisory Council meeting and had asked for a planning grant. A grant is available, but in terms of applying for the grant, it has been postponed until February 2009. Commissioner Mills thought that perhaps the Clean Water Advisory Council would accommodate Mr. Deputy, Mr. Izzo and himself to have a January 2009 meeting to consider the grant. Mayor Cooper did not want to wait until February 2009. Commissioner Mills suggested that City Manager Gregory Ferrese enter into a contract with the County to hire an engineering firm to get that underway at the City's cost.

Mr. Izzo said the estimate for the engineers to form the scope of work at a cost of $38,000, consulting fees for the City at $15,000 which would total $53,000; and DNREC will fund 50% of the costs. Mayor Cooper said there was no problem in moving forward with this.

Mr. Deputy indicated that the planning grant will be on the agenda until December 17, 2008. Mr. Izzo had provided the scope of work on December 12, 2008, and the City has asked for additional work. He asked if there can be an agreement to be satisfied with a grant of $26,500.00, the cost of the study being possibly more than $53,000, and splitting the difference. Mayor Cooper was pleased with Mr. Deputy and DNREC's offer, but he was concerned with being locked into a scope of work that he did not think was complete.

January 5, 2009 Workshop Meeting

Agenda:

"Public discussion concerning alternate wastewater discharge methods, funding, permitting, other areas of interest; planning future discussions and related matters."

Minutes of the January 5, 2008 meeting regarding this agenda item:

Mayor Cooper called for public discussion concerning alternate wastewater discharge methods, funding, permitting, other areas of interest; planning future discussions and related matters.

Commissioner Stan Mills mentioned that the Commissioners are still waiting for cost analyses, and he wondered what progress has been made on the ocean outfall costing and on talking about a partnership with the County. Commissioner Kuhns had referred to a letter, dated December 19, 2008, from Mr. Dave Baker, Sussex County, to the Mayor and Commissioners asking for input in doing an evaluation study. Mayor Cooper has spoken with Mr. Baker and is trying to set a meeting with the County's and the City's engineers to discuss the scope of work. Mayor Cooper would like to understand, before the Commissioners approve the scope of work, why the County is proposing that the flow would be equalized. When the County made its presentation to the Wastewater Council, the alternative of the City sending its raw waste to the Inland Bays facility is $40,000,000.00 more than the ocean outfall. It would be helpful to understand how to get the cost down. Commissioner Mills said that the Commissioners have the preliminary scope for the City and the County, so it is a matter of meeting with them to get it finalized. He would like to be included in the meeting. The scope needs to be finalized before the submittal can be finalized for a planning grant. The Wastewater Council meets on January 21, 2009. Mayor Cooper said Mr. Terry Deputy had indicated that he would ask to have a meeting.

Mayor Cooper had asked the County if it is willing, wanting or able to partner with the City and take the City's waste to the Inland Bays facility. In the meantime, the County had applied for a grant from the Wastewater Council which would be a 50% grant that would need to be matched by an equal amount, to hire a consultant. In this case, it would be a combined effort between the County's consultant and the City's consultant to look at what would be involved with that and the costs. The County came up with a scope of work, and it is proposing that the City would send the County equalized flow which would require that the City would maintain tankage and the headworks at the plant. This would result in a substantial cost and would not be desirable from the City's standpoint. The Wastewater Council could approve this on January 21, 2009. Mayor Cooper said that in regard to ocean outfall, Mr. Rip Copithor of Stearns & Wheler had assured him the report is being drafted with cost estimate.

Commissioner Mills had put a call into former Representative Greg Hastings who is the Chair of the State Authorized Spray Irrigation Task Force. The report is due January 15, 2009. He wanted to see if the Task Force was on its timeline. If so, he suggested presented the report at the next meeting.

January 20, 2009 Regular Meeting

Agenda:

"Public discussion concerning alternate wastewater discharge methods, funding, permitting, other areas of interest; planning future discussions and related matters."

Minutes of the January 20, 2009 meeting regarding this agenda item:

Mayor Cooper called for public discussion concerning alternate wastewater discharge methods, funding, permitting, other areas of interest; planning future discussions and related matters.

Mayor Cooper reported that on January 7, 2009, a meeting was held between the City and the County. Mayor Cooper, Commissioner Mills, Mr. Rip Copithorn, Mr. Ferrese, County Engineer and County Administrator were present. The County Engineer had put together a scope of work which is adequate and was be forwarded to the Clean Water Advisory Council by the middle of last week for a meeting to be held on January 21, 2009. When the scope of work was expanded, the pricing has increased. Hopefully the Clean Water Advisory Council will approve the grant on January 21, 2009 which would be 50% of the cost. The contract will need to be approved by County Council with its engineering firm to do its part of it before the scope of work can be started.

Commissioner Mills has contacted former Representative Greg Hastings on the Spray Irrigation Task Force and is still waiting on a response to present the report to the Commissioners. The report was due out on January 15, 2009, and Commissioner Mills will find out what the status is of the report.

Ms. Linda Kauffman, President of the Homeowners' Association, presented questions to be conveyed to the Commissioners for answers to update its members. She asked if the City will consider going out for RFP or bid again to get specific costs for either the ocean outfall or spray irrigation, or both; and if not, why not. Mayor Cooper said that the Commissioner are asked to take a position that has not been advertised on the agenda. It is not something that is factual which can be responded to because there would have to be a changed circumstance for the Commissioners to consider that. Ms. Kauffman said that there might have been flawed pieces in the process. She noted that the costs to provide the RFP were hefty because of engineering studies that would have had to have been done similar to the argument that was given for the engineering studies that would have had to have been done for ocean outfall that the City chose not to do because of the costs. Ms. Kauffman asked if cost is going to be a factor that is to be considered, then how is the cost derived; and if it is not by RFP, then what is needed to get to the spray irrigation costs. Mayor Cooper said that the City went out for an RFP and received no real response. As part of the bid process, none of the firms wrote a letter and said that this is unfair or that the City needs to pay them to develop the RFP because there are costs associated with it. Ms. Kauffman asked if there was any analyses as to why the Commissioners did not get any responses and if that could be corrected to get a better response. Mayor Cooper said no, and he has his own reasons.

Ms. Kauffman asked how a cost estimate is gotten for spray irrigation so it can be compared to a cost estimate for ocean outfall. Mayor Cooper said that this was done in the original report. The City can own and operate the spray facility which was looked at in the report which could be revisited if desired. He is hoping soon to get the engineer's final report on the detailed costing of ocean outfall. Ms. Kauffman asked if there is an estimate for spray irrigation. Mayor Cooper said that the City is going to develop it with the County. Ms. Kauffman asked if the Commissioners have considered a referendum on the issue of

which method should be used and letting citizens decide which method potentially could be used by looking at a referendum. Mayor Cooper said that a referendum would be needed to decide what the referendum question was because there will be lots of arguments around both sides. Ms. Kauffman noted that the Homeowners' Association Board supports the beginning to add a surcharge on to water and sewer rates over a four or five year period. The reasons are to build up an escrow and to begin to get people acclimated to the costs over a period of time. The Board will be taking action and supporting one method or another, and when that meeting is scheduled the Commissioners will be invited to attend.

February 2, 2009 Workshop Meeting

Agenda:

"Public discussion concerning alternate wastewater discharge methods, funding, permitting, other areas of interest; planning future discussions and related matters."

Minutes of the February 2, 2009 meeting regarding this agenda item:

Mayor Cooper called for public discussion concerning alternate wastewater discharge methods, funding, permitting, other areas of interest; planning future discussions and related matters.

Mayor Cooper reported that a final schedule of work was put together for the study to look at partnering with the County. The cost increased to approximately $74,000.00. Commissioner Mills, Mr. Gregory Ferrese and Mayor Cooper had attended the Clean Water Advisory Council Meeting which was held in Dover, DE. It was passed by the Council when presented by Mr. Terry Deputy. On January 27, 2009, the County Council approved the contract. The Clean Water Advisory Council will then recommend to the Secretary of the Department of Natural Resources for approval. A kick-off meeting will be held on February 5, 2009 with the County engineers, and the City engineer will be present.

February 17, 2009 Regular Meeting

Agenda:

"Public discussion concerning alternate wastewater discharge methods, funding, permitting, other areas of interest; planning future discussions and related matters."

Minutes of the February 17, 2009 meeting regarding this agenda item:

Mayor Cooper called for public discussion concerning alternate wastewater discharge methods, funding, permitting, other areas of interest; planning future discussions and related matters.

Mayor Cooper said that since the last meeting, the County was going to approve a contract with its consultant to look at the joint disposal of the City's wastewater with the County. On January 10, 2009, there was a kick-off meeting that the County held with its engineers, and Commissioner Mills, Mr. Gregory Ferrese, Mayor Cooper, Mr. Rip Copithorn of Stearns & Wheler were in attendance. Mayor Cooper has since forwarded information he has to the County's consultant regarding the City's treatment plant. The next meeting will be held on March 6, 2009.

Commissioner Mills noted that the report would be completed sometime in April 2009 regarding sending raw or treated wastewater to a County facility. After that evaluation, there will be estimated user fees for the different options.

Mayor Cooper entered all of the sewer billings for a year to calculate an average bill. The State uses a figure of 240 gallons per day per EDU. Multiplying what the City's rates are would result in approximately $494.00. Mayor Cooper calculated an average of $325.00 for actual sewer billings. In the third quarter of the year, 52% of the year-round of the total is used. The average customer would use approximately 25,000 gallons in that quarter, but only 4,000 gallons in the first quarter of the year. The number of accounts which had no usage in the first quarter of the year was substantial. No usage is balanced out with high summer usage.

Commissioner Mills noted that the State appointed Spray Irrigation Task Force's report was due January 15, 2009, and he will forward this report to the Commissioners upon receipt.

March 2, 2009 Workshop Meeting

Agenda:

"Public discussion concerning alternate wastewater discharge methods, funding, permitting, other areas of interest; planning future discussions and related matters."

Minutes of the March 2, 2009 meeting regarding this agenda item:

This meeting was cancelled because of a snow storm and was not rescheduled.

March 16, 2009 Regular Meeting

Agenda:

"Public discussion concerning alternate wastewater discharge methods, funding, permitting, other areas of interest; planning future discussions and related matters."

Minutes of the March 16, 2009 meeting regarding this agenda item:

Mayor Cooper called for public discussion concerning alternate wastewater discharge methods, funding, permitting, other areas of interest; planning future discussions and related matters.

Mayor Cooper reported that a meeting was held with the County in Georgetown, DE on March 6, 2009 about the joint study. Commissioner Mills, Mr. Ferrese, Mayor Cooper and Mr. Rip Copithorn of Stearns & Wheler were in attendance. There was discussion of the issues involved and what would need to be done on the City's and County's ends to make that happen. Copies of a report regarding the ocean outfall costs were distributed today from Stearns & Wheler to the Commissioners and the County. The cost for ocean outfall was approximately $35,000,000.00 which includes the entire construction, pumping station, pipes, etc. Data has been supplied that includes operational costs. The average bill is approximately $325.00 per year, and the costs will be approximately 110% increase with the assumption that it would only be 20 years of financing with 4.4% interest. The text of the report will be placed on the City website. The Commissioners will review the report and advise Mayor Cooper about Mr. Copithorn going over the report at a future meeting.

Commissioner Mills reported that a study is being done in partnership between the City and Sussex County where the County would take either the City's raw sewage or its treated wastewater. The timeline for the first presentation to the County Council is April 21, 2009. A presentation might possibly be scheduled for the May 2009 Workshop Meeting. Mayor Cooper said that the County has a lot of work to do with a costing model that would work for it.

Mr. Timothy Spies, 53 Columbia Avenue, asked if the County is partnering with a public utility such as Artesian Water Company or Tidewater; or if the County is doing this on its own. Mayor Cooper said that the County is not partnering with a public utility.

April 3, 2009 Workshop Meeting

Agenda:

"Public discussion concerning alternate wastewater discharge methods, funding, permitting, other areas of interest; planning future discussions and related matters."

Minutes of the April 3, 2009 meeting regarding this agenda item:

Mayor Cooper called for public discussion concerning alternate wastewater discharge methods, funding, permitting, other areas of interest; planning future discussions and related matters.

Mayor Cooper reported that on April 1, 2009, the County held a meeting with its engineers. The County was shocked with the total size of the scope of what could be looked at in regard to the City partnering with County. The scope will be retooled. The engineers are committed to having it take a minimal amount of time, and they had originally hoped to present the scope to the County Council on April 21, 2009. Prior to the last meeting of the Mayor and Commissioners, the report was handed out from Stearns & Wheler regarding the cost for ocean outfall.

Commissioner Kuhns asked if Mr. Rip Copithorn of Stearns & Wheler and a speaker from the County could be present at the next Workshop Meeting regarding their findings in regard to an alternate wastewater discharge method and costs. Mayor Cooper thought that Mr. Copithorn courld be present. Mayor Cooper suggested that the ocean outfall be incorporated with the findings from the County. If there is an opportunity for next Workshop Meeting, it will be placed on the agenda.

Commissioner Mills noted that no feedback from the State appointed Spray Irrigation Task Force has been received to date.

April 17, 2009 Regular Meeting

Agenda:

"Public discussion concerning alternate wastewater discharge methods, funding, permitting, other areas of interest; planning future discussions and related matters."

Minutes of the April 17, 2009 meeting regarding this agenda item:

Mayor Cooper called for public discussion concerning alternate wastewater discharge methods, funding, permitting, other areas of interest; planning future discussions and related matters.

Mayor Cooper reported that a meeting is scheduled with the County on April 30, 2009. No information has been received from the County to date in regard to a proposed partnership discharge system, but information on this matter may be received before the County's upcoming meeting. As reported at the Mayor and Commissioners Workshop Meeting on April 3, 2009, Mayor Cooper thought that the County had done a good job with the technical aspects of a joint partnership system and what the present capacities are and

ultimate capacities would be at the County's two wastewater treatment plants. When the consultants presented the capital costs with all that is proposed, it was a shock. The County wanted to review what needed to be done right away and in the near future, and postpone some aspects of the proposed project. It is basically up to the County to decide what it would be willing to go forward with. The year 2015 is when the City would be online, and many things need to happen before 2015.

Commissioner Mills requested clarification as to whether more time would be needed for an analysis of the user fees after the report is received from the County, or the user fees would be known simultaneously with when the report is received. He thought that it would be the former. Mayor Cooper said that as long as the report is presented correctly, it should not take too much to plug that into the City's user fees. For the most part, it all is a function of what is the total cost to the City vis-à-vis of what the cost is today. Mayor Cooper thought that when the County has all the capital costs instilled, it will have work to do to come up with a financial model in the sense of the City's share in something which has already been built and that the County wants to be compensated for that, the land that might be used, what kind of compensation the County wants for the Inland Bays, etc. Commissioner Mills hoped that by June 2009, the Commissioners should be discussing all of the alternatives. Correspondence was received from WSI International at www.wsi-llc.com, who is interested in the alternate wastewater program with regard to water reuse technologies. The report from the State's Spray Irrigation Task Force which was due January 15, 2009, has not been completed to date.

May 1, 2009 Workshop Meeting

Agenda:

"Public discussion concerning alternate wastewater discharge methods, funding, permitting, other areas of interest; planning future discussions and related matters."

Minutes of the May 1, 2009 meeting regarding this agenda item:

Mayor Cooper called for public discussion concerning alternate wastewater discharge methods, funding, permitting, other areas of interest; planning future discussions and related matters.

Mayor Cooper reported that the meeting with the County regarding the study on Rehoboth sending treated or raw sewage to a County facility for discharge was postponed from April 30, 2009 to May 4, 2009.

Commissioner Mills has received the undated Spray Irrigation Task Force Report. Once the report has been verified that it is the final version, he will forward it to the Commissioners for their review. The report will be placed on the City website. Commissioner Mills recommended that Mr. Rip Copithorn of Stearns & Wheler be in attendance at the May 15, 2009 Regular Meeting, and Mr. Copithorn and County

representatives be in attendance at the June 19, 2009 Regular Meeting to discuss the partnership report regarding the City sending treated or raw sewage to the County facility.

May 15, 2009 Regular Meeting

Agenda:

"Presentation by Rip Copithorn of Stearns & Wheler on their report dated March 2009 regarding the cost to construct an ocean outfall to replace the City's Canal discharge of its treated wastewater effluent and public discussion concerning alternate wastewater discharge methods, funding, permitting, other areas of interest; planning future discussions and related matters."

Minutes of the May 15, 2009 meeting regarding this agenda item:

Mayor Cooper called for the presentation by Mr. Rip Copithorn of Stearns & Wheler on their report dated March 2009 regarding the cost to construct an ocean outfall to replace the City's Canal discharge of its treated wastewater effluent and public discussion concerning alternate wastewater discharge methods, funding, permitting, other areas of interest; planning future discussions and related matters.

Mr. John Schneider of DNREC was in attendance at the meeting. The March 2009 report is currently available on the City website.

Mr. Rip Copithorn of Stearns & Wheler presented an update on Ocean Outfall Alternative. He has been working with the City on what is a parallel path that the City is exploring, and that is looking at land application for disposal of treated wastewater and ocean outfall as wastewater alternatives. Mr. Copithorn's presentation this evening is on ocean outfall. He had talked to marine contractors to define the cost estimates to further determine a user charge. The location of the outfall would include a new pump station at the wastewater treatment plant to pump the treated effluent along a proposed route. The force main would run from the wastewater treatment plant along State Road crossing over Rehoboth Avenue and along Henlopen Avenue to the beach entrance. The report is very detailed as to how the outfall may be built. There are several different construction techniques which could be used to build the outfall. A more conventional approach would be to excavate the street to build the force main. Directional drilling was also looked at where burrowing underground would occur. Directional drilling also has advantages in terms of environmental impact. The two types of pipe material looked at were: concrete encased steel pipe which has been typically used for outfall and high density polyethylene pipe (HDPE) which is more prevalent. The advantage to the HDPE pipe is that it is corrosion resistant. When the HDPE pipe is full, it is buoyant. In using the conventional trenching-type construction technology, an eight foot deep section would be dredged out. The bedding material would be barged in and applied from the bottom. The pipe would be laid and would

be backfilled from a barge. The ballast rock and armor rock would laid on top to protect the pipe from turbulence in the ocean and any movement above from a possible anchor. When the pipe is floated out over the trench, concrete collars are required to sink the HDPE pipe. A screw anchor could be added to the sides of the concrete collar which would be burrowed into the sea bed to further stabilize the pipe. The diffuser is located at the end of the outfall pipe and is a series of ports that are designed to inject treated effluent so it quickly disperses and mixes with the sea water. The construction techniques for conventional excavation are establishing a construction area at the shore; establishing a pipe spooling area; installing sheet piling through the surf zone; excavating; dredging to the diffuser; laying the bedding material; pulling the pipe and welding sections; backfilling and installing the armor pipe; installing the diffuser; removing the sheet piling and restoring the area. Divers would install the diffusers onto the structure. The construction techniques for horizontal direction drilling (HDD) are establishing a construction area behind the dunes in the parking area; establishing a pipe spooling area; drilling a pilot hole the length of the outfall and reaming to a larger diameter; pushing the pipe from shore side and welding sections; dredging for the diffuser section; installing the diffuser using divers and restoring the area. Mr. Copithorn was not sure if directional drilling can be done. The soil boring geo-technical information is positive which indicates that directional drilling can be done. Actual borings at the specific site would need to be done. A few additional upgrades would be recommended or required for the wastewater treatment plant. They include a new effluent filter, pump station and motor control center improvements. The original engineer's estimate for the cost of the outfall and the diffuser is $25,900,000.00. Estimates were received from Weeks Marine from the New Orleans area and Worley Parsons based in Australia. The average cost for HDPE pipe, excavation and buried pipe is $19,700,000.00. The average cost for HDPE pipe, directional drilling and boring is $18,400,000.00. The cost for the wastewater treatment plant is $3,700,000.00, and the pump station and force main is $3,900,000.00. The total capital cost is $27,300,000.00, and the project cost is $34,600,000.00. It is anticipated that the annual interest rate from the Delaware Water Pollution Control Revolving Loan Fund would be 4.4% for a 20-year term. The costs would be shared by the different service districts who would Rehoboth Beach, Dewey Beach, Henlopen Acres and North Shores. The average daily use per resident is 150 gallons per day, and the typical annual charge is $325.00. The proposed user charge for Rehoboth Beach is $680.00. If the City decides to go with an outfall, there are a number of permitting issues to go through from Federal and State agencies. The Federal agencies would involve the US Corps of Engineers (USCOE), Environmental Protection Agency (EPA), US Fish & Wildlife and US Marine Fisheries. The State agencies would involve DNREC, Coastal Zone Management, Delaware State Historic Preservation, and Soil & Water Conservation. The environmental impact assessment requires baseline studies, water quality impacts, public health impacts and dilution modeling. A timeline was provided to show the date of the permit on October 5, 2005 through to the date to be in compliance, December 14, 2014. Mr. Copithorn expected a minimum of three years for the permitting process to occur, and construction could be done in one season. The alternative study was completed in August 2005. Baseline studies can be done along with geotechnical studies. A decision is needed in the near future. Discussion ensued as to whether some ocean outfalls are being removed in other parts of the country.

Commissioner Mills commented that none of the pipes are surface mounted anywhere. The staging area at Deauville Beach will be restricted to the parking lot area. Mayor Cooper said that if a space could be found which is cost effective and is not too imposing, that location would be used.

Mr. Copithorn said that an alignment study should be done for the location of the forced main from the wastewater treatment plant to the beach area. The disturbance during construction to bury the pipe along the street is temporary.

Commissioner Mills sasked if a wastewater district could be clarified. Mayor Cooper noted that in regard to the wastewater district, there is a different rate schedule for the Rehoboth Beach, Dewey Beach, Henlopen Acres and North Shores customers. The City customers pay what is billed by the City. After the City of Lewes and the City of Rehoboth Beach split from the partnership with the County, the two entities had to agree that they would plan for the area around them. The U.S. EPA said that it was not going to accept any solution which did not include sewerage east of the canal. The City had to take that over. The City contracted with the County on behalf of Dewey Beach, and there was a separate contract for Henlopen Acres where the City takes the cost of the plant on an annualized basis and they pay on a quarterly basis based on a estimate of the cost. The County pays their proportionate share plus a 15% override for overhead and billing costs. The City collects the actual costs of operating the wastewater treatment plant on a proportional basis from the County on behalf of Dewey Beach and Henlopen Acres. At the time when this plan was in design, the City had some wastewater from 21 Ocean Drive in the area of that immediate vicinity. North Shores had paid double the in-town rate, but the County would not accept it if the rest of it did not get sewered. The capital costs were paid upfront less the grant money. The City contracted to sewer the rest of it. The contract with the North Shores Board of Governors said that the City collects the cost of operation, and the City would get a 50% override on that. The City's auditors, in view of the contract years ago, made the decision that with capital costs, the City would only recover in the form of depreciation. When the City spent approximately $3,000,000.00 to do the upgrades to get the nutrients down which added to the cost of the plant, it added to the depreciation; and the City recovered it through the depreciation.

Commissioner Kuhns said that the cost estimates in the 2004 report were approximately $35,000,000.00, and today they are approximately $35,000,000.00. In the 2004 report, the dollar amounts were put into the 2012 dollars, so the costs would be approximately $40,000,000.00. A small amount of that money will go to engineering fees, but the construction is when the City starts paying. In the 2004 chart and the chart from today, there are inconsistencies. The annual costs in 2004 were $5,300,000.00, and today it is $4,500,000.00. In 2004, the interest on an annual basis was $1,750,000.00 at 4%, and now the interest is $800,000.00 at 4.4%. Commissioner Kuhns thought that the interest on 4.4% will be more annually than what it is now. He questioned the figures presented. In the 2004 report, there are additional O&M costs for the wastewater treatment plant at approximately $400,000.00 per year. The costs were not listed in the current chart. Mr. Copithorn said that the $400,000.00 is excluded because those costs were discretionary and did not have to be budgeted for. He will review whether that figure was per year or not. In 2004 report,

the typical user rate would go up 223%, and today, it is being said that it will go up 110%. Mr. Copithorn said that the estimate is $680.00 based on the current cost estimate vs. $977.00 from 2004. Mayor Cooper thought that the 2004 report was flawed in the sense that the revenues were looked at for the wastewater treatment plant as opposed to the expenses. There is a $1,200,000.00 in revenue, but there is only $800,000.00 in costs associated with the City. The City is already $400,000.00 towards its goal, then the cost is increased to Dewey Beach and Henlopen Acres but reduces it to the City. The City has bonds on the elevated storage tanks which will be up in three years; and the principle and interest on those are approximately $380,000.00 per year.

Commissioner Kuhns has heard from representatives of DelDOT that when a street is torn up, it has to be replaced with curbs. He suggested that this matter should be looked into and the costs associated with doing this. Commissioner Kuhns was concerned with the possibility of the County not partnering with the City for ocean outfall which may result in losing approximately 40% in revenue. Mr. Copithorn said that the costs are independent. If Sussex County were to partner in a regional outfall, it would need to build a pump station. Commissioner Mills said that the City last met with the County and consulting engineers on May 4, 2009 in regard to its report on sending treated effluent or raw sewage to a County facility for disposal. The next meeting will held on June 1, 2009.

Mr. Paul Lovett, 510 Rehoboth Avenue asked if directional drilling is used under the City. He also asked if there is a possibility to go down the Canal so it is not so intrusive on the City. There is room between Henlopen Acres and North Shores which is almost clear of obstructions. Mr. Copithorn that it possible to use directional drilling for the force main. A study could be done in regard to where the pipe would be located.

Mr. Copithorn said that when this is resolved with the County, that is when the ocean outfall vs. land application comparison can be made. Commissioner Mills had suggested that Mr. Copithorn and the County representatives should be present for that meeting.

June 5, 2009 Workshop Meeting

Agenda:

"Public discussion concerning alternate wastewater discharge methods, funding, permitting, other areas of interest; planning future discussions and related matters. "

Minutes of the June 5, 2009 meeting regarding this agenda item:

Mayor Cooper called for public discussion concerning alternate wastewater discharge methods, funding, permitting, other areas of interest; planning future discussions and related matters.

Mayor Cooper, City Manager Gregory Ferrese and Commissioner Mills attended a meeting with the County yesterday at which time the County gave them a financial model for at least part of what is being looked at.

Commissioner Mills said that the Clean Water Advisory Council (CWAC) had a planning workshop this past week. Mayor Cooper, Mr. Ferrese and Commissioner Mills also were in attendance at the meeting. Mr.. Joe Corrato, the new Chair would like the CWAC promote water reuse. He would like to re-evaluate all the criteria for assessing wastewater treatment plants before they ask for monies. That conversation will be continue. Commissioner Mills has received the Irrigation Preservation Task Force Final Report which is not dated. He has asked for a list of names of the members. Commissioner Mills would like to post this report on the City website under Ongoing Business. The report refers to spray irrigation and water reuse, and the desire by farmers to use it.

June 19, 2009 Regular Meeting

Agenda:

"Public discussion concerning alternate wastewater discharge methods, funding, permitting, introduction of the report of the Irrigation Preservation Task Force that was established by the Delaware General Assembly, other areas of interest, planning future discussions, and related matters."

Minutes of the June 19, 2009 meeting regarding this agenda item:

Mayor Cooper called for public discussion concerning alternate wastewater discharge methods, funding, permitting, introduction of the report of the Irrigation Preservation Task Force that was established by the Delaware General Assembly, other areas of interest; planning future discussions and related matters.

Commissioner Mills noted that the next meeting with the County is scheduled for July 8, 2009. A copy of the final report and recommendations from the Irrigation Preservation Task Force was forwarded to the Commissioners. The report was dated May 8, 2009. The membership of the Task Force is identified in House Concurrent Resolution No. 67. Commissioner Mills will forward the final list of actual members to the Commissioners. The General Assembly created the Task Force specifically to locate water re-use for the agricultural industry. The Task Force findings were that the wastewater facility can pipe water to a farm and the farmer can use that water for irrigation. The other scenario is that the wastewater facility would lease the land from the farmer and allow him to farm it. It is

mandated how gallons per day or pay week have to be put on the farmland. In the end of the report, the Task Force evaluates and defines advantages and disadvantages for spray irrigation. The Task Force recommends that the State of Delaware explore ways to provide incentives including utilizing existing funding sources that are available to any wastewater entity that will cease discharging effluent into surface waters and instead divert reclaimed wastewater to farmers' fields. This is not something for the City of Rehoboth to react on and is aimed at a statewide program to advocate this type of program to the different counties.

July 6, 2009 Workshop Meeting

Agenda:

"Public discussion concerning alternate wastewater discharge methods, funding, permitting, other areas of interest, planning future discussions, and related matters."

Minutes of the July 6, 2009 meeting regarding this agenda item:

Mayor Cooper called for public discussion concerning alternate wastewater discharge methods, funding, permitting, other areas of interest; planning future discussions and related matters.

Mayor Cooper noted that a meeting is scheduled with the County on July 9, 2009.

Commissioner Mills said that this meeting will be in regard to the study undertaken by an engineering consultant to analyze a partnership between the City and the County in taking Rehoboth's raw sewage or treated effluent and disposing of it by land application at a County facility. The onus is on the County to finalize the report and for the Commissioners to analyze it, and for the County Council to weigh in on it too.

July 17, 2009 Regular Meeting

Agenda:

"Public discussion concerning alternate wastewater discharge methods, funding, permitting, other areas of interest, planning future discussions, and related matters."

Minutes of the July 17, 2009 meeting regarding this agenda item:

Mayor Cooper called for public discussion concerning alternate wastewater discharge methods, funding, permitting, other areas of interest planning future discussions and related matters.

Commissioner Mills said that the Commissioners are waiting for the engineering study regarding partnering with the County to analyze taking the City's raw sewage or treated effluent and sending it for disposal on a County land application or spray irrigation site. Mayor Cooper, Mr. Gregory Ferrese and Commissioner Mills last met with the County and consulting engineers on July 8, 2009. The next meeting to be held with the County and consulting engineers is scheduled for August 11, 2009; and it is anticipated that the report will be received and finalized that this meeting. At the Clean Water Advisory Council meeting which will be held on August 18, 2009, the County will give its presentation on the report. On August 18, 2009 at 3:00 p.m., the County Council will be given the same presentation. Commissioner Mills and possibly Mayor Cooper would like to await a response from County Council to know what its position is before bringing it back before the Commissioners. Mayor Cooper said that the report would be final except for comments, and there may be some changes afterward. Commissioner Mills said that they will have a week to do the final revisions before the public hears the presentation.

August 7, 2009 Workshop Meeting

Agenda:

"Public discussion concerning alternate wastewater discharge methods, funding, permitting, other areas of interest, planning future discussions, and related matters."

Minutes of the August 7, 2009 meeting regarding this agenda item:

Mayor Cooper called for public discussion concerning alternate wastewater discharge methods, funding, permitting, other areas of interest; planning future discussions and related matters.

Mayor Cooper was not aware of any new developments since the last meeting. A meeting with the County is scheduled for August 11, 2009, but no preliminary information has been received to date. The County Council meeting is scheduled for August 18, 2009 to present the findings of the prior meeting. The Clean Water Advisory Council (CWAC) meeting will be held on August 19, 2009.

August 21, 2009 Regular Meeting

Agenda:

"Public discussion concerning alternate wastewater discharge methods, funding, permitting, other areas of interest, planning future discussions, and related matters."

Minutes of the August 21, 2009 meeting regarding this agenda item:

Mayor Cooper called for public discussion concerning alternate wastewater discharge methods, funding, permitting, other areas of interest planning future discussions and related matters.

Mayor Cooper reported that a meeting was held with the consulting engineers, the County, and representatives of the City. The outline of the presentation regarding the report on a joint project with the County was put together, and the County's engineers and the County along with assistance from Mayor Cooper made that presentation to the County Council on August 18, 2009 and to the Clean Water Advisory Council on August 19, 2009 in Dover, DE. The County's engineers were asked to issue the report as quickly as possible. Mayor Cooper thought that at some point the Commissioners need to have the presentation, and they need to begin to pull this matter to a conclusion and make a decision. The County Council intends to put this subject back on its agenda for the September 15, 2009 meeting to discuss and possibly make a decision. At the next Workshop Meeting, the Commissioners should discuss how to pull this to a conclusion, what information to present, etc.

Commissioner Mills had prepared a timeline regarding moving forward on this issue, and he distributed it to the Commissioners. At the Sussex County Council Meeting, it was indicated that a vote would likely be entertained to give the County engineer direction. The timeline reflected the Board of Commissioners, Sussex County Council and Clean Water Advisory Council meetings from September 4, 2009 to December 16, 2009. The County presentation could come before the Commissioners at the Workshop Meeting on September 4, 2009. At the September 15, 2009 Sussex County Council Meeting, Sussex County could potentially vote on either eliminating one option or prioritizing several options and moving forward. If not, the Council could potentially meet anytime thereafter. The CWAC will be meeting on September 16, 2009, and one of its agenda items is to meet with DNREC and discuss water reuse. At the September 18, 2009 Board of Commissioners Regular Meeting, Mr. Rip Copithorn of Stearns & Wheler could provide a presentation on the amendment of the March 9, 2009 report. Commissioner Mills would like to look forward and alert the public that this subject is coming to a conclusion soon. He would also like to elicit responses from the public, and possibly set a public hearing date or dates as early as October or November 2009.

Mayor Cooper said that the City should move independently of the Sussex County Council and CWAC. The City should take its own destiny in its hands and decide on this matter. Mr. Rip Copithorn could give a presentation at the same time as the County presentation on September 4, 2009. The City was forced by the TMDL to removed its

discharge from the Canal. If not for nitrogen or phosphorous, the City could continue to pump into the Canal. The City is under a court order at this time because it basically put itself under a court order. The TMDL was issued in 1998, and the City immediately filed an appeal to it in the court and the Environmental Appeals Board. The State moved to keep the City from going to the Environmental Appeals Board, and the court struck that down so the City never did go before the Board. The City then began to negotiate the timeline, etc. In the end, the City along with the County agreed to a consent order in 2002 or 2003. City Solicitor Glenn Mandalas said that it would be a monumental task to get this thing turned around. The City would probably be fighting up to the day of compliance. Mayor Cooper did not think that the bay will be noticeably different; but at least, Rehoboth will not be to blame. Many of the scientists and the people from the State have said that the bays are not flushed very well. If the bays are better flushed, the City may not be in this circumstance. It is not a matter that the wastewater is all that bad, it is just that the wastewater does not get flushed out in a timely fashion. Rehoboth Bay is the best of the three bays with Indian River Bay being the worst because of the more intense farming and chicken operations along it.

Commissioner Kuhns agreed that the Commissioners need to have an opportunity to vote on this, and the only way to do this is by having all the information. He asked if any thought has been given to a referendum to approve the vote of the Commissioners so that the people in the City can weigh in. Commissioner Kuhns referred to the Charter in that the Commissioners may in their sole discretion elect to adopt an ordinance subject to a referendum. In such an event, the Commissioners shall at the same time such ordinance is adopted, pass the resolution subjecting such ordinance to a referendum. Commissioner Mills clarified to go beyond a public hearing where people would voice their opinions, and have a more formalized vote process. Commissioner Kuhns said that after the public hearing when the information is out in the public, the Commissioners can make their decision; and then have the people in the City make their decision.

Commissioner Barbour was troubled with that suggestion because there are two issues: 1. Science. 2. Economics. Ultimately, it is the responsibility of the Commissioners to decide which is best for the City. Commissioner Kuhns said that because this is a controversial subject and the City is a tourist industry city within a tourist industry county, the property owners and residents in the City need to weigh in on this subject. Once all the information is on the table, it will be easy for the community to make a decision as well as easy for the Commissioners to make a decision.

Mayor Cooper said that the City has an obligation to inform the citizens. A synopsis should be given to the people with enough information to make an informed decision. This should go out as part of a mailing with a ballot.

Ms. Joyce Lussier, 99 Henlopen Avenue, said that this will be a tough decision, and she would have to trust the Commissioners in making a decision. She would have a problem with voting in a referendum, and she thought the decision should be left up to the Commissioners.

Mr. Paul Lovett, 510 Rehoboth Avenue, said because this will be costly, that possibly a presentation could be done by those people who originally thought a wastewater alternative should happen. The rationale might need to be redeveloped.

Commissioner Barbour said that the Commissioners need a simple way of explaining this subject to the public. A clean history needs to be developed, and it should be put on the City website. The people should be given a broad outline of this subject. Commissioner Mills would be willing to work with Mayor Cooper in putting together a presentation.

Ms. Cindy Lovett, 510 Rehoboth Avenue, asked if anyone has looked to see if there is a new technology to clean out more nutrients to get the nitrogen and phosphorous to zero. Mayor Cooper said that the effluent has to be at zero. Commissioner Mills said that water can be discharged into any body of water if the nitrogen and phosphorous are at zero, but the technology is non-existent today to do that.

Mayor Cooper will talk with Mr. Rip Copithorn and the County in regard to presentations for the Workshop Meeting on September 4, 2009.

September 4, 2009 Workshop Meeting

Agenda:

"Public discussion concerning alternate wastewater discharge methods, including presentation of the results of the joint study with Sussex County to investigate the feasibility of a joint City/County land application project, input from the City's engineers, Stearns & Wheler, funding, permitting, other areas of interest; planning future discussions and related matters."

Minutes of the September 4, 2009 meeting regarding this agenda item:

Mayor Cooper called for public discussion concerning alternate wastewater discharge methods, including presentation of the results of the joint study with Sussex County to investigate the feasibility of a joint City/County land application project, input from the City's engineers, Stearns & Wheler, funding, permitting, other areas of interest; planning future discussions and related matters.

Mr. Dave Baker, County Administrator, Mr. Dennis Hasson with the County's engineering firm, Mr. Rip Copithorn, the City's engineer with Stearns & Wheler, Mr. Bob Stenger, Rehoboth Beach Wastewater Treatment Plant Superintendent, Mr. Greg Pope of DNREC and Ms. Jule Gibbons, County engineer were in attendance at the meeting.

Mr. Dave Baker noted that Mr. Hasson's presentation was given on August 19, 2009 to the State of Delaware Clean Water Advisory Council and on August 18, 2009 to Sussex County Council. This presentation is a summary of work done to date on the joint study funded by the State of Delaware, City of Rehoboth Beach and Sussex County. This

presentation also reflects what the Clean Water Advisory Council heard and what Sussex County Council heard in August 2009.

Mr. Dennis Hasson said that the purpose of "A Regional Planning Report To Assess The Joint Sussex County And The City of Rehoboth Land Application Project" was to look at the feasibility of the City of Rehoboth participating in a land application project with Sussex County and comparing that to work which was previously done with respect to ocean outfall. The planning period looked at was from the present to 2030. Design flows consisted of West Rehoboth expansion flows which contribute 4.4 million gallons per day (MGD), Inland Bays service area flows contribute 2.9MGD and the Rehoboth Beach flows which include Dewey Beach, Henlopen Acres and North Shores contribute 2.5MGD. In 2030, the treatment and disposal capacity needed is 9.8MGD. The north coastal planning area is defined by the inland bays to the south, Atlantic Ocean to the east, the bay to the north and Route 24 to the west. In this planning area, there are both existing and proposed sanitary sewer districts. The County operates West Rehoboth, the Long Neck area and Oak Orchard which are existing sanitary sewer districts. Currently, construction is soon to start in the Angola planning area. Central to the planning area are three major wastewater treatment facilities: Wolf Neck in the West Rehoboth area which is a lagoon treatment land application plant, City of Rehoboth Beach which is a nutrient removal wastewater plant located within the City limits, and Inland Bays land application plant which is a Sussex County owned and operated facility. Raw wastewater alternatives which were looked at are: 1. City of Rehoboth discontinuing the operation of its wastewater treatment plan and sending raw wastewater to the Wolf Neck facility for treatment and disposal; and what could not be treated there, would be sent to the County's Inland Bays regional wastewater facility. 2. City of Rehoboth discontinuing the operation of its wastewater treatment plan and sending raw wastewater to the Wolf Neck facility; and the excess capacity which could not be treated there, would be sent west to a treatment site owned and operated by a private wastewater provider. Treated effluent options which were looked at are: 1. City of Rehoboth continuing the operation of its wastewater treatment plant and sending treated effluent to the Wolf Neck facility for disposal; and the excess capacity would be sent to the County's Inland Bays regional wastewater facility. 2. City of Rehoboth continuing the operation of its wastewater treatment plant and sending treated effluent to the Wolf Neck facility for disposal; and the excess capacity would be sent west to a treatment site owned and operated by a private wastewater provider. 3. Because of this being a separate treatment and disposal option, the City and the County would go their separate ways. The City of Rehoboth, instead of participating in the joint land application project, would send its flow to the ocean outfall, and then the County would send what it cannot treat at Wolf Neck south to the Inland Bays facility. Mr. Hasson presented capital costs for the various alternatives. In summary, projects involving land application are more beneficial to Sussex County, and the project involving ocean outfall is more beneficial to the City of Rehoboth. The most expensive alternative regarding user rate impacts would be treatment provided by the private service provider followed by joint land application. The least expensive alternative would be the County continuing to pump to the Inland Bays facility, and the City's ocean outfall project. The origin of the figures for the private provider scenario came from the County meeting with private providers who gave a preliminary agreement based

on bulk rate for wastewater treatment. The bulk rate was used to calculate the cost from the private provider.

Commissioner Mills said that a Request For Proposal (RFP) was not done, and private providers did not give prices specific to this. The private provider gave the County a price approximately one year ago, and it used their old figures. The County needs to expand regardless of what the City does. Alternative 4 was not a part of the study. It referred back to something which was presented approximately one year ago.

Mr. Baker noted that in June 2008, the County Council voted to go with the spray irrigation option for the County's expansion. At the last County Council meeting on August 25, 2009, Mr. Mike Izzo was asked to give a summary of all of the different projects which the County engineering department was working on. The consensus at this meeting was not to change the County's position to go with the spray irrigation option. No matter what the City of Rehoboth Beach decides, the County is involved to a certain extent because Dewey Beach and Henlopen Acres are served by the City. In terms of growth in the West Rehoboth area, the County Council's position at this time is to agree with the position of June 2008.

Commissioner Mills reviewed the timeline. On August 18, 2009, a presentation was made to County Council. At that time, the Council indicated that this topic would be placed on the agenda for the September 15, 2009 meeting. Prior to September 15, 2009, the Council discussed its position. Mr. Baker spoke with the President of the County Council; and at this point in time, this topic is not planned to be on the agenda for the September 15, 2009 meeting. Commissioner Mills suggested that the Commissioners look at the City's timeline without the County's input, and discuss a timeline in moving forward at the next Board of Commissioners' meeting.

Mayor Cooper thought that the City needs to make decisions and provide feedback to others. A letter, dated February 17, 2009, from Mr. Baker to Mayor Cooper had been distributed to the Commissioners prior to the meeting regarding the idea of a RFP for a private land application option requesting the City to share 50% of the cost of it. The City has not acted on this request. It would be helpful to Mr. Baker if the Commissioners would give an answer to him so he could decide to go forward with the RFP even if the City elects not to. Mayor Cooper's position was that the City went out to RFP with considerable costs and received one response, but it was not an offer; and there was no point in giving the information which was contained in the contract that the one provider offered to the County. Commissioner Mills' response was that the City does not want to participate in the County's process, but reasons should be given that the City was not satisfied with the process.

Commissioner Kuhns asked if Alternate 4 is out of the picture. Mr. Baker said that in regard to Alternate 4, the Council's primary concern is cost. From the County's standpoint, there is an additional cost of approximately $11,000,000.00 for the County. At the August 25, 2009 meeting, there was concern of what the least costly alternative is for the residents. Mr. Baker added that a change where Dewey Beach, Henlopen Acres and North Shores

would not contract to the City for wastewater treatment would not be an impossibility for Dewey Beach, but it would be costly for the County to transfer wastewater to the Wolf Neck or the Inland Bays treatment plants. A change for Henlopen Acres would not be feasible. Mayor Cooper said that if the City participates in something the County is going to do, it will lower the County's costs. If the County was to participate in something the City is going to do, it will lower the City's costs. Commissioner Kuhns said that in regard to Alternate 3, the County would share in 40% of the $35,000,000.00 of the cost which would be approximately $22,000,000.00 for the City of Rehoboth Beach. Mr. Baker said that Dewey Beach and Henlopen Acres would pay their share. Mayor Cooper noted that the capital costs of $35,000,000.00 are expressed as the Rehoboth Beach Wastewater Treatment Plant. The annual costs are expressed for the residents of the City which does not include Dewey Beach and Henlopen Acres.

Mr. Hanson said that the intent for the draft report, "A Regional Planning Report To Assess The Joint Sussex County And The City of Rehoboth Land Application Project" is that it will be finalized. Mayor Cooper said that he would like for the Commissioners to have a final document before a decision is made.

Mr. Rip Copithorn of Stearns & Wheler, commented that the City worked closely with the County in reconciling the numbers in the report. There is confidence in the numbers regarding land application. In terms of the timeline, 2014 is the deadline; but there is no need to panic.

Mr. Greg Pope reiterated the timeline. In January 2010, projects will be solicited for the fiscal year 2011 budget. Projects are ranked on environmental benefit and readiness to proceed. This project has been the highest ranking project as far as environmental benefit for the last five years, but it has not been ready to proceed.

Mayor Cooper said that it is important to get the final report in order to move forward in making a decision. Commissioner Mills said that at the next meeting, he would have a better idea of when the report will be finalized. The next step after that would be the Commissioners' discussion and a public hearing.

Commissioner Coluzzi said that the Commissioners need to have everything together before January 2010 so the application can be made for funding.

September 18, 2009 Regular Meeting

Agenda:

"Public discussion concerning the process and timeline for deciding which of the two identified disposal alternatives – a joint Sussex County/City of Rehoboth land application project and an ocean outfall – the City will pursue for disposal of its treated wastewater, including funding, permitting, other areas of interest, planning future discussions and related matters."

Minutes of the September 18, 2009 meeting regarding this agenda item:

Mayor Cooper called for public discussion concerning the process and timeline for deciding which of the two identified disposal alternatives – a joint Sussex County/City of Rehoboth land application project and an ocean outfall – the City will pursue for disposal of its treated wastewater, including funding, permitting, other areas of interest, planning future discussions and related matters.

Mr. John Schneider, Division of Watershed Assessment with DNREC, was in attendance at the meeting.

Mayor Cooper said that Sussex County and its engineer need to polish up its report, "A Regional Planning Report To Assess The Joint Sussex County And The City of Rehoboth Land Application Project" which was presented at the September 4, 2009 Mayor and Commissioners Workshop Meeting, and forward it to the Commissioners. Tonight, he hoped to have a plan to arrive at a decision and a process before the end of 2009.

Commissioner Mills would like to wait for the County to release supporting data upon which it based its joint report. He talked with Mr. Dave Baker today who had indicated that it may take three weeks to get that done. Once the supporting data is improved, the County wants to present it to County Council. Commissioner Mills, Mayor Cooper and Mr. Ferrese were in attendance at a board meeting at the Inland Bays facility today where Mr. Mike Izzo gave the same presentation which had been presented to the Commissioners. Commissioner Mills would like to have the supporting data available to the public. At the September 9, 2009 Workshop Meeting, Mr. Greg Pope of the Financial Assistance Branch of DNREC, had reminded the Commissioners of the process for funding through the Clean Water Advisory Council (CWAC). Commissioner Mills followed up with Mr. Pope in a telephone conversation and conveyed the process in more detail: 1. File for a Notice of Intent. The deadline is January 31, 2010. The Notice of Intent needs to define which route will be taken – ocean outfall or spray irrigation. 2. CWAC uses current ranking criteria, and it ranks the projects deemed as eligible. In past years, the City has always received top priority. 3. Municipality will be notified in March or April 2010 that it is eligible, and application would be submitted in May 2010. The ranking criteria could possibly be changed which may jeopardize the City's top ranking. Commissioner Mills mentioned that the College of Marine Ocean & Environment held a seminar in June 2009 intended for government officials and the public. Ms. Mable Granke, 1013 Scarborough Avenue Extended, and Commissioner Mills attended that seminar. He recently met with someone in the Dean's Office who indicated that its next workshop is intended to evaluate environmental impacts of wastewater treatment options and offshore energy. The College would like to offer its services to set up a panel for educational outreach and to focus on science based information. The seminar could be set up in November or December 2009 if anyone is interested in attending. Commissioner Mills thought that the City needs to be independent of the County with the wastewater alternative. He would prefer that a public hearing should be held in December 2009, but the Commissioners should wait to have the actual vote until January 2010.

Mayor Cooper preferred that the public hearing should be held in November 2009 with a presentation of approximately 15-20 minutes of the history of the process and issues to date, and then allow the public to speak.

Commissioner Barbour said it is important that the Commissioners try to clarify the issues for the public.

Commissioner Bill Sargent thought that more discussion is needed of what some of the environmental issues are for ocean outfall and land application. The Commissioners could make the decision for the specific alternative method in the next month. A document could be created that lays out the Commissioners' rationale of the decision. This document would be presented to the public. It is the responsibility of the Commissioners to filter the data and make a clear statement to the public of why the Commissioners believe that a specific direction is right for Rehoboth, and defend that decision. Commissioner Barbour agreed.

Commissioner McGuiness preferred to have key people from the College of Marine Studies, etc. to make presentations, and then let the people speak. She recommended to schedule a structured public hearing and allow for two hours of input. Easels could also be provided with basic information.

Commissioner Coluzzi did not think that the public would want the Commissioners to make a decision without its input. It is important to have a very structured public hearing releasing some information for people to look at and ask questions.

Commissioner Barbour requested that Mayor Cooper take the structuring of the public hearing under advisement and make a recommendation as to how it will be handled. Mayor Cooper did not think that any of the Commissioners should be presenters at the public hearing. The engineers need to be a part of the public hearing and should be present.

Mr. John Schneider said that as a result of some meetings which occurred this week, a strong preference for the spray irrigation method is emerging in the department at DNREC and CWAC. The direction the CWAC wants to go in is to reuse all wastewater in the State. Mayor Cooper and the Commissioners would be willing to look at the scientific data that land application is better than ocean outfall.

Ms. Mable Granke, 1003 Scarborough Avenue Extended voiced concern that there is a great deal of propaganda about spray irrigation in terms of how beneficial it is for the farmers. The reason this point source was declared that it had to come out of the Canal was because of the inland bays. Science needs to go to the proof of how spray irrigation or ocean outfall benefits the inland bays. Mayor Cooper noted there are environmental issues, and the sites that would be used would need to be looked at along with the existing permits, etc.

October 2, 2009 Workshop Meeting

Agenda:

"Public discussion concerning alternate wastewater discharge methods, including the public hearing scheduled for November 7, 2009, funding, permitting, other areas of interest, planning future discussions, and related matters."

Minutes of the October 2, 2009 workshop regarding this agenda item:

Not yet approved/available.

October 16, 2009 Regular Meeting

Agenda:

"Public discussion concerning alternate wastewater discharge methods, including the Public Hearing scheduled for November 7, 2009, funding, permitting, other areas of interest, planning future discussions, and related matters. "

Minutes of the October 16, 2009 meeting regarding this agenda item:

Not yet approved/available.

Agendas and minutes compiled by Commissioner Stan Mills
Last updated, October 29, 2009

Also see city web site www.cityofrehoboth.com for handouts and presentations distributed during these meetings.

Rehoboth Beach Wastewater Treatment Plant

Alternative Discharge Evaluation

November 7, 2009

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Agenda

History

Review Previous Studies

Effluent Disposal Study	August 2005
Alternative Discharge Cost Evaluation	March 2009
County Study	October 2009

Ocean Outfall

Land Application

Summary of Costs

Schedule

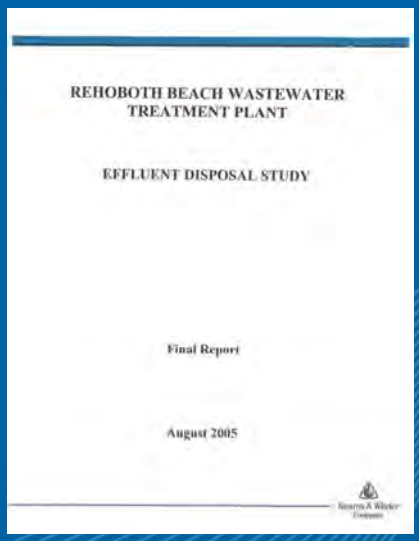
History

TMDL - zero discharge	Aug	1998
Negotiations with DNREC and EPA		
Effluent Disposal Study		
JPPM Presentation	Jan	2002
Kick-Off Meeting	Dec	2002
Workshops and Presentations		
Final Report	Aug	2005
Update Ocean Outfall Costs	Mar	2009
Various Meetings and Presentations		
Further Investigate Land Application Opportunities	Oct	2009

2005 Effluent Disposal Study

Evaluated:

- Land Application
- Rapid Infiltration Beds
- Deep Well Injection
- Shallow Well Injection
- Ocean Outfall


REHOBOTH BEACH WASTEWATER TREATMENT PLANT

EFFLUENT DISPOSAL STUDY

Final Report

August 2005

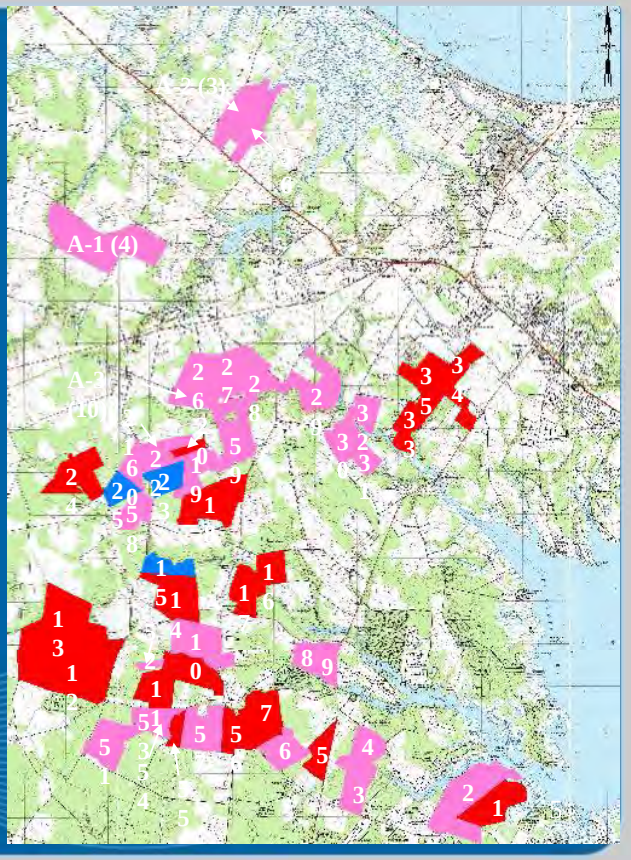
Search for Land

- Not interested (17)
- No response (43)
- Interested (3)

Professional agency hired

Took 2 years

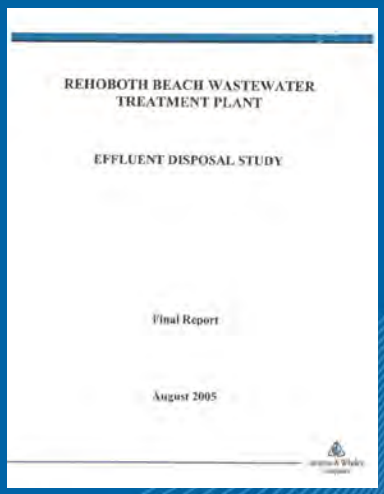
Several rounds of mailings and phone contacts



2005 Effluent Disposal Study

Eliminated:

- Spray Irrigation
  - Land not available
- Rapid Infiltration Beds
  - Land not available
  - Nutrient discharge to Inland Bays
- Shallow Well Injection
  - No appropriate sites or aquifers
  - Nutrient discharge to Inland Bays
- Deep Well Injection
  - Excessive risk and cost


REHOBOTH BEACH WASTEWATER TREATMENT PLANT

EFFLUENT DISPOSAL STUDY

Final Report

August 2005

Recommended Alternative:

- Ocean Outfall
  - Lowest PW Value
  - Regional solution

2009 Alternative Discharge Cost Evaluation

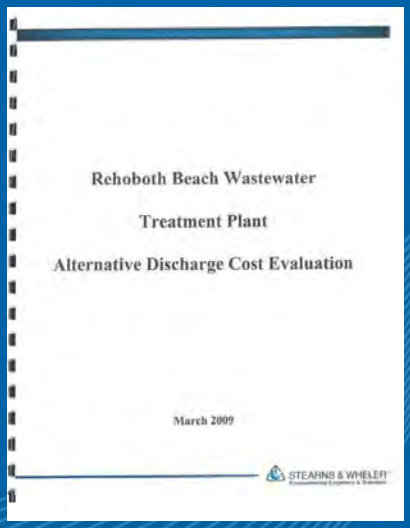
Purpose - Refine Cost Estimates:

Ocean Outfall

- Obtain cost estimates from outfall contractors
  - Weeks Marine
  - Worley Parsons

Land Application

- Solicit proposals from Private Utilities
  - Artesian


Rehoboth Beach Wastewater

Treatment Plant

Alternative Discharge Cost Evaluation

March 2009

STEARNS & WHELER

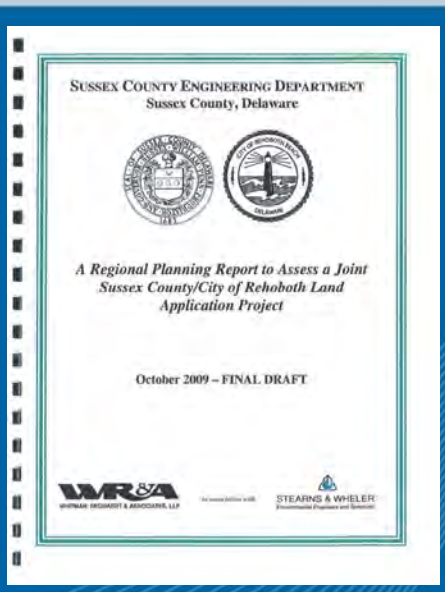
2009 County / City Report

Purpose:

Consider joining with Sussex County for a Regional Land Application project

Refined Costs for:

- Land Application of Treated Effluent
- Ocean Outfall


SUSSEX COUNTY ENGINEERING DEPARTMENT
Sussex County, Delaware

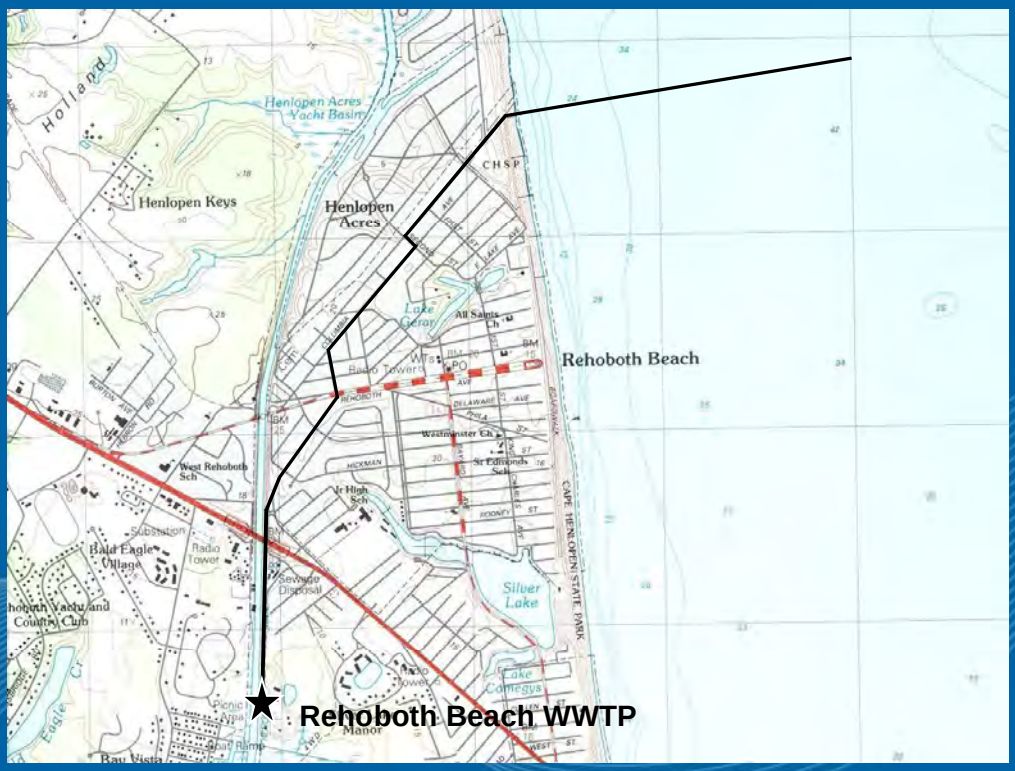
A Regional Planning Report to Assess a Joint Sussex County/City of Rehoboth Land Application Project

October 2009 – FINAL DRAFT

WR&A

STEARNS & WHELER

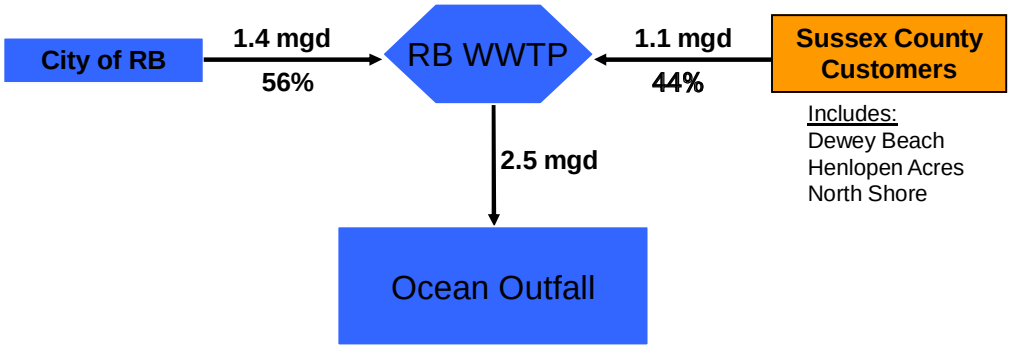
Ocean Outfall



Ocean Outfall

City of Rehoboth Beach Only

Flow Schematic



Note: All flow rates refer to year 2030 Max Month treatment and disposal requirements

Ocean Outfall
City of Rehoboth Beach Only

Capital Costs

Pump Station	990,000
WWTP Upgrades	3,370,000
FM to Outfall	2,820,000
Ocean Outfall	17,020,000
Subtotal	24,200,000
Eng & Admin	5,320,000
Permitting (outfall)	850,000
Total Project Cost	30,370,000

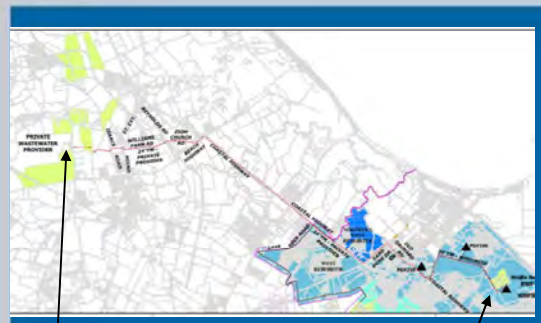
O&M Costs

Rehoboth Beach	
Existing	1,040,000
Additional	90,000
Total	1,130,000

Estimated User Charges

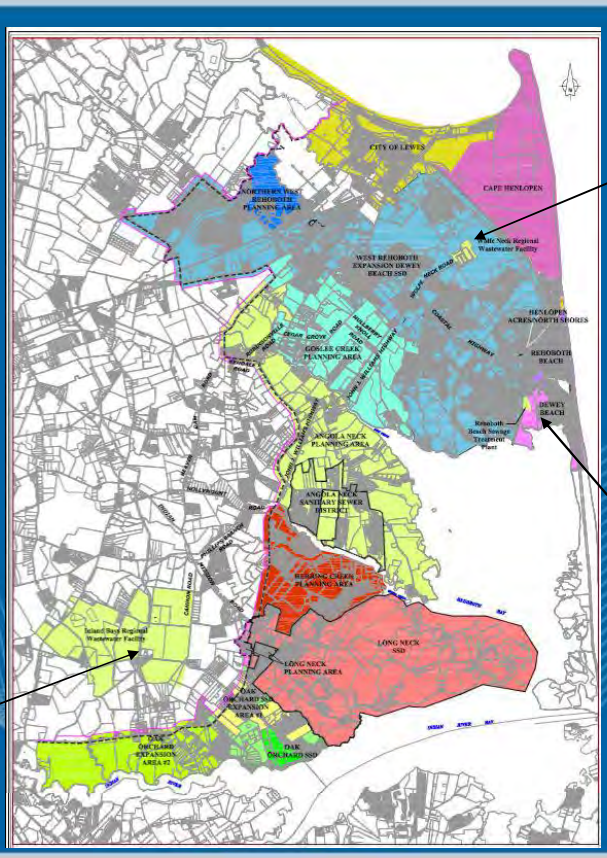
Annual Capital Cost	$ 1,300,000
O&M Cost	1,130,000
Total	$ 2,430,000
User Charge	$ 640 / year

Land Application
Treated Effluent



Private Wastewater Provider

Wolfe Neck RWF

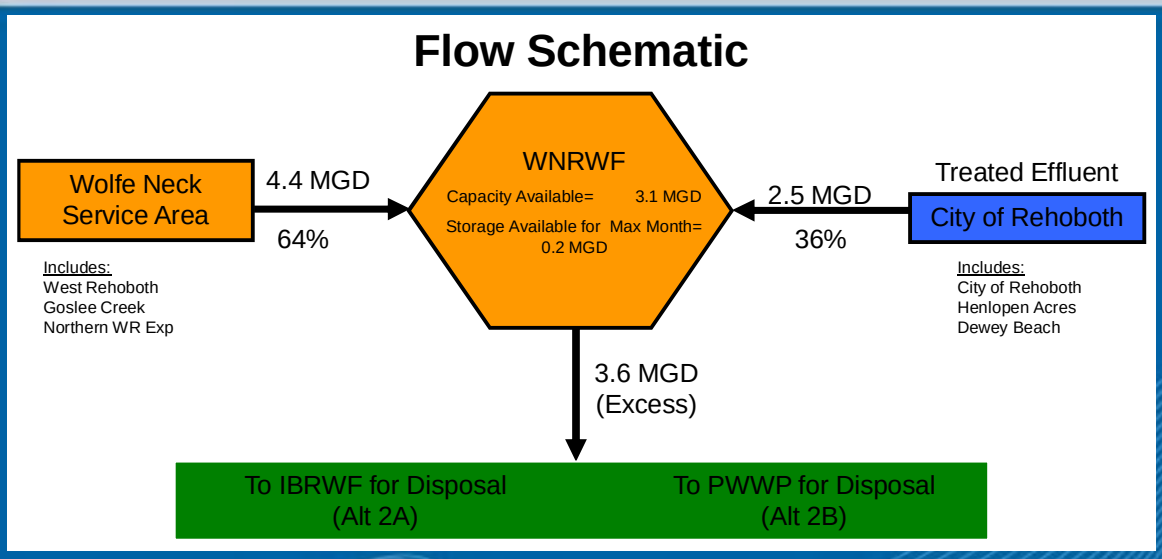


Wolfe Neck RWF

Rehoboth Beach WWTP

Inland Bays RWF

Land Application
Treated Effluent



The Rehoboth Beach WWTP would continue to operate and send treated wastewater to Wolfe Neck RWF for disposal

Excess wastewater will be sent to Inland Bays RWF (or a private provider)

A new treated effluent pump station & force main would be constructed by the City

A force main to Inland Bays RWF or the private provider will be shared by the City & the County

Land Application
Treated Effluent

Capital Cost	
RB Pump Sta.	990,000
FM to WNRWF	3,850,000
WWTP Upgrades	3,370,000
WNRWF Pump Sta.	1,040,000
FM to IBRWF	5,970,000
IBRWF Upgrades	20,010,000
Land / Easements	11,250,000
Subtotal	46,480,000
Eng & Admin	7,750,000
Total Project Cost	54,230,000

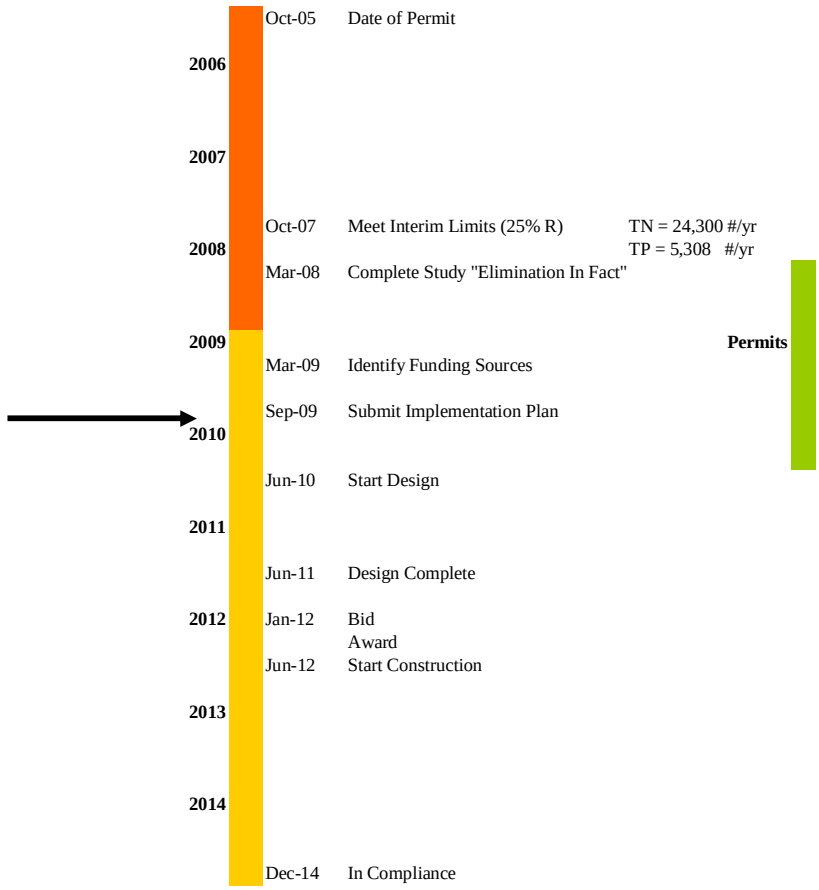
O & M Cost	
Rehoboth Beach	
Existing	1,040,000
Additional	20,000
Sussex County	510,000
Total	1,570,000

Estimated User Charges	
Annual Capital Cost	$ 2,330,000
O&M Cost	1,570,000
Total	$ 3,900,000
User Charge	$ 1,010 / year

Alternative Summary

Alternative	Estimated User Charges
Land Application	($/Yr)
Raw Wastewater	
County	1,160
Private	1,430
Treated Effluent	
County	1,010
Private	1,420
Ocean Outfall	
Rehoboth Beach only	640
Regional (City + County)	550 (2030 Flow)
Regional (City + County)	500 (Buildout Flow)

Schedule



NOTICE OF PUBLIC HEARING

Notice is hereby given by the City of Rehoboth Beach that on Friday, September 18, 2009, during a regular meeting of the Commissioners of the City of Rehoboth Beach, Delaware, the Commissioners of the City of Rehoboth Beach set a public hearing on the subject of:

ALTERNATE WASTEWATER DISCHARGE METHODS

PUBLIC HEARING

Date:	November 7, 2009
Time:	10:00 a.m.
Location:	Rehoboth Beach Volunteer Fire Company 219 Rehoboth Avenue Rehoboth Beach, DE, 19971

SYNOPSIS: A public hearing will be conducted on November 7, 2009 for the Mayor and Commissioners of the City of Rehoboth Beach to hear public comment on the alternate wastewater discharge methods under consideration for use by the City of Rehoboth Beach. Those methods include, but are not limited to, ocean outfall and land application. The Commissioners of the City of Rehoboth Beach will also entertain public comment on the various alternatives available through a partnership with Sussex County.

For more information on the alternate wastewater discharge methods, please visit www.cityofrehoboth.com.

Each member of the public who wishes to speak will have an opportunity to be heard. Written comments received prior to the public hearing on November 7, 2009, will be accepted c/o the Building and Licensing Department, City of Rehoboth Beach, 306 Rehoboth Avenue, Rehoboth Beach, DE 19971.

STEARNS & WHELER
CLIENTS | PEOPLE | PERFORMANCE

Memorandum

Date: March 24, 2010

To: Attendees

From: Rip Copithorn

Re: Rehoboth Beach Ocean Outfall Project
DNREC Permit Meeting (March 23, 2010)

Attendees:

Sam Cooper	SC	Mayor, City of Rehoboth Beach
Greg Ferrese	GF	City Manager, City of Rehoboth Beach
Bill Sargent	BS	Commissioner, City of Rehoboth Beach
Stan Mills	SM	Commissioner, City of Rehoboth Beach
Bob Stenger	BS	City of Rehoboth Beach
Kathy Bunting-Howarth	KH	DNREC / Water Resources
Tricia Arndt	TA	DNREC / Delaware Coastal Programs
Laura Herr	LH	DNREC / Wetlands
Jennifer Walls	JW	DNREC/OTC
Tony Hummel	TH	DNREC / Surface Water Discharge Section
Jeff Tinsman	JT	DNREC / Fish & Wildlife
Maria Sadler	MS	DNREC / Soil & Water Conservation
Tony Pratt	TP	DNREC / Soil & Water Conservation
Robert Underwood	RU	DNREC / Surface Water Discharge Section
Terry Deputy	TD	DNREC / Financial Assistance Branch
Greg Pope	GP	DNREC / Financial Assistance Branch
Mike Izzo	MI	Sussex County / Engineering
Rip Copithorn	RC	GHD / Stearns & Wheler
Maureen Wingfield	MW	GHD / Stearns & Wheler

The purpose of the meeting was to discuss permit and schedule issues regarding the Rehoboth Beach Ocean Outfall Project. A proposed schedule was distributed (attached). The key dates are summarized as follows:

Task	Date
Obtain background data from Contact Univ. of Delaware, DNREC USCOE	June 1, 2010
Outline of EIA for Draft Report	mid June 2010
Alternative Analysis (Draft)	October 2010

The following permit issues were discussed:

USCOE Section 404 Permit
The major effort associated with this permit is the Environmental Impact Assessment (EIA) that must address all of the anticipated environmental (biological, physical, water quality, air etc.) impacts and discuss methods to mitigate or avoid the impacts. The EIA will form the basis for a number of other required permits even if the formats vary.

NPDES Permit
The current permit expires September 30, 2010 and application for renewal should be made 180 days prior to that date. KH commented that the department has the expectation that the permit will be more restrictive than South Coastal. South Coastal WWTP does not have a nutrient limit of cap.
Note: After further discussions with DNREC / Surface Water Discharge (Tony Hummel) it was agreed that the City should submit a letter requesting time extension (by March 30, 2010) for the existing permit and fill out an application for the new permit after that. TH indicated that the new permit will probably lower BOD limit to 15/23 which is the technology limit for filtered secondary effluent. There will interim and final limits to address the new discharge location. There is no regulatory basis for imposing a nutrient limit but the notes in permit may require the plant to be continued to operate as a nutrient removal plant (without concentration limits or a waste load allocation).

Beach Preservation
The regulations are on a three year cycle. New regs due 2012.

Subaqueous and Wetlands Permits
They are separate permits but are submitted and reviewed based on one application (joint form). The Alternative Analysis will be required and the physical layout of the pipelines must be defined. The EIA developed for the USCOE permit will also be referred to or submitted as part of this application.

Construction Permit
After the draft EIA is submitted a construction permit will be required for each construction project (filter upgrade, pump station, force mail).

Erosion & Sediment Control
Sussex County will require a permit from the conservation district. However, since this is for a municipal project, it can obtain a utility waiver.

Dewatering Permits will be required for dewatering during pipeline construction.

ERES Waters
The project will have to comply with the ERES standards found in the Water Quality Standards.

Public Notice
It is anticipated that there will be one public hearing for all of the permits requiring a public notice.

Financial Assistance Branch
The DNREC Financial Assistance Branch (FAB) has their own requirements for an EIA. Expect that the EIA would fulfill all of the standards for an EIA that are addressed by the other agencies.

The FAB proposed to finance half the project through their agency SRF money) and the other half through USDA – Rural Development. USDA has a 40 year bonding requirement; DNREC has 20 years. The City would have to finance all planning and design costs until the loan is closed at the end of the project. They can not commit to funding until the environmental review has been completed (requires EIA to be done) but they do intend to fund it.

The public comment period closes April 10 – they indicated that the City should get an application in by then.

EPA / SRF requirements may change. For example current Davis Bacon wage rates apply. In the future, there may be a requirement to study sustainable infrastructure. The draft guidance should be reviewed.

There would be no grant money based on Rehoboth Beach MHI. Perhaps Sussex County would qualify and they contribute 38% of capital costs (MHI probably still too high).

If USDA is contributing to the funding then they may want to be the lead agency (rather than the USCOE). This should be clarified in a meeting with USDA.

Fish & Wildlife
Possible issues include androgynous fish, juvenile flounder, shad spawning, clams – doubtful but could require “windows” for construction.

National Marine Fisheries
Also have potential requirements for windows

Coordination
JW mentioned that she could be the single point of contact for everything in DNREC except Fish & Wildlife (Edna Stetzar) or CZM (Tricia Arndt).

Attachments:

Proposed permitting Schedule

STEARNS & WHELER
CLIENTS | PEOPLE | PERFORMANCE

MEETING MINUTES

Rehoboth Beach Ocean Outfall Project
DNREC Review Meeting
June 11, 2010 9:30 AM

Attendees:
Sam Cooper (SC) / Mayor, City of Rehoboth Beach
Bill Sargent / Commissioner, City of Rehoboth Beach
Stan Mills (SM) / Commissioner, City of Rehoboth Beach
Bob Stenger (RS) / City of Rehoboth Beach
Michael Izzo (MI) / Sussex County
Juel Gibbons (JG) / Sussex County
Renee Searfoss (RS) / US EPA
Denise MacLeish (DM) / USDA Rural Development
Lisa Fitzgerald (LF) / USDA Rural Development
Kathy Bunting-Howarth (KH) / DNREC, Water Resources
John Schneider (JS) / DNREC, Water Resources
LeeAnn Walling (LW) / DNREC, Chief of Planning
Greg Pope (GP) / DNREC, Financial Assistance Branch
Tricia Arndt (TA) / DNREC, Delaware Coastal Programs
Bart Wilson (BW) / DNREC, Delaware Coastal Programs
Sarah Cooksey (SC) / DNREC, Coastal Management
Jennifer Wheatley (JW) / DNREC, Soil and Water Conservation
Tony Hummel (TH) / DNREC, Surface Water Discharge Section
Robert Underwood (RU) / DNREC, Surface Water Discharge Section
Jeff Tinsman (JT) / DNREC, Fish & Wildlife
Edna Stetzar (ES) / DNREC, Fish & Wildlife
Laura Herr (LH) / DNREC, Wetlands
Juan (Jay) Crofton (JC) / Crofton Diving
Rip Copithorn (RC) / GHD Stearns & Wheler
Robert Geist (RG) / GHD Stearns & Wheler
Maureen Wingfield (MW) / GHD Stearns & Wheler

Copies to:
File

The DNREC Review Meeting was held at 9:30 AM on June 11, 2010 at 229 Rehobeth Avenue, Rehobeth Beach to discuss the permit and scheduling regarding the Rehoboth Beach Ocean Outfall Project. The following items were discussed:

Progress Update

- University of Delaware has compiled background information and associated reports for the project. See bibliography. GHD has copies of all information on CD.
- University of Delaware field work expected to start mid July. Two acoustic doppler current profilers will be used to collect data.
- Draft Alternative Analysis was sent to DNREC on 6/7/10. See copy handout.
- Draft Chapters 1 – 3 and a Table of Contents for the Environmental Impact Statement (EIS) are available. See copy handout.

Lead Agency and the EIS

- RC requested information concerning who would be the lead agency with respect to the NEPA process. It was reported that USDA would be the lead federal agency (not the US Army Corps of Engineers) along with DNREC as a co-lead.
- DM mentioned that the USDA will have to establish a cooperative agency agreement between the USDA, City and DNREC. The USDA has an example draft agreement.
- DM mentioned that the firm/agency completing the EIS must be an "independent" source and cannot be the design engineer. This is based upon her conversations with the USDA national organization.
    - The "independent" source must also hold the scoping meetings so that there is an unbiased opinion.
    - The EIS must go through the RFP process and be advertised so it is competitively awarded.
- RC mentioned that going through the RFP process could impact the schedule and may jeopardize the consent order deadline.
- A conference call with the USDA national organization will be held on Monday, June 14, 2010 to obtain additional clarification concerning the lead agency and NEPA requirements.

Project Schedule and Permitting

- GHD presented the project schedule. See copy handout.
- There is a one year review period for the Water Quality Permit Determine, which lies on the critical path. Representatives from DNREC mentioned that permits could fall in parallel to the Water Quality Permit Determination but stated that the one year review period is realistic and the process may actually take that long.
- Any DNREC permit notice could require a public hearing such as NPDES, construction, subaqueous, coastal zone management, and coastal construction permit processes. DNREC prefers to align these permit processes into joint hearings as much as possible. It is expected that at least two hearings will be required: one for NPDES and one for other permits.
- There is a potential for an additional hearing if proposed disturbance locations are in "protective" areas.
- NPDES authorization
    - GHD is currently preparing NPDES permit renewal application.
    - Notice is not provided until draft permit is prepared.
    - A separate hearing may be required for NPDES.

Alternative Analysis

- Draft Alternative Analysis includes four options determined from the 2005 and 2009 reports.
- Ocean outfall is the preferred and only feasible alterative.
- RC asked if the EIS needed to include more than two options: ocean outfall and no action. A representative from DNREC said that the lead agency needs to decide.

- For USDA to fund the project, the process needs to follow USDA NEPA EIS regulations, which includes a notice of intent and scoping meetings, notice of draft EIS, notice of final EIS, and record decision.
- EPA can not concur on the NPDES permit until the EIS is submitted.
- KH mentioned that DNREC will be coming out with new water quality standards and will know more about the status in July, but now efforts should follow the current standards.

Location of Diffusers

- Two maps were handed out on the proposed outfall diffuser location with respect to the Hen and Chicken Shoal (HCS) area, which is located 6,000 LF off the shoreline at approximately 38°43'45"N 75°3'31"W.
- RS also provided a map of the outfall location showing another depiction of the HCS area. She mentioned that the HCS area extends further than the limits shown on the maps and is based upon the bathemetric features.
- The diffuser location was based upon previous work performed which identified this location as the preferred location based on modeling results.
- There is a concern about the HCS area with relation to the proximity of the diffuser location. However, projected impacts will be unknown until modeling is performed.
- The EPA would like to have multiple sampling locations (more than two). RC suggested that the project move forward with 2 sets of data; develop model now (summer) and repeat in the winter, recalibrating if necessary.
- DNREC and EPA would like to review the sampling work plan.
- DNREC suggested that the Wong publications be reviewed in relation to the currents when selecting the optimal locations.
- The EIS could address the alterative locations.
- Pollutants are of concern with the modeling. RC suggested taking the conservative approach and assume no degradation with all mixing. DNREC concurred with this approach. JS mentioned to also review water quality standards from 2003 letter sent to RC.

Outfall Construction Techniques

- Crofton Diving attended meeting. JC visited the proposed site. RC mentioned that directional drilling would be preferred at least through the surf zone and hopefully will be feasible all the way to the diffusers. A representative from DNREC mentioned that directional drilling would be preferred so as to not impact the fisheries and ocean bottom.

End of Meeting Comments

- DNREC endangered species representative mentioned to address sea turtles in the EIS write-up.
- DNREC fisheries representative mentioned that he preferred directional drilling as it would reduce concerns within the benthic communities. The main concern with of directional drilling is frac-out.
- RS mentioned that her concerns were the location of the outfall and water quality coordination with the monitoring. She would like to have sediment benthic sampling during both pre and post construction. She and DNREC would like to review the modeling and sampling approach write-ups. Allow two weeks to review.

- Review the Delaware Geological Survey website and shoreline waterways for borrow sites.

Action Items:

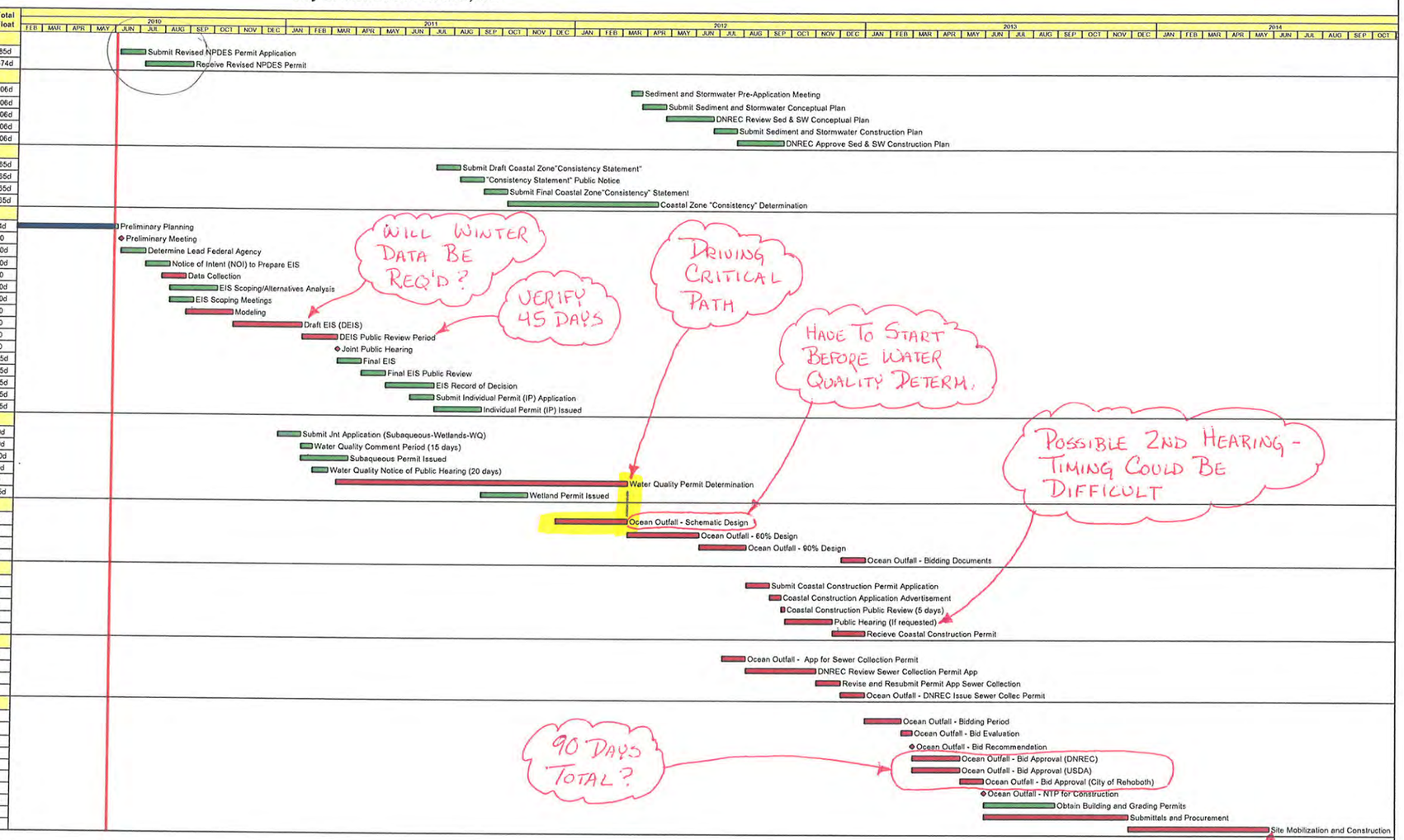
- DNREC/USDA Teleconference on June 14, 2010 at 9:00am to determine lead agency and clarify NEPA requirements.
- GHD to submit modeling and sampling plan for EPA/DNREC review. All comments to be provided back to GHD within two weeks.

Attachments:

- Overall Schedule
- EIS Timeline (USDA)
- Bibliographies of University of Delaware Data Collection
- Two qty. NOAA Maps of Proposed Outfall (GHD)
- One qty. NOAA Map of Proposed Outfall (EPA)

City of Rehoboth Beach, DE

Activity ID	Activity Description	Original Duration	Percent Complete	Remaining Duration	Early Start	Early Finish	Late Start	Late Finish	Total Float
NPDES									
NPDES-1000	Submit Revised NPDES Permit Application	30	0	30	06/08/10	07/07/10	09/01/10	09/30/10	85d
NPDES-1010	Receive Revised NPDES Permit	60	0	60	07/08/10	09/05/10	05/12/12	07/10/12	674d
Sediment & Stormwater Management									
E&S-1000	Sediment and Stormwater Pre-Application Meeting	14	0	14	03/13/12	03/26/12	06/27/12	07/10/12	106d
E&S-1010	Submit Sediment and Stormwater Conceptual Plan	30	0	30	03/27/12	04/25/12	07/11/12	08/09/12	106d
E&S-1020	DNREC Review Sed & SW Conceptual Plan	60	0	60	04/26/12	06/24/12	08/10/12	10/08/12	106d
E&S-1030	Submit Sediment and Stormwater Construction Plan	30	0	30	06/25/12	07/24/12	10/09/12	11/07/12	106d
E&S-1040	DNREC Approve Sed & SW Construction Plan	60	0	60	07/25/12	09/22/12	11/08/12	01/06/13	106d
Coastal Zone Management									
CZ-1000	Submit Draft Coastal Zone"Consistency Statement"	30	0	30	07/12/11	08/10/11	04/02/12	05/01/12	265d
CZ-1010	"Consistency Statement" Public Notice	30	0	30	08/11/11	09/09/11	05/02/12	05/31/12	265d
CZ-1020	Submit Final Coastal Zone"Consistency" Statement	30	0	30	09/10/11	10/09/11	06/01/12	06/30/12	265d
CZ-1030	Coastal Zone "Consistency" Determination	190	0	190	10/10/11	04/16/12	07/01/12	01/06/13	265d
USACOE Individual Permit									
IP-1000	Preliminary Planning	60	93	4	02/01/10	06/07/10	02/01/10	06/11/10	4d
IP-1010	Preliminary Meeting	0	0	0		06/11/10		06/11/10	0
IP-1020	Determine Lead Federal Agency	30	0	30	06/12/10	07/11/10	07/02/10	07/31/10	20d
IP-1030	Notice of Intent (NOI) to Prepare EIS	30	0	30	07/12/10	08/10/10	08/01/10	08/30/10	20d
IP-1040	Data Collection	30	0	30	08/01/10	08/30/10	08/01/10	08/30/10	0
IP-1050	EIS Scoping/Alternatives Analysis	60	0	60	08/11/10	10/09/10	08/31/10	10/29/10	20d
IP-1060	EIS Scoping Meetings	30	0	30	08/11/10	09/09/10	09/30/10	10/29/10	50d
IP-1070	Modeling	60	0	60	08/31/10	10/29/10	08/31/10	10/29/10	0
IP-1080	Draft EIS (DEIS)	90	0	90	10/30/10	01/27/11	10/30/10	01/27/11	0
IP-1090	DEIS Public Review Period	45	0	45	01/28/11	03/13/11	01/28/11	03/13/11	0
IP-1100	Joint Public Hearing	0	0	0		03/13/11		03/13/11	0
IP-1110	Final EIS	30	0	30	03/14/11	04/12/11	08/16/11	09/14/11	155d
IP-1120	Final EIS Public Review	30	0	30	04/13/11	05/12/11	09/15/11	10/14/11	155d
IP-1130	EIS Record of Decision	60	0	60	05/13/11	07/11/11	10/15/11	12/13/11	155d
IP-1140	Submit Individual Permit (IP) Application	30	0	30	06/12/11	07/11/11	03/03/12	04/01/12	265d
IP-1150	Individual Permit (IP) Issued	60	0	60	07/12/11	09/09/11	04/02/12	05/31/12	265d
Subaqeuous, Wetlands, and Water Quality									
JP-1000	Submit Jnt Application (Subaqueous-Wetlands-WQ)	30	0	30	12/29/10	01/27/11	01/08/11	02/06/11	10d
JP-1010	Water Quality Comment Period (15 days)	15	0	15	01/28/11	02/11/11	02/07/11	02/21/11	10d
JP-1020	Subaqueous Permit Issued	60	0	60	01/28/11	03/28/11	11/06/12	01/06/13	650d
JP-1030	Water Quality Notice of Public Hearing (20 days)	20	0	20	02/12/11	03/03/11	02/22/11	03/13/11	10d
JP-1040	Water Quality Permit Determination	365	0	365	03/14/11	03/12/12	03/14/11	03/12/12	0
JP-1050	Wetland Permit Issued	60	0	60	09/10/11	11/08/11	11/08/12	01/06/13	425d
Design									
DES-1000	Ocean Outfall - Schematic Design	90	0	90	12/14/11	03/12/12	12/14/11	03/12/12	0
DES-1010	Ocean Outfall - 60% Design	90	0	90	03/13/12	06/10/12	03/13/12	06/10/12	0
DES-1020	Ocean Outfall - 90% Design	60	0	60	06/11/12	08/09/12	06/11/12	08/09/12	0
DES-1040	Ocean Outfall - Bidding Documents	30	0	30	12/08/12	01/06/13	12/08/12	01/06/13	0
Coastal Construction									
CC-1000	Submit Coastal Construction Permit Application	30	0	30	08/10/12	09/08/12	08/10/12	09/08/12	0
CC-1010	Coastal Construction Application Advertisement	15	0	15	09/09/12	09/23/12	09/09/12	09/23/12	0
CC-1020	Coastal Construction Public Review (5 days)	5	0	5	09/24/12	09/28/12	09/24/12	09/28/12	0
CC-1030	Public Hearing (If requested)	60	0	60	09/29/12	11/27/12	09/29/12	11/27/12	0
CC-1040	Recieve Coastal Construction Permit	40	0	40	11/28/12	01/06/13	11/28/12	01/06/13	0
Centralized Sewer Collection Permit									
CSCP-1000	Ocean Outfall - App for Sewer Collection Permit	30	0	30	07/11/12	08/09/12	07/11/12	08/09/12	0
CSCP-1010	DNREC Review Sewer Collection Permit App	90	0	90	08/10/12	11/07/12	08/10/12	11/07/12	0
CSCP-1020	Revise and Resubmit Permit App Sewer Collection	30	0	30	11/08/12	12/07/12	11/08/12	12/07/12	0
CSCP-1030	Ocean Outfall - DNREC Issue Sewer Collec Permit	30	0	30	12/08/12	01/06/13	12/08/12	01/06/13	0
Bidding and Construction									
CON-1000	Ocean Outfall - Bidding Period	45	0	45	01/07/13	02/20/13	01/07/13	02/20/13	0
CON-1010	Ocean Outfall - Bid Evaluation	14	0	14	02/21/13	03/06/13	02/21/13	03/06/13	0
CON-1020	Ocean Outfall - Bid Recommendation	0	0	0		03/06/13		03/06/13	0
CON-1030	Ocean Outfall - Bid Approval (DNREC)	60	0	60	03/07/13	05/05/13	03/07/13	05/05/13	0
CON-1040	Ocean Outfall - Bid Approval (USDA)	60	0	60	03/07/13	05/05/13	03/07/13	05/05/13	0
CON-1050	Ocean Outfall - Bid Approval (City of Rehoboth)	30	0	30	05/06/13	06/04/13	05/06/13	06/04/13	0
CON-1060	Ocean Outfall - NTP for Construction	0	0	0		06/04/13		06/04/13	0
CON-1070	Obtain Building and Grading Permits	90	0	90	06/05/13	09/02/13	09/03/13	12/01/13	90d
CON-1090	Submittals and Procurement	180	0	180	06/05/13	12/01/13	06/05/13	12/01/13	0
CON-1100	Site Mobilization and Construction	180	0	180	12/02/13	05/30/14	12/02/13	05/30/14	0



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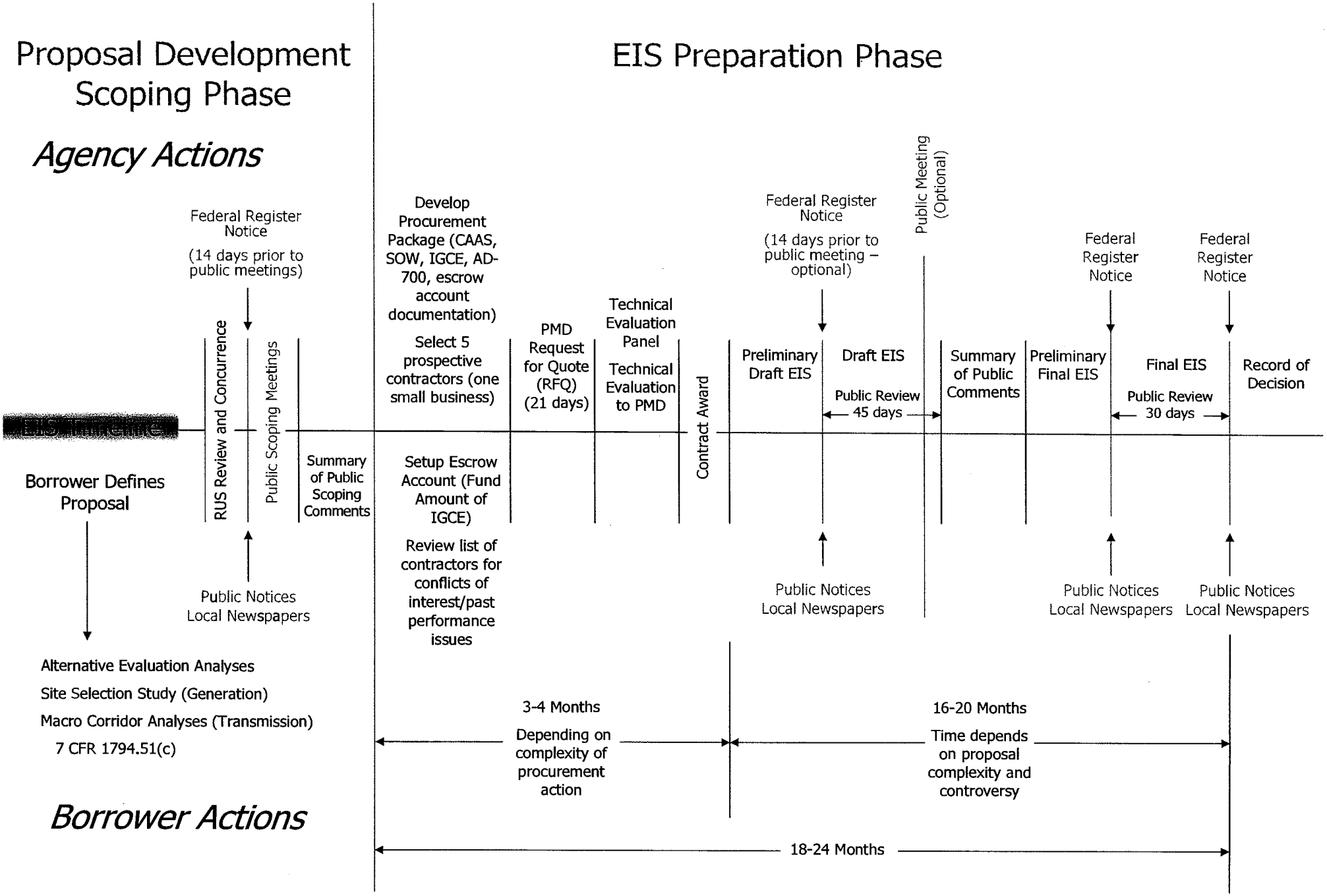
Stearns & Wheler GHD
Rehoboth Beach Ocean Outfall

Early bar
Progress bar
Critical bar
Summary bar
Progress point
Critical point
Summary point
Start milestone point
Finish milestone point

Environmental Impact Statement Timeline



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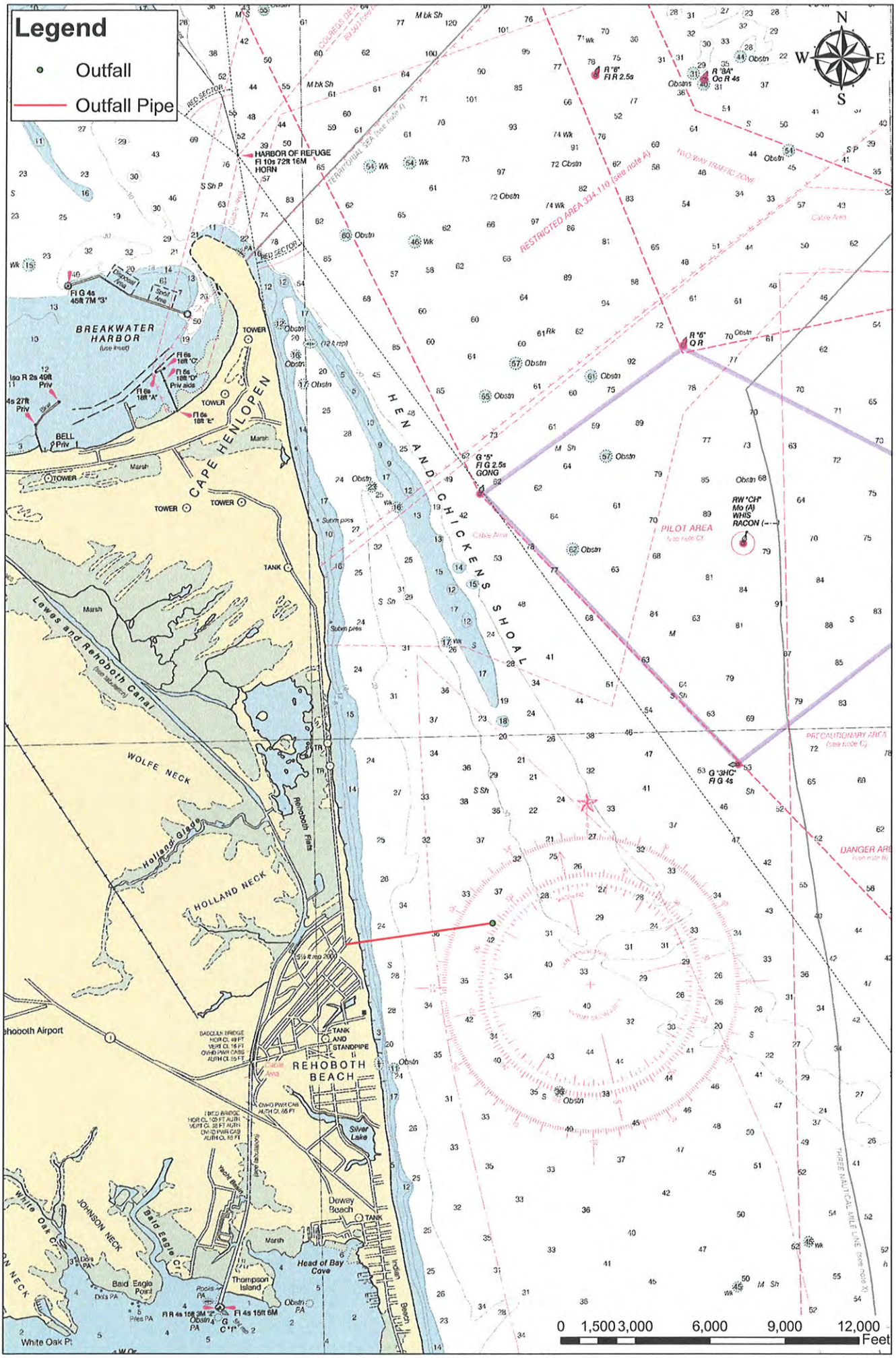
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TWO WAY TRAFFIC ZONE
PILOT AREA
PRECAUTIONARY AREA
DANGER AREA
THREE NAUTICAL MILE LINE
WOLFE NECK
Lewes and Rehoboth Canal
Holland Glade
HOLLAND NECK
Rehoboth Flats
REHOBOTH BEACH
Silver Lake
Dewey Beach
Head of Bay Cove
Thompson Island
JOHNSON NECK
Bald Eagle Point
White Oak Pt
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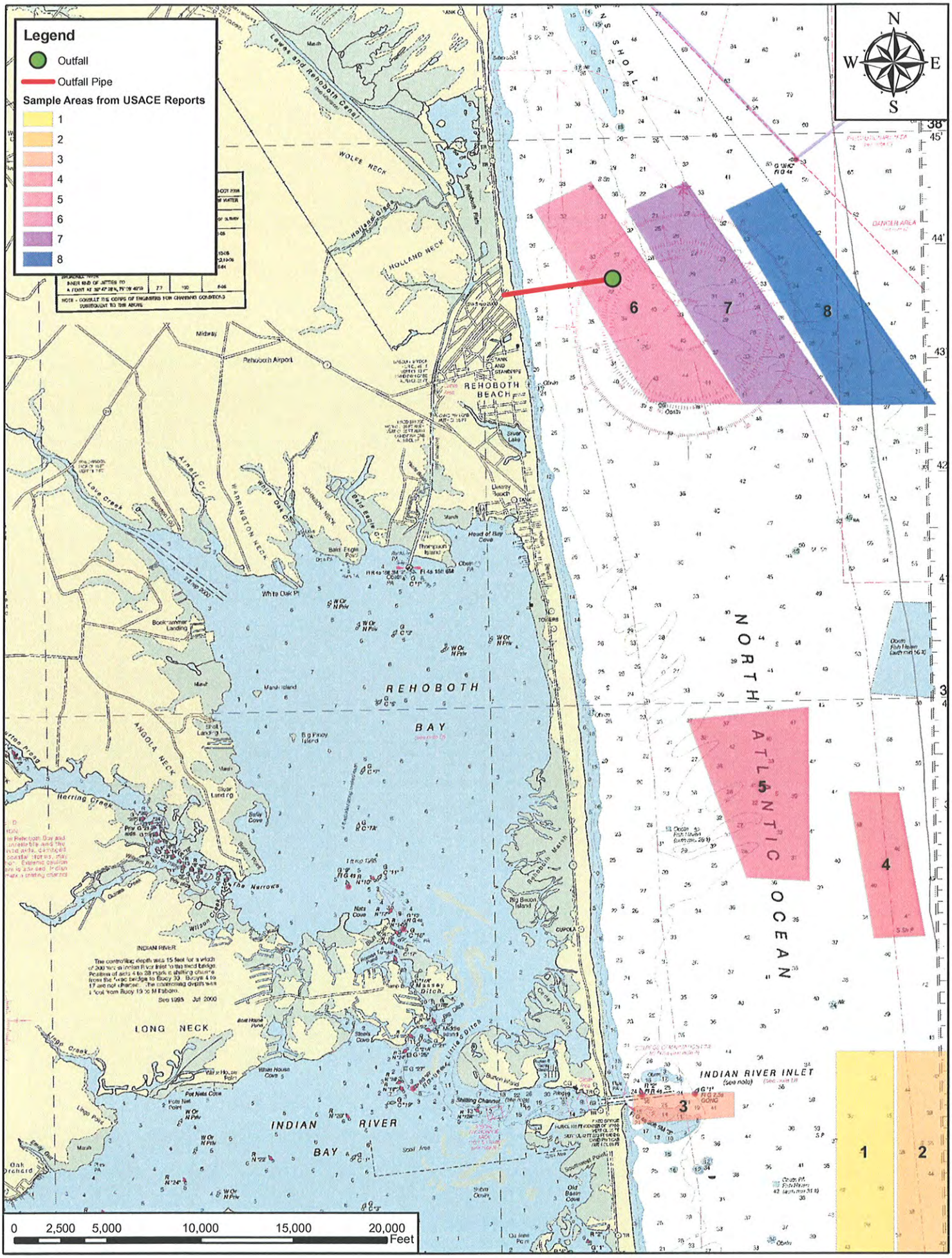
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INDIAN RIVER INLET
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WOLFE NECK
HOLLAND NECK
ANGOLA NECK
WARRINGTON NECK
Rehoboth Airport
0 2,500 5,000 10,000 15,000 20,000 Feet

Proposed Rehoboth Beach Outfall

May, 2010

CITY OF REHOBOTH BEACH
ENVIRONMENTAL IMPACT STATEMENT
SCOPING MEETING

Public Meeting Agenda

DNREC will be holding a scoping meeting for the City of Rehoboth Beach Environmental Impact Statement (EIS) on Tuesday, September 21, 2010, beginning at 1:30 p.m. until 4:30 p.m. at the Rehoboth Beach Convention Center, 229 Rehoboth Avenue, Rehoboth Beach, Delaware.

SCOPOING MEETING

1. Welcome
2. Introductions of Scoping Team, City of Rehoboth Beach officials and City Engineer's
3. Overview of EIS process and timing
4. EIS Format
    a. Cover Sheet
    b. Summary
    c. Table of Contents
    d. Purpose and need for action
    e. Alternatives including proposed action
    f. Affected Environment
    g. Environmental Consequences
    h. List of Preparers
    i. List of Agencies, Organizations, and persons to whom copies of the statement are sent.
    j. Index.
    k. Appendices
5. Other required elements
    a. Cost-Benefit Analysis
6. Public Comment
7. Next Steps
8. Adjournment

Notice of Intent to Prepare an Environmental Impact Statement for Wastewater Disposal Options Including a Proposed Ocean Outfall for the City of Rehoboth Beach Wastewater Treatment Facility, Sussex County, Delaware

DELAWARE DEPARTMENT OF NATURAL RESOURCES AND ENVIRONMENTAL CONTROL

Notice of Intent to Prepare and Environmental Impact Statement for Wastewater Disposal Options Including a Proposed Ocean Outfall for the City of Rehoboth Beach Wastewater Treatment Facility, Sussex County, Delaware

AGENCY: Delaware Department of Natural Resources and Environmental Control (DNREC).

ACTION: Notice of Intent to Prepare a Draft Environmental Impact Statement (EIS).

SUMMARY: This notice advises the public that pursuant to Title 40 CFR, Part 35 the Department of Natural Resources and Environmental Control (DNREC) will analyze and evaluate the impacts of a proposed ocean outfall for the Rehoboth Beach Wastewater Treatment Facility. The Draft EIS will evaluate all alternatives for the disposal of treated water from the Rehoboth Beach Wastewater Treatment Facility. This notice is being provided as required by the Environmental Review Procedures for the Delaware Water Pollution Control Revolving Fund to obtain comments and information from other agencies and the public on the scope of issues to be addressed in the Draft EIS. A public scoping meeting will be held to obtain community input to ensure that all concerns are identified and addressed in the Draft EIS.

On June 14, 2010, the City of Rehoboth Beach submitted a loan application for project funding assistance from the Water Pollution Control Revolving Fund. Given the significance of the project, DNREC is required to prepare an Environmental Impact Statement prior to the approval of financial assistance for the project.

DATES: DNREC will conduct a public scoping meeting from 1:30 pm to 4:30 pm on September 21, 2010 at the Rehoboth Beach Convention Center, Rehoboth Beach, DE 19971. Full public participation by interested federal, state, and local agencies as well as other interested organizations and the general public is encouraged during the scoping process. The scoping process will end 45 days from the date of this notice. Public comments on the scope of the Draft EIS, reasonable alternatives that should be considered, anticipated environmental problems, and actions that might be taken to address them are requested.

FOR FURTHER INFORMATION CONTACT: Comments will be accepted for 45 days following the date of this notice by Mr. Greg Pope, P.E., Engineer VI, DNREC Financial Assistance Branch, 5 E. Reed Street, Suite 200, Dover, DE, 19901. Telephone: 302/739-9941, Facsimile: 302/739-2137. E-mail: greg.pope@state.de.us.

SUPPLEMENTARY INFORMATION:

Background

The Federal Clean Water Act requires states to identify water bodies that do not meet water quality standards and to impose a "Total Maximum Daily Load" (TMDL) on both the point and non-point sources that discharge to the water body. The TMDL is intended to limit the pollutant discharges so that the water quality will improve. In 1996 portions of both 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, Rehoboth Bay, and their tributaries shall be eliminated systematically." Thus, the Rehoboth Beach Wastewater Treatment Plant (WWTP), which discharges into the Lewes-Rehoboth canal, was no longer allowed to discharge and had to find an alternate method to discharge its treated wastewater effluent.

Although there was considerable discussion regarding the impacts of the TMDL on the operation of the Rehoboth Beach WWTP, an extended period of negotiations over the details of its implementation resulted in an agreement in the form of a consent order to eliminate the discharge. The consent order provides a timetable for 1) meeting interim permit levels for nitrogen and phosphorus based on a 25% reduction from currently permitted levels; 2) study of alternatives for eliminating the discharge; 3) identifying sources of funding for the project; and 4) implementing the recommended improvements. Trading with non-point sources to reduce or "eliminate" the nutrient load discharged to the Inland Bays was also permitted.

Studies were conducted to evaluate various alternatives for the disposal of treated effluent from the Rehoboth Beach Wastewater Treatment Plant with the primary criteria for an acceptable alternative being that it not result in the discharge of any nitrogen or phosphorus to the Inland Bays.

The various alternatives were evaluated to identify the most technically feasible, cost effective and environmentally acceptable option. On December 14, 2009, City Commissioners elected to proceed with an ocean outfall as its proposed method of disposal of treated effluent from the Rehoboth Beach Wastewater Treatment Plant.

Coordination with the U.S. Environmental Protection Agency and other government agencies, as required, will take place to ensure compliance with applicable federal and state laws and regulations.

The environmental review of this project will be conducted in accordance with the requirements of the Environmental Review Procedures of the Water Pollution Control Revolving Fund, and other appropriate federal regulations and the DNREC procedures for compliance with those regulations. Copies of the Draft EIS will be transmitted to federal and state agencies and other interested parties for comments as well as public comment.

Alternatives

The Draft EIS to be prepared will consider a range of alternatives, including the no action alternative, based on issues and concerns associated with the project. The Draft EIS will identify, describe, and evaluate the existing environmental, cultural, sociological and economical, and recreational resources; and evaluate the impacts associated with the alternatives under - consideration. Significant issues that have been identified to be addressed in the Draft EIS include, but are not limited to, impacts to water resources, water quality, cultural and biological resources, and human health effects.

The Draft EIS will evaluate five alternatives, as described herein:

1) Ocean Outfall – Proposed Action
Treated effluent is discharged through an outfall and diffuser into the ocean at a depth and distance from the shore that insures public health and environmental standards are met.

2) Land Application
Treated effluent is sprayed on agricultural land to irrigate crops and provide nutrients. The effluent percolates through the soil to the groundwater.

3) Rapid Infiltration Beds
Treated effluent is flooded on to sand beds allowing the water to percolate down into the groundwater.

4) Subsurface Injection
Treated effluent is injected either through a shallow well in an area where the groundwater is contaminated or through a deep well into an aquifer that is confined below the drinking water aquifers.

5) Nutrient Trading
Per the Consent Order, nutrient trading is an allowable alternative.

6) No Action
WWTP would continue to discharge into Lewes-Rehoboth canal.

Availability of the Draft EIS

DNREC anticipates the Draft EIS will be made available to the public by January 2011.

Dated: August 8, 2010.

ENVIRONMENTAL IMPACT STATEMENT (EIS) FORMAT

Per the Environmental Review Procedures for the Water Pollution Control Revolving Fund, the content and format of the Environmental Impact Statement must follow that specified in 40 CFR, Part 6, Subpart B – Content of EIS's which states:

§6.207 Environmental impact statements.

(a)(1)(4) An EIS must be prepared consistent with 40 CFR Part 1502. **and**

(d) An EIS must:

(1) Comply with all requirements at 40 CFR parts 1500 through 1508.

(2) Analyze all reasonable alternatives and the no action alternative (which may be the same as denying the action). Assess the no action alternative even when the proposed action is specifically required by legislation or a court order.

(3) Describe the potentially affected environment including, as appropriate, the size and location of new and existing facilities, land requirements, operation and maintenance requirements, auxiliary structures such as pipelines or transmission lines, and construction schedules.

(4) Summarize any coordination or consultation undertaken with any federal agency, state and/or local government, and/or federally-recognized Indian tribe, including copies or summaries of relevant correspondence.

(5) Summarize any public meetings held during the scoping process including the date, time, place, and purpose of the meetings. The final EIS must summarize the public participation process including the date, time, place, and purpose of meetings or hearings held after publication of the draft EIS.

(6) Consider substantive comments received during the public participation process. The draft EIS must consider the substantive comments received during the scoping process. The final EIS must include or summarize all substantive comments received on the draft EIS, respond to any substantive comments on the draft EIS, and explain any changes to the draft EIS and the reason for the changes.

(7) Include the names and qualifications of the persons primarily responsible for preparing the EIS including an EIS prepared under a third-party contract (if applicable), significant background papers, and the EID (if applicable).

(e) The Responsible Official must prepare a supplemental EIS when appropriate, consistent with 40 CFR 1502.9.

Therefore the EIS shall follow the recommended format set forth in 40 CRF 1502:

§ 1502.10 Recommended format.

Agencies shall use a format for environmental impact statements which will encourage good analysis and clear presentation of the alternatives including the proposed action. The following standard format for environmental impact statements should be followed unless the agency determines that there is a compelling reason to do otherwise:

(a) Cover sheet.

(b) Summary.

(c) Table of contents.

(d) Purpose of and need for action.

(e) Alternatives including proposed action (sections 102(2)(C)(iii) and 102(2)(E) of the Act).

(f) Affected environment.

(g) Environmental consequences (especially sections 102(2)(C)(i), (ii), (iv), and (v) of the Act).

(h) List of preparers.

(i) List of Agencies, Organizations, and persons to whom copies of the statement are sent.

(j) Index.

(k) Appendices (if any).

If a different format is used, it shall include paragraphs (a), (b), (c), (h), (i), and (j), of this section and shall include the substance of paragraphs (d), (e), (f), (g), and (k) of this section, as further described in §§1502.11 through 1502.18, in any appropriate format.

§ 1502.11 Cover sheet.

The cover sheet shall not exceed one page. It shall include:

(a) A list of the responsible agencies including the lead agency and any cooperating agencies.

(b) The title of the proposed action that is the subject of the statement (and if appropriate the titles of related cooperating agency actions), together with the State(s) and county(ies) (or other jurisdiction if applicable) where the action is located.

(c) The name, address, and telephone number of the person at the agency who can supply further information.

(d) A designation of the statement as a draft, final, or draft or final supplement.

(e) A one paragraph abstract of the statement.

(f) The date by which comments must be received (computed in cooperation with EPA under §1506.10).

The information required by this section may be entered on Standard Form 424 (in items 4, 6, 7, 10, and 18).

§ 1502.12 Summary.

Each environmental impact statement shall contain a summary which adequately and accurately summarizes the statement. The summary shall stress the major conclusions, areas of controversy (including issues raised by agencies and the public), and the issues to be resolved (including the choice among alternatives). The summary will normally not exceed 15 pages.

§ 1502.13 Purpose and need.

The statement shall briefly specify the underlying purpose and need to which the agency is responding in proposing the alternatives including the proposed action.

§ 1502.14 Alternatives including the proposed action.

This section is the heart of the environmental impact statement. Based on the information and analysis presented in the sections on the Affected Environment (§1502.15) and the Environmental Consequences (§1502.16), it should present the environmental impacts of the proposal and the alternatives in comparative form, thus sharply defining the issues and providing a clear basis for choice among options by the decision maker and the public. In this section agencies shall:

(a) Rigorously explore and objectively evaluate all reasonable alternatives, and for alternatives which were eliminated from detailed study, briefly discuss the reasons for their having been eliminated.

(b) Devote substantial treatment to each alternative considered in detail including the proposed action so that reviewers may evaluate their comparative merits.

(c) Include reasonable alternatives not within the jurisdiction of the lead agency.

(d) Include the alternative of no action.

(e) Identify the agency's preferred alternative or alternatives, if one or more exists, in the draft statement and identify such alternative in the final statement unless another law prohibits the expression of such a preference.

(f) Include appropriate mitigation measures not already included in the proposed action or alternatives.

§ 1502.15 Affected environment.

The environmental impact statement shall succinctly describe the environment of the area(s) to be affected or created by the alternatives under consideration. The descriptions shall be no longer than is necessary to understand the effects of the alternatives. Data and analyses in a statement shall be commensurate with the importance of the impact, with less important material summarized, consolidated, or simply referenced. Agencies shall avoid useless bulk in statements and shall concentrate effort and attention on important issues. Verbose descriptions of the affected environment are themselves no measure of the adequacy of an environmental impact statement.

§ 1502.16 Environmental consequences.

This section forms the scientific and analytic basis for the comparisons under §1502.14. It shall consolidate the discussions of those elements required by sections 102(2)(C)(i), (ii), (iv), and (v) of NEPA which are within the scope of the statement and as much of section 102(2)(C)(iii) as is necessary to support the comparisons. The discussion will include the environmental impacts of the alternatives including the proposed action, any adverse environmental effects which cannot be avoided should the proposal be implemented, the relationship between short-term uses of man's environment and the maintenance and enhancement of long-term productivity, and any irreversible or irretrievable commitments of resources which would be involved in the proposal should it be implemented. This section should not duplicate discussions in §1502.14. It shall include discussions of:

(a) Direct effects and their significance (§1508.8).

(b) Indirect effects and their significance (§1508.8).

(c) Possible conflicts between the proposed action and the objectives of Federal, regional, State, and local (and in the case of a reservation, Indian tribe) land use plans, policies and controls for the area concerned. (See §1506.2(d).)

(d) The environmental effects of alternatives including the proposed action. The comparisons under §1502.14 will be based on this discussion.

(e) Energy requirements and conservation potential of various alternatives and mitigation measures.

(f) Natural or depletable resource requirements and conservation potential of various alternatives and mitigation measures.

(g) Urban quality, historic and cultural resources, and the design of the built environment, including the reuse and conservation potential of various alternatives and mitigation measures.

(h) Means to mitigate adverse environmental impacts (if not fully covered under §1502.14(f)).

[43 FR 55994, Nov. 29, 1978; 44 FR 873, Jan. 3, 1979]

§1502.17 List of preparers.

The environmental impact statement shall list the names, together with their qualifications (expertise, experience, professional disciplines), of the persons who were primarily responsible for preparing the environmental impact statement or significant background papers, including basic components of the statement (§§1502.6 and 1502.8). Where possible the persons who are responsible for a particular analysis, including analyses in background papers, shall be identified. Normally the list will not exceed two pages.

§ 1502.18 Appendix.

If an agency prepares an appendix to an environmental impact statement the appendix shall:

(a) Consist of material prepared in connection with an environmental impact statement (as distinct from material which is not so prepared and which is incorporated by reference (§1502.21)).

(b) Normally consist of material which substantiates any analysis fundamental to the impact statement.

(c) Normally be analytic and relevant to the decision to be made.

(d) Be circulated with the environmental impact statement or be readily available on request.

§ 1502.23 Cost-benefit analysis.

If a cost-benefit analysis relevant to the choice among environmentally different alternatives is being considered for the proposed action, it shall be incorporated by reference or appended to the statement as an aid in evaluating the environmental consequences. To assess the adequacy of compliance with section 102(2)(B) of the Act the statement shall, when a cost-benefit analysis is prepared, discuss the relationship between that analysis and any analyses of unquantified environmental impacts, values, and amenities. For purposes of complying with the Act, the weighing of the merits and drawbacks of the various alternatives need not be displayed in a monetary cost-benefit analysis and should not be when there are important qualitative considerations. In any event, an environmental impact statement should at least indicate those considerations, including factors not related to environmental quality, which are likely to be relevant and important to a decision.

§ 1502.24 Methodology and scientific accuracy.

Agencies shall insure the professional integrity, including scientific integrity, of the discussions and analyses in environmental impact statements. They shall identify any methodologies used

and shall make explicit reference by footnote to the scientific and other sources relied upon for conclusions in the statement. An agency may place discussion of methodology in an appendix.

CLIENTS | PEOPLE | PERFORMANCE

Rehoboth Beach Ocean Outfall Project

Progress Report

Commissioners Meeting
October 11, 2011

Agenda

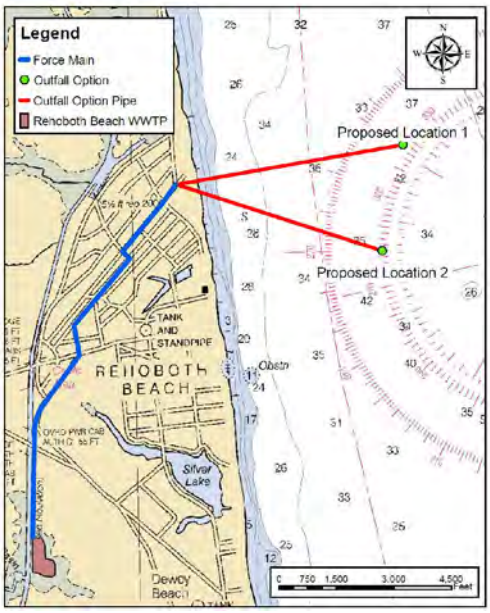
- EIS
  - Report
  - Modeling
  - Construction method
- Related Permits
- Force Main Alignment Study
- Wastewater Treatment plant PER
- Engineering costs
- Schedule

Updated Environmental Impact Statement

No Action vs. Land Application vs. Ocean Outfall Alternatives

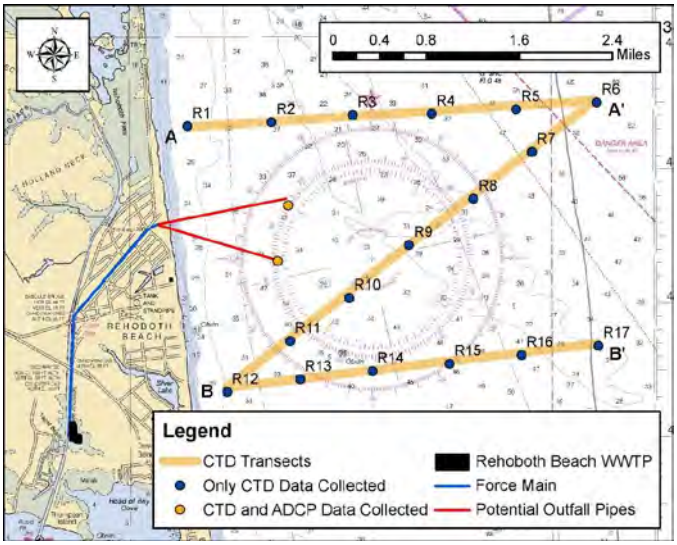
EIS

- Draft EIS nearly complete
- Workshops with DNREC
  - March 18, 2011
  - June 3, 2011
  - September 29, 2011
- Additional focus on:
  - Land application
  - Stress pharmaceuticals
  - Archealogical / Historical sites
  - Water quality
  - Fish and marine mammals
  - Endangered species
  - Environmental justice
  - Cumulative effects
  - Cost benefit analysis
- Remaining Efforts
  - Incorporate second set of ADCP data
  - Construction technique



Modeling

Modeling Update
Data Collection



ADCP Data

2010: September – November (one ADCP failure)

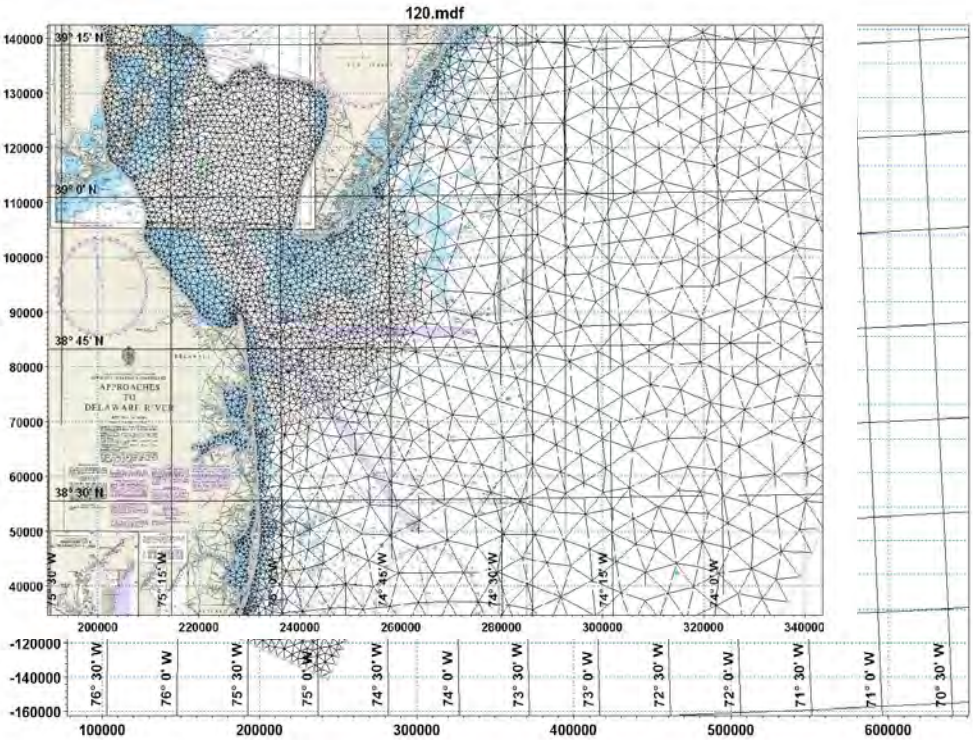
2011: April - June (complete ADCP failure)
July – September (data collected at both sites)

CTD Data

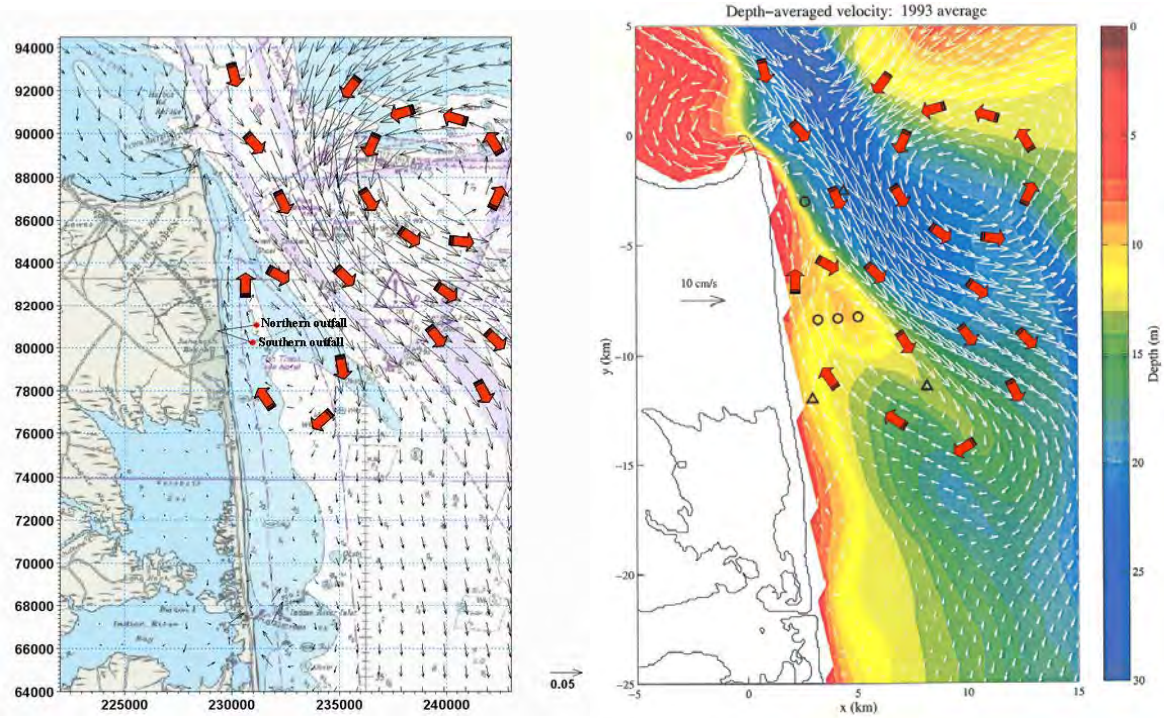
2010	Nov	*
2011	Jun	
	Mar	
	May	
	Jul	*
	Sep	

* Water Quality Data

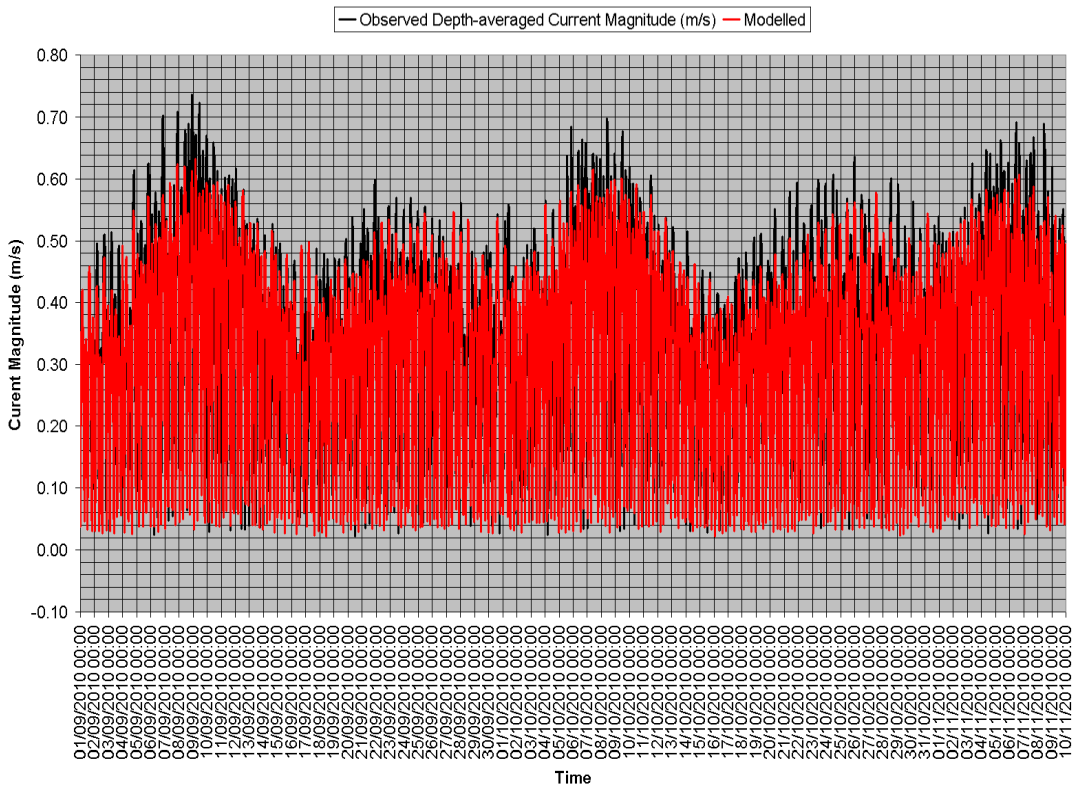
Extents of Modelling



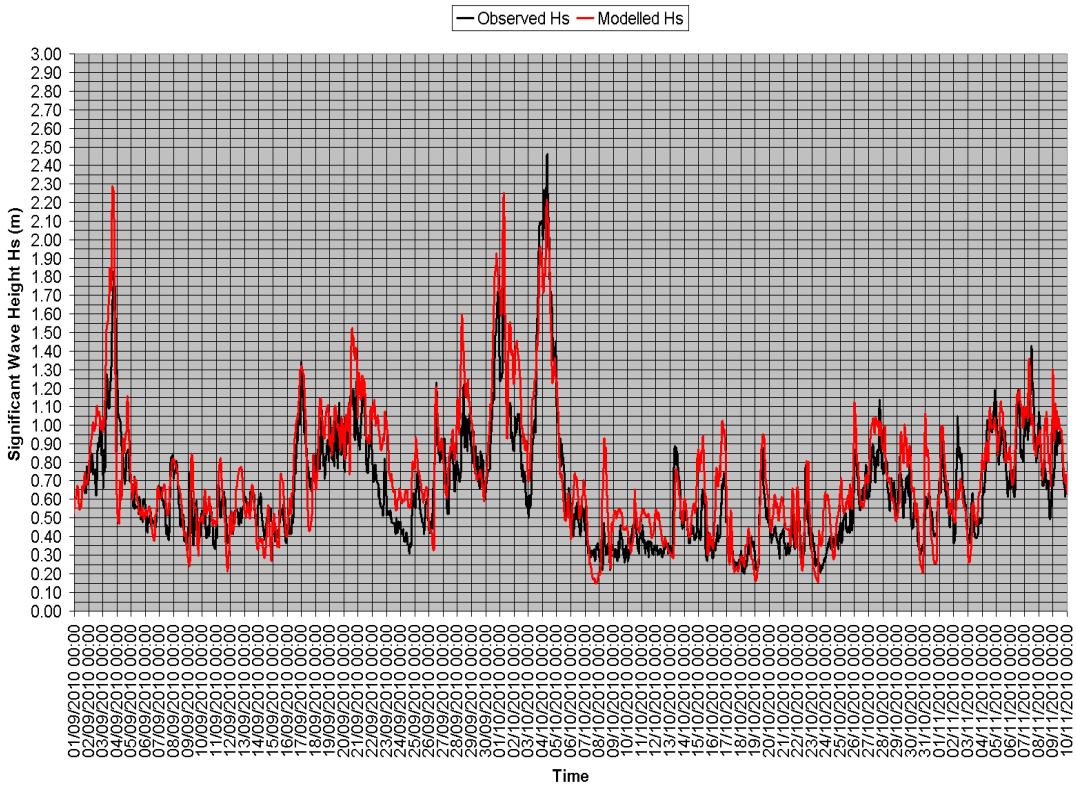
Far Field Model – Residual Velocities



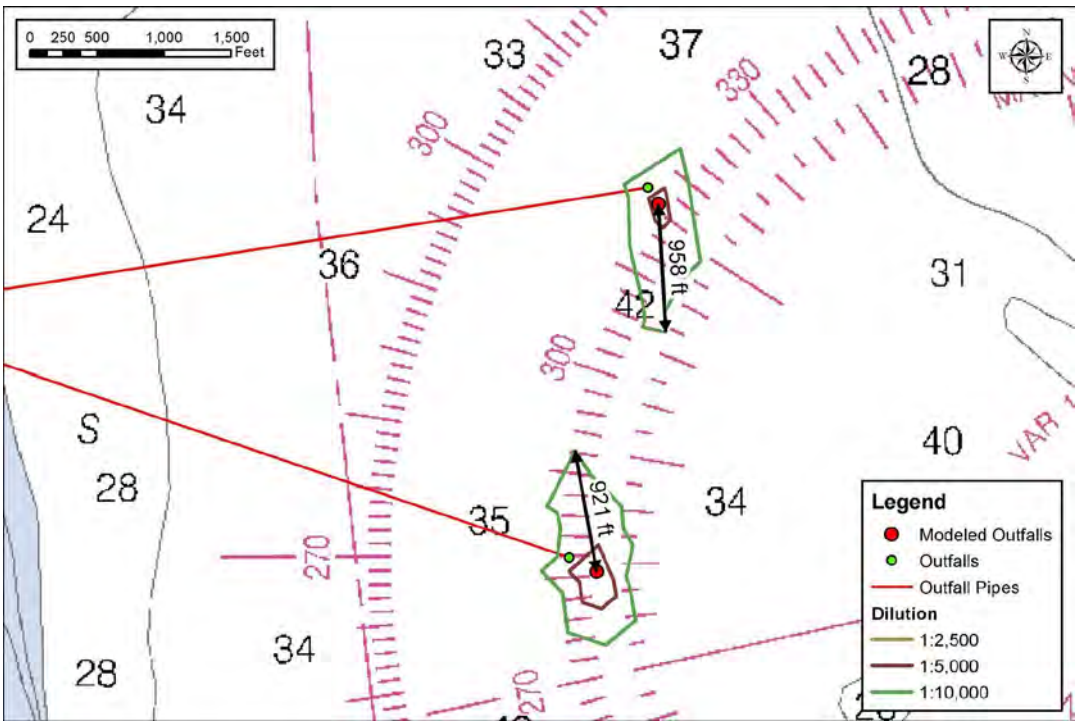
Model calibration – Current Magnitude at ADCP 1 Site



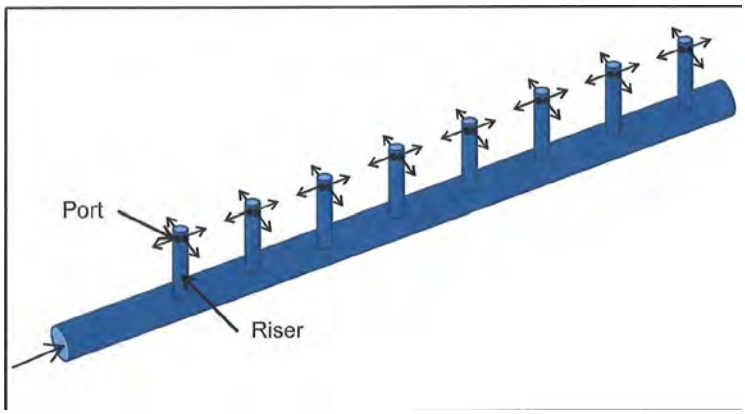
Model calibration – Wave Height at ADCP 1 Site



Far Field Modeling



Near Field Model



Diffuser

Dilution Required During Normal Plant Operation

Parameter	Background Level [1]	Plant Effluent [2]	Dilution Required
BOD, 5-Day (mg/L)	5.08	2.80	None
Enterococcus (cfu/100mL)	0.17	2.70	1:17
Nitrogen, Total, Alkaline Persulfate (mg/L)	0.44	6.20	1:15
Phosphorus, Total, Alkaline Persulfate (mg/L)	0.07	0.30	1:5
Residue, Nonfilterable (TSS) (mg/L)	30	5.4	None

Notes:

[1] Average of samples taken from three different depths at each outfall site

[2] Performance data based on January 2007 – July 2010. Annual average flow for reported period was 1.1 mgd.

Dilution Required During Worst Case Scenario

Failure of the Disinfection and Filtration Processes

- Bacteria and virus controlling

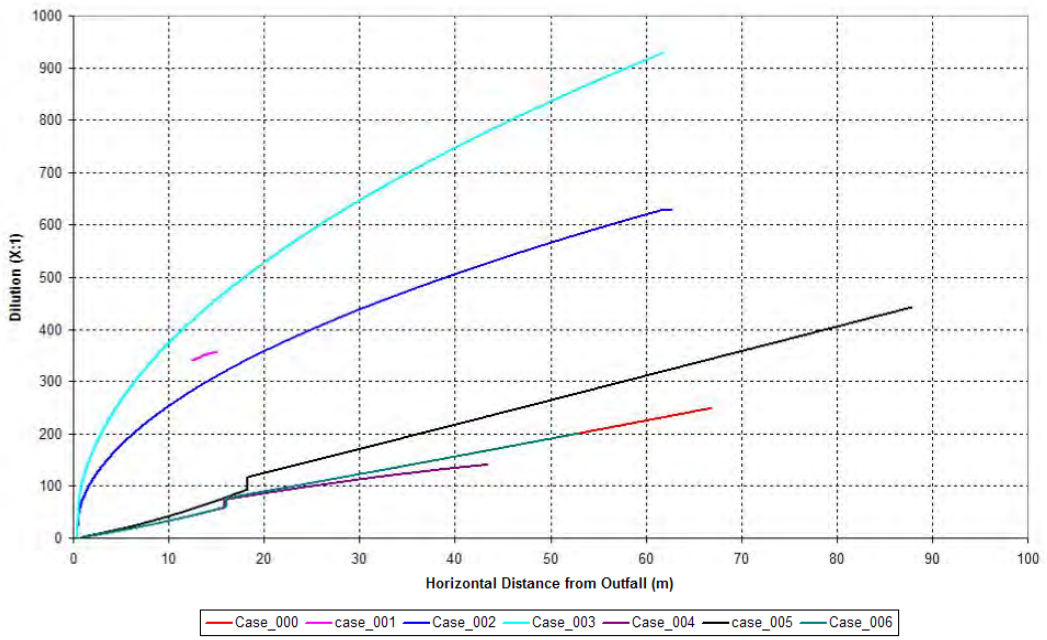
Parameter	Water Quality Standard[1]	Plant Effluent [2]	Dilution Required
Enterococcus (cfu/100mL)	35 (geometric mean)	2.2×10^3	1:100
Virus	n/a	1.5×10^3	

Notes:

[1] Surface Water Quality Standards (amended July 11, 2004).

[2] Compiled from numerous sources, see report Chapter 9.

Near Field Modeling



Near Field Modeling

Run Scenario	Distance to end of NFR	Dilution at end of NFR (1:D)	Terminal height of plume above ports
Case 000	66 m / 217 ft	250	Rise to surface
Case 001	Undefined	360 at 10 m(33 ft)	Rise to surface
Case 002	62 m / 203 ft	630	Rise to surface
Case 003	62 m / 203 ft	930	Rise to surface
Case 004	43 m / 141 ft	141	4.39 m / 14.4 ft
Case 005	88 m / 289 ft	442	Rise to surface
Case 006	66 m / 217 ft	250	Rise to surface
Case 007	119 m / 390 ft	82	1.69 m / 5.5 ft
Case 008	220 m / 722 ft	89	1,27 m / 4.2 ft

Modeling Conclusions

Conclusion

- Dilution to background concentrations achieved within initial zone during normal operation
- Dilution to Water Quality Standards achieved within the initial zone during worst case scenario if water column is not stratified
- Stratification may be present seasonally but not a factor even if occurs due to high degree of far-field mixing
- 4 log dilution (1:10,000) within 1000 feet of outfall
- 3D modeling not required

Proposed Construction

Construction Methods

Outfall Pipe

- Maximize use of directional drilling (~3000 ft)
- Some open trench excavation will be required
- Recent boring data will be used to confirm

Diffuser

- Diffuser will be pile supported

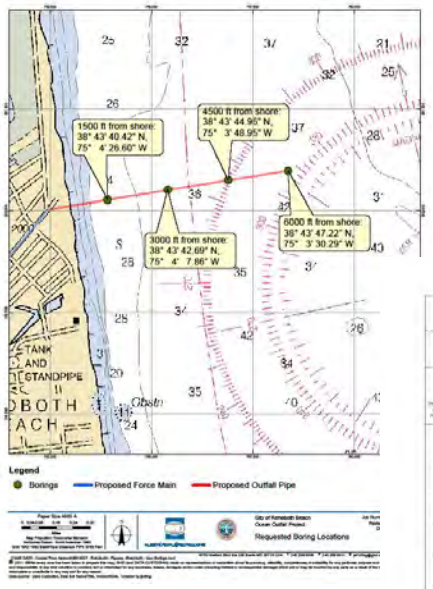
Dredging

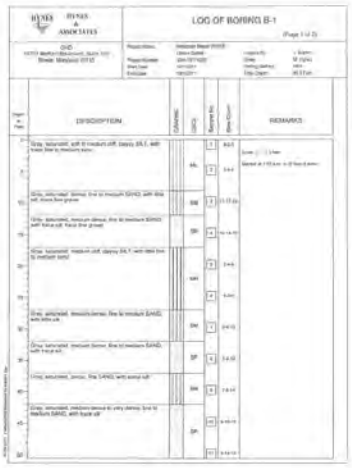
Clam shell dredge

Cutter suction dredge

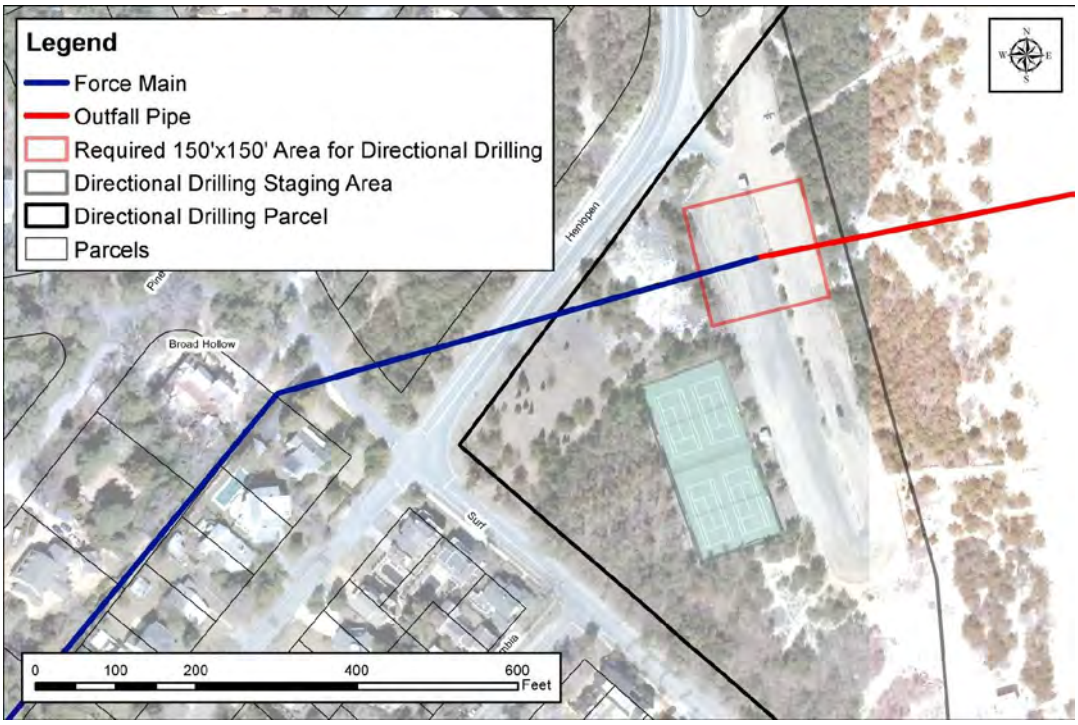
Dredged materials will be side cast
Some material used for bedding and backfill

Soil Borings

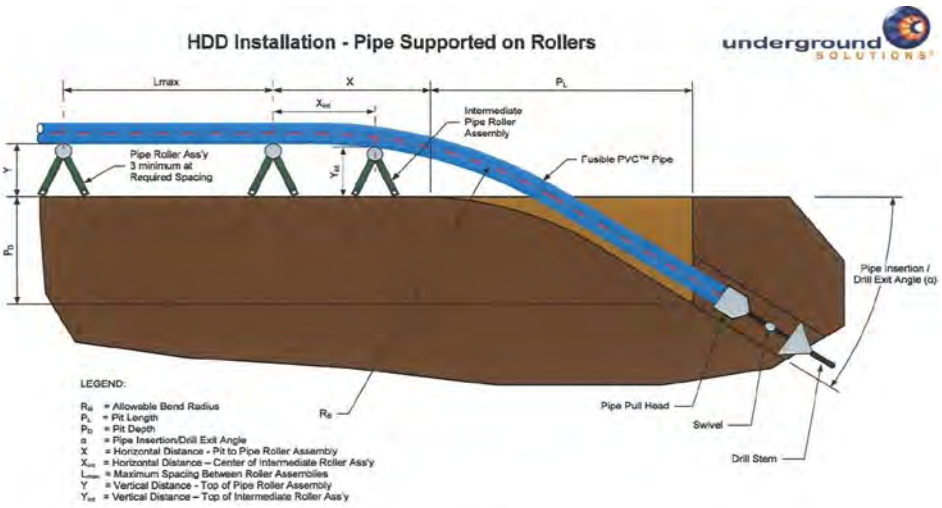




Mears Group's Horizontal Directional Drilling Process



Mears Group's Horizontal Directional Drilling Process



Pipe Type	DIPS	Lmax	48.00	ft
Nom. Dia.	24"	Distance (X)	44.00	ft
Pipe OD	25.80 in	Distance - Xint	8.00	ft
Bend Radius (R_B)	538.00 ft	Distance - Yint	23.00	in
Insertion Angle	11.00 degrees	Pit Length (P_L)	61.00	ft
Roller Height (Y)	24.00 in 2.00 ft	Pit Depth (P_D)	9.00	ft

Disclaimer Note:
The calculations for the pit sizing shown are based on minimum requirements of the pipe product being selected above and do not take into consideration any soil bearing conditions, access requirements, required shoring, or project specific information, all of which should be considered and adjusted as necessary for each project.

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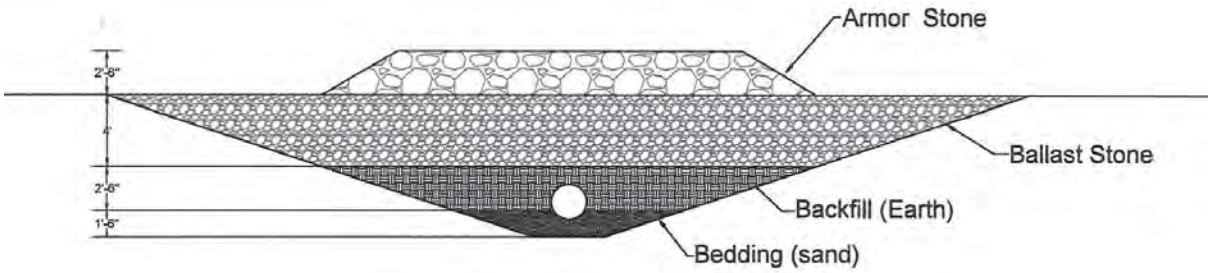
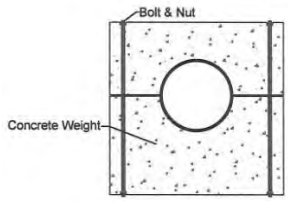
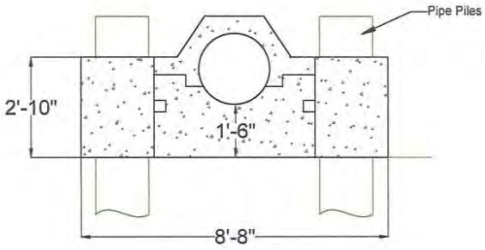
Typical Cross Sections



Typical Trench Cross Section

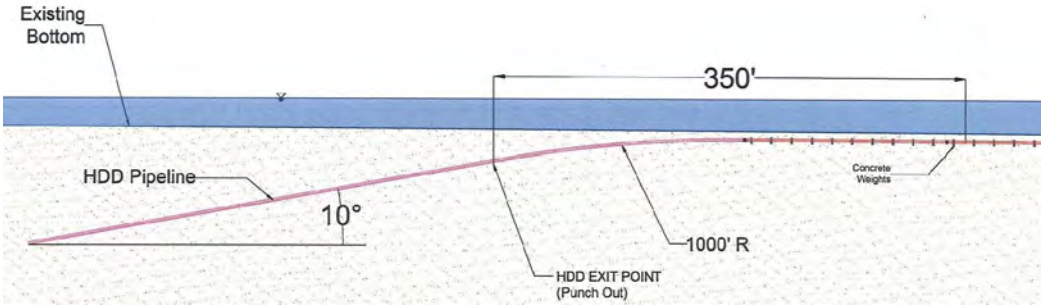


Typical Concrete Weight Cross Section

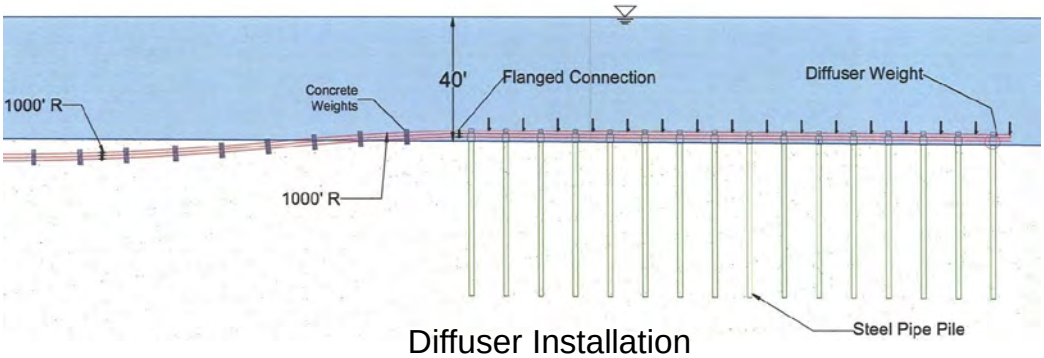


Diffuser Concrete Weight Connection

Typical Pipeline and Ocean Outfall Profile



HDD Exit Pit and Trench



Diffuser Installation

Related Permits

- Coastal Zone Act Permit
- Wetlands and Subaqueous Lands Permit
- Coastal Construction Permit

Force Main Alignment Study

Force Main Alignment Study

Alternate Alignments

Alt A: Lewes-Rehoboth Canal – Henlopen Ave

Alt B: State Rd – 5th Street – Columbia Ave.

Alternate A is preferred option:

- Less congestion of existing utilities
- Fewer bends in alignment
- Wider right-of-way
- Less traffic
- Lower cost
  - Alt A: $ 4.54 million
  - Alt B: $ 5.64 million

Force Main Alignment Study

Permit Issues

DNREC Division of Parks & Recreation Cultural Heritage Section

- Conducted desk top review and site visit
- Limited archaeological study required in open cut areas

DNREC Division of Fish & Wildlife

- No record of state or federal listed plants or animals that would be impacted

DNREC Division of Water Resources, Wetlands Div.

- No state regulated wetlands along alignment
- Wetlands consultant under contract

WWTP Preliminary Engineering Study

Objectives

- Condition Assessment of Existing Plant
- Prioritized Capital Improvements Plan
- Alternatives Analysis
  - Filtration
  - Biosolids Treatment and Disposal
- Preliminary Design of New Plant
  Effluent Pumping Station
- Develop Preliminary Engineering
  Report Required for USDA Funding

Process Alternatives Evaluated

Biosolids Treatment and Disposal Alternatives

- Alternative B-1: Liquid Disposal of Class B Biosolids Product
- Alternative B-2: Autothermophilic Aerobic Digestion (ATAD)
- Alternative B-3: Lime Pasteurization
- Alternative B-4: Solids Drying
- Alternative B-5: Outsourcing Biosolids Treatment and Disposal

Filtration Alternatives

- Alternative F-1: Cloth Disc Filters
- Alternative F-2: Continuous Backwash Filters
- Alternative F-3: Traveling Bridge Filters

Report Recommendations

Category

1	Replacement/Rehabilitation Needed Immediately
2	Replacement/Rehabilitation Needed Within 5-20 Years
3	Replacement/Rehabilitation Needed for Cosmetic Reasons
4	No Replacement/Rehabilitation Needed Within the Next 20 Years

Project Schedule

Tentative Schedule

- December 1, 2011 — Draft EIS submitted to DNREC
- January 3, 2012 — Draft EIS sent to Public Notice
- January 18, 2012 — Public Hearing
- February 17, 2012 — Close of public comment period
- May 18, 2012 — Final EIS (respond to comments)
- ? — Record of Decision

Engineering Costs

Task Order Summary

TO #	Task Description	Original Budget	Change Orders	Total Budget	Expended / Invoiced	Remaining Budget	Status
1	Preliminary Permitting	$214,649	0	$214,649	$214,626.38	$22.62	closed
2	Final Permitting	$200,000	0	$200,000	$22,797.02	$177,202.98	active
3	Field Studies	$251,449	$10,000	$261,449	$229,915.18	$31,533.82	active
3.2	Archaeology Ocean Survey	$29,806	0	$29,806	$29,137.51	$668.49	active
3.3	Boring Services	$113,380	$26,400	$139,780	$139,780	0	active
4	Dispersion Modeling	$210,000	0	$210,000	$205,606.29	$4,393.71	active
4	Dispersion Modeling – Contingency	$73,000	0	$73,000	0	$73,000	active
5	WWTP PER	$124,000	0	$124,000	$105,004.52	$18,995.48	active
7	Alignment Study	$37,700	0	$37,700	$24,979.94	$12,720.06	active
	Total	$1,253,984	$36,400	$1,290,384	$832,066.84	$458,317.16	

Questions

City of Rehoboth Beach

LEGAL NOTICE

Public Hearing

Notification of the Issuance of and Request for Comments on the Draft Environmental Impact Statement for the Proposed Ocean Outfall in Rehoboth Beach, Delaware

The City of Rehoboth Beach has prepared a draft Environmental Impact Statement (EIS) to permit the design and construction of a new ocean outfall to discharge treated effluent. The EIS has been completed in accordance with the Environmental Review Procedures of the Delaware Water Pollution Control Revolving Loan Fund as directed by the Delaware Department of Natural Resources and Environmental Control (DNREC).

The City of Rehoboth Beach Wastewater Treatment Plant receives wastewater from the City and surrounding areas of Henlopen Acres and Dewey Beach and discharges the treated effluent to the Lewes-Rehoboth Canal. To meet the Consent Order between the City of Rehoboth Beach and the Department of Natural Resources and Environmental Control and executed by Superior Court on December 11, 2002, the need for an alternative method of discharge is required. The proposed ocean outfall will replace the existing outfall and will discharge into the ocean approximately 6,000 feet from the Deauville Beach parking area. The proposed alignment of the force main would predominately follow existing utilities and right of ways.

The draft EIS compares various alternative methods of treated effluent disposal including no-action and land application as well as the preferred alternative of the ocean outfall and provides an analysis of relevant environmental issues and impacts. The draft EIS can be reviewed on the City of Rehoboth Beach and DNREC websites (http://www.cityofrehoboth.com/ and http://www.dnrec.delaware.gov) and at the Rehoboth Beach Public Library from 10am-8pm M-W, 10am-5pm Th-F, and 10am-3pm Sat. until the end of the public comment period. Digital copies are available on request and reasonable requests for printed copies will also be fulfilled.

The public hearing to discuss the contents of the draft EIS will be held on **Tuesday, April 10, 2012 at 1:00pm** at the Rehoboth Beach Convention Center, 229 Rehoboth Avenue, Rehoboth Beach, DE 19971. The meeting will be transcribed and will include the following agenda items: (1) a brief presentation of DNREC's roles and responsibilities and the EIS process, (2) a presentation summarizing the contents of the draft EIS, and (3) an opportunity for interested government agencies, organizations, and individuals to provide comments on the draft EIS.

Written comments may be submitted during the public comment period until **May 10, 2012 at 4:30pm.** Please send written comments to Greg Pope, Department of Natural Resources and Environmental Control, Financial Assistance Branch, 5 E. Reed St. Suite 200, Dover, DE 19901 or by fax (302)-739-2137 or email at Rehoboth_EIS_Comments@state.de.us.
Electronic submission is preferred.
3/7,14-NJ

0110887456-01

NEW CASTLE COUNTY
Department of Administration

NOTICE OF PETITION FOR CUSTODY

TO: Kashawn Roy,
Respondent(s),
FROM: Clerk of Court - AT RISK New Castle County,

Danielle Lockhart,
Petitioner(s), has brought suit against you for Petition for Custody in the Family Court of the State of Delaware for New Castle County in Petition No. 11-32125. If you do not serve a response to the petition on the Court and to the Petitioner's Attorney or the petitioner if not represented at the following address:

c/o Keean Williams
500 King Street
Wilmington, DE 19801

within 20 days after publication of this notice, exclusive of the date of publication, as required by statute, this action will be heard without further notice at Family Court.
3/14-NJ

0110889522-01

IN THE SUPERIOR COURT OF WARE COUNTY STATE OF GEORGIA

RE: PETITION OF TOMMY BROOMFIELD and JACOUELYN ANN BROOMFIELD FOR ADOPTION OF AMANI RENAE COOPER, A FEMALE MINOR CHILD

CIVIL ACTION No.12A-002

NOTICE OF PETITION FOR ADOPTION

TO: **TAJ C. RICKETTS,** whose whereabouts is unknown
Last known to be in Newcastle, Delaware
Legal Father of Amani Renae Cooper

Under the provisions of O.C.G.A. Section 19-8-10(c), you are hereby given notice that:

Legal Notices

Legal Notice -
Foster Parent Recruitment

The State of Delaware's Department of Services for Children, Youth and Their Families, Division of Family Services DFS is accepting applications from interested adults 21 years and older who can provide care to abused or neglected or dependent children/youth entering foster care.
Those who qualify must meet specific requirements including: a criminal background and fingerprint check returned without prohibited offenses; a child protection registry check; attend up to 30 hours of pre-service training and an additional 5 to 20 hours each year thereafter of in-service training; provide for personal references; the economically stable; pass a home health and safety study completed by DFS; have three sessions of joint assessment with a DFS foster care worker in your residence; and pass a medical clearance. Foster care providers receive a stipend for care of children who are in the custody of DFS ranging from $13.30 per day to $55 per day. Stipends are determined by the child's needs and age, the foster parent's skill level has calculated through an automated leveling and the service level the foster parent agrees to provide. For more information, please visit www.kids.Delaware.gov or call 2-1-1.
3/14,18,21-NJ

0110889277-01

Delaware State Housing Authority DSHA

PUBLIC HEARING NOTICE
ON THE FY2013 MOVING TO WORK ANNUAL PLAN

Notice is given that the Delaware State Housing Authority (DSHA) will conduct two Public Hearings concerning the submission of their Moving To Work Annual Plan for FY2013 to the U.S. Department of Housing and Urban Development (HUD). This Plan outlines the activities of the Moving To Work Program as well as the court

Legal Notices

NOTICE OF TERMINATION OF PARENTAL RIGHTS ACTION

TO: David L. Goodrich,
DOB: 01/23/74,
Respondent(s)

From: Confidential Clerk of Family Court

The Department of Services for Children, Youth and Their Families, Petitioner, has brought a civil action (Petition #12-05790) against you to terminate your parental rights of your child(ren):

Minor Female
DOB: 05/21/09

Minor Male
DOB: 09/19/07

A hearing has been scheduled at Family Court, 400 Court Street, Dover, Delaware, on 05/22/12, at 1:30 p.m.

If you do not appear at the hearing, the Court may terminate your parental rights without your appearance.

IF YOU WISH TO BE REPRESENTED BY AN ATTORNEY IN THIS MATTER BUT CANNOT AFFORD ONE, YOU MAY BE ENTITLED TO HAVE THE COURT APPOINT AN ATTORNEY TO REPRESENT YOU FOR FREE. FOR MORE INFORMATION, PLEASE CONTACT THE CONFIDENTIAL CLERK AT FAMILY COURT, (302) 672-1001.
3/14,21,28-NJ

0110889673-01

FAMILY COURT FOR THE STATE OF DELAWARE

NOTICE OF FAMILY COURT ACTION
TO: Eric M. Stoye,
Respondents(s)
Petitioner, Thomas W. McGovern, has filed a Guardianship petition against you in the Family Court of the State of Delaware for New Castle County on 02/07/12. If you do not file an answer with the Family Court within 20 days after publication of this notice, exclusive of the date of publication, as required by statute, this action will be heard in Family Court without further notice.

IF YOU WISH TO BE REPRESENTED BY AN ATTORNEY IN THIS

Legal Notices

Notice is hereby given that on April 10, 2012 at 9am at Tri State Self Storage, 1050 Ridge Rd, Claymont, DE, 100 Hickman Rd, Claymont, DE and at 4016 N. DuPont Hwy., New Castle, DE the undersigned, Tri State Self Storage will sell at Public Sale by competitive bidding the personal property heretofore stored with the undersigned below:

RIDGE RD:
#084 R. Ruth, #162 J. Kennedy, #239 J. Marcin, #308 K. Williams, #309 S. Smith, #388 D. Williams, #394 O. Fulton, #486 and #490 M. Edwards, #602 R. Bailey, #660 K. Logan.

HICKMAN RD:
#032 M. Rickoski, #063 J. Spence, Jr., #210 T. Jenkins, #245 C. Crowder, #264 A. Weh Dorline, #266 M. Jones, #274 B. Sills, #293 G. Hatcher, #341 M. McCommons.

DUPONT HWY:
#B-131 F. Holloway, Jr., #D-123 V. Carter, #E-12 L. Johnson, #E-22 P. Brightman, #E-3 C. Williams, #F-115 T. Lee, #F-134 K. Wilson, #F-139 M. Poteat, #F-146 R.E. Williams (R.E. Williams- Tax Accts Inc.), #F-09 T. Wilkerson, #G-108 R. Lloyd, #G-145 B. McCollister, #H-159 E. Cramer, #H-206 V. Carson, #H-262 D. Maxwell, #H-28 P. Cooke, #H-285 D. Maxwell, #H-301 T. Wynn, #H-362 W. Sanders, #H-384 L. Chambers, #I-100 and J-104 A. Calloway, #J-126 A. Griffin, #P-26 T. Winters, #P-29 S. McCoy, #P-30 V. Brown.

ALL UNITS CONTAIN HOUSEHOLD MISC. ITEMS
3/7,14-NJ

0110888510-01

WATER SYSTEM IMPROVEMENTS

REFERENDUM

March 24, 2012
8 am - 6 pm

Notice is hereby given to the residents and property owners in the Town of Milton that a referendum for the purpose of voting for or against the borrowing of up to $3,450,000 on the full faith, credit and taxing power of the town. The purpose of the loan is to make improvements to the Town of Milton water system. Such improvements include a new elevated storage tank, water supply

Legal Notices

FAMILY COURT FOR THE STATE OF DELAWARE
NOTICE OF FAMILY COURT DEPENDENCY AND NEGLECT CUSTODY ACTION

TO: Wayne Slagle
DOB: 01-16-1963,
Respondent(s)
From: Carol Robinson, DIVISION OF FAMILY SERVICES

Minor Female
DOB: 1/19/94

This publication is to advise you that the Division of Family Services has attempted to reach you Via Mail with decision of our investigation. However we were unable to reach you, because we were not provided with a proper mailing address.

Upon response of your observation of this notice of publication, the Division of Family Service will mail a letter of substantiation to you, providing you with the outcome of our investigation. Also The Family Court of the State of Delaware will schedule the petition for a hearing.

IF YOU WISH TO BE REPRESENTED BY AN ATTORNEY IN THIS MATTER BUT CANNOT AFFORD ONE, YOU MAY BE ENTITLED TO HAVE THE COURT APPOINT AN ATTORNEY TO REPRESENT YOU FOR FREE. FOR MORE INFORMATION, PLEASE CONTACT THE CONFIDENTIAL CLERK AT FAMILY COURT, (302) 255-0239.
3/9,10,11,12,13,14,15,16-NJ

0110869000-01

Bids & Proposals

Appoquinimink School District
Appoquinimink Early Childhood Center
Kitchen Addition
Bid Pac 'A'
March 12, 2012

SECTION 001113
ADVERTISEMENT FOR BID

Public notice is hereby given that sealed bids for the following prime contract will be received for the construction of the Appoquinimink Early Childhood Center Kitchen Addition located in Middletown, Dela

Bids & Proposals

BID #1203 - Sealed bids for voice and data cabling at the District Professional Development Center in the Capital School District will be accepted until 3:00 pm Eastern Time on Friday, March 30, 2012 at Capital School District, 945 Forest Street, Dover, DE 19904, at which time they will be opened, read, and recorded. A pre-bid meeting will be held at 3:00 on Friday, March 16 in the District Office, 945 Forest Street, Dover, DE 19904. Bid Specifications can be obtained at the aforementioned address or by calling (302) 672-1512.
3/7,14-NJ

0110888589-01

CITY OF NEWARK
Delaware

CONTRACT NO. 12-02

WELL 14R METER PIT AND PIPING IMPROVEMENTS

NOTICE OF LETTING

Sealed bids for Contract No. 12-02, Well 14R Meter Pit and Piping Improvements, will be received in the Purchasing Office, Newark Municipal Building, 220 Elkton Road, Newark, Delaware 19711 until 2 p.m., prevailing time, Tuesday, March 27, 2012 and will be publicly opened and read aloud in the Council Chamber shortly thereafter.

Attendance is **MANDATORY** at a pre-bid meeting on Tuesday March 20, 2012 at 10:00 am at the South Well Field Water Treatment Plant, located at 910 South Chapel Street (Rt. 72) in Newark, DE. For information, call (302) 366-7055.

Plans and Specs may be obtained from the City's web page www.cityofnewarkde.us. Information can be found by using the following links: Business Services, Bid/Proposal Opportunities.
3/12,13,14-NJ

0110889246-01

Appoquinimink School District
Olive B. Loss Elementary School - Additions & Renovations
Bid Pac"A" 5 March 2012

SECTION 001113
ADVERTISEMENT FOR BID

State Public Legal Notice

State Public Legal Notice

DEPARTMENT OF AGRICULTURE
Delaware Jockey's Health and Welfare Board
Statutory Authority: 3 Delaware Code, Section 10171(c) (3 Del.C. §10171(c) and 29 Del. C. § 4815 (b) 3 (c)
3 DE Admin. Code 1002

Proposed
Public Notice

The Delaware Jockey's Health and Welfare Board in accordance with 3 **Del.C.** §10171(c) and 29 Del. C. § 4815 (b) 3 (c), has proposed changes to its rules and regulations. The proposal amends the rules and regulations regarding criteria for an active Delaware Jockey to be eligible for health insurance under the Delaware Jockey's Health and Welfare Fund by increasing the minimum number of mounts from 25 to 50.

A public hearing will be held on April 11, 2012 at 9:15 a.m. in the second floor conference room of the Horseman's Office, located on the grounds of Delaware Park, 777 Delaware Park Boulevard, Wilmington, Delaware 19804 where members of the public can offer comments. Anyone wishing to receive a copy of the proposed regulations may obtain a copy from the Delaware Thoroughbred Racing Commission, 777 Delaware Park Boulevard, Wilmington, Delaware 19804. Persons wishing to submit written comments may forward these to the Commission at the above address. The final date to receive written comments will be at the public hearing.

The Commission will consider promulgating the proposed regulation at its regularly scheduled meeting following the public hearing.

2.1.1 An Active Delaware Jockey, who regularly rides in Delaware, is eligible for health insurance coverage under the fund, if the jockey had fifty (50) ~~twenty-five (25)~~ mounts in a Delaware Park season at Delaware Park; and
410382 DSN 2/23;3/15/2012

KENT COUNTY -
DEPARTMENT OF PUBLIC WORKS
INVITATION TO BID

Sealed Bids for the purchase and delivery of specified materials for the Central Transmission System Enhancements Project - Phase 3 will be received by Kent County Levy Court, at the Department of Public Works, 555 Bay Road, Dover, Delaware 19901, until **2:00 p.m., (local time) on April 5, 2012**, at which time they will be publicly opened and read aloud.

Materials shall include approximately 5,000 LF of 16 Inch Diameter Coated Ductile Iron Pipe, with associated fittings.

Contract Documents may be obtained or examined at the office of Kent County Levy Court, Depart-

State Public Legal Notice

State Public Legal Notice

State Public Legal Notice

City of Rehoboth Beach

LEGAL NOTICE

Public Hearing

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411283 DSN 3/8,15/2012

State Public Legal Notice

State Public Legal Notice

INMATE PUBLICATION LIST

SUPERVISED CUSTODY

Cochran, Dan	DUI
Minor, Sean	DUI
Terry, Willie	DUI

WORK RELEASE

Chase, Felton	Reck End 1st
Cooper, Joseph	VOP (Poss Use Cons)
Dorsey, George	Drug Deal
Laber, Lawrence	Theft
McCasline, Von	VOP (Poss Use Con)
Swanson, Kenneth	Civ Cont
Hamilton, Richard	VOP (Dist 300' Park)
Austin, Caison	Poss Dead Weap
	Dur Com Fel

412494 DSN 3/15/2012

LEGAL NOTICE
CATEGORICAL EXCLUSION
DATE: March 12, 2012

In accordance with the Environmental Review Procedures for the Delaware Drinking Water State Revolving Fund Regulation, the DHSS has granted the Town of Georgetown a Categorical Exclusion from the requirement to prepare a Finding of No Significant Impact statement for the proposed project as described below.

- Water Treatment Plant Upgrades

Comments supporting or disagreeing with this decision may be submitted for consideration no later than April 9, 2012 to the Office of Engineering, Edgehill Shopping Center, 43 South DuPont Highway, Dover, DE 19901. Attention: Doug Lodge, P.E.
412456 DSN 3/15,22/2012

Place your
FREE
CLASSIFIED AD
ONLINE 24/7
Place Your Ad Online,
From the Comfort

Public Notices
For more listings, go to www.newszap.com

Public Notice

FAMILY COURT FOR THE STATE OF DELAWARE NOTICE OF FAMILY COURT ACTION

TO: **Gabriel Custis,**
Respondent
Petitioner, **Gwendolyn Coleman** has filed a Guardianship petition against you in the Family Court of the State of Delaware for Kent County on Feb. 28, 2012. If you do not file an answer with the Family Court within 20 days after publication of this notice, exclusive of the date of publication, as required by statute, this action will be heard in Family Court without further notice.

IF YOU WISH TO BE REPRESENTED BY AN ATTORNEY IN THIS MATTER BUT CANNOT AFFORD ONE, YOU MAY BE ENTITLED TO HAVE THE COURT APPOINT AN ATTORNEY TO REPRESENT YOU FOR FREE. FOR MORE INFORMATION, CONTACT THE CLERK OF THE COURT AT FAMILY COURT.

DATE: 3/13/2012
Gwendolyn Coleman
412462 DSN 3/15/2012

State Public Legal Notice

NOTICE

Bernard Anthony, Age 52, former address, W. Tatnall St., Wilm., DE- date of death, 3-1-2012. Any relatives or friends are requested to imme-