

This presentation is an abbreviated version of the original PowerPoint presentation of June 23, 2005.

This version was presented at the Commissioners' Workshop of July 7, 2008.

# Rehoboth Beach Effluent Disposal Study

## Evaluation of Wastewater Discharge Alternatives

**Workshop**

June 23, 2005



**Stearns & Wheler, LLC**  
Environmental Engineers and Scientists

# Objectives

- Identify the most cost-effective and technically feasible solution for the City of Rehoboth Beach
- Identify the most cost-effective and technically feasible Regional solution

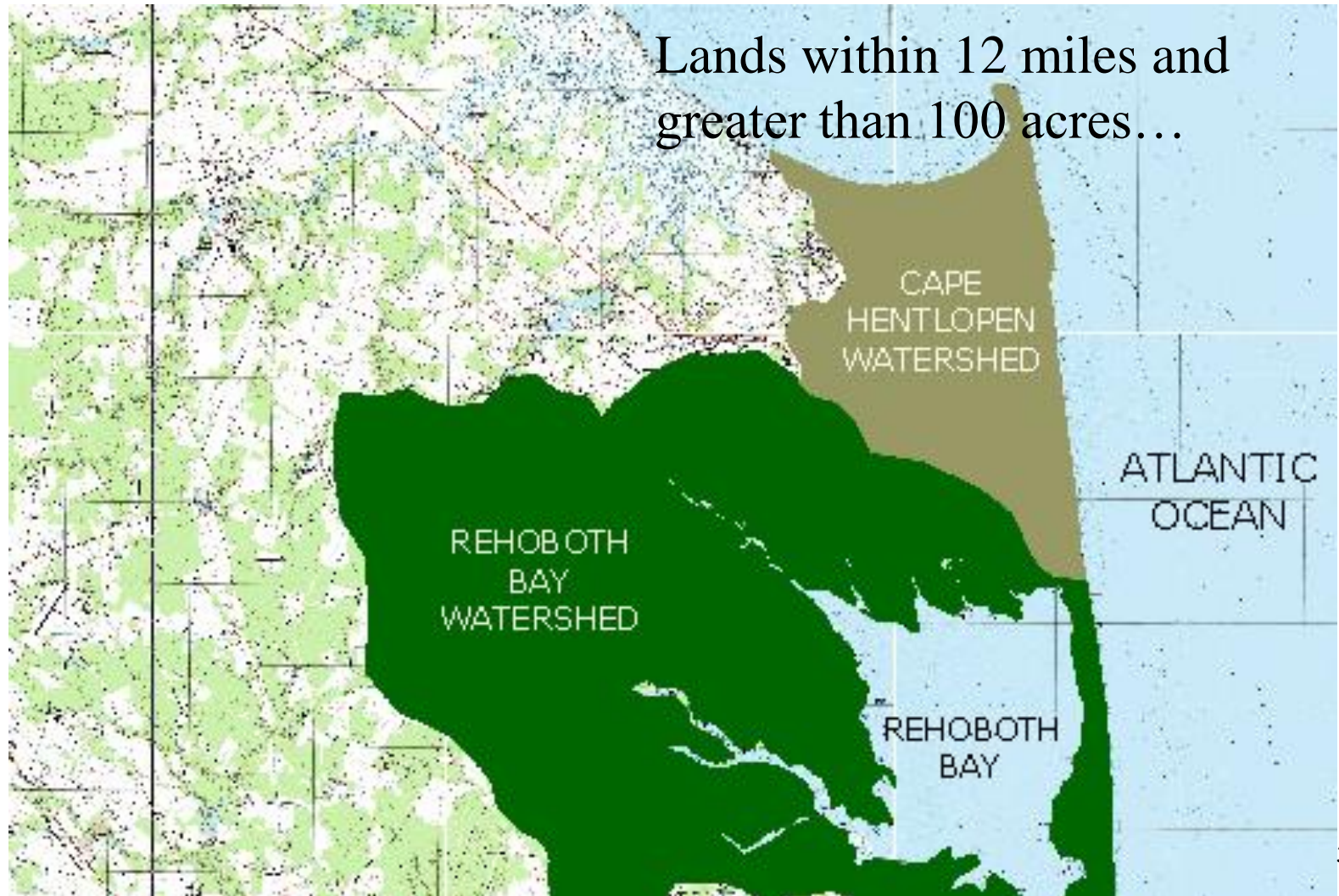
# Approach

Evaluate the following discharge alternatives

- **Rehoboth Beach Solutions**
  - Land Application
  - Rapid Infiltration Beds
  - Underground Injection
    - Deep Injection Wells
    - Shallow Injection Wells
  - Ocean Outfall
- **Regional (Rehoboth Beach and Sussex County)**
  - Ocean Outfall

# Land Availability Study

## Watershed



# Spray Irrigation Land Requirements

- **Area required**
  - Spray fields only 496 acres
  - Total (including buffers and lagoon) 740 acres
- **Not enough land available for purchase or lease**

# Spray Irrigation Cost Summary

Description	Cost
Rehoboth Beach WWTP Effluent Pump Station	\$1,000,000
Force Main to Lagoon (Holding Pond)	\$15,500,000
Spray Irrigation System	\$16,400,000
Land Purchase Price <sup>(1)</sup>	\$18,500,000
<b>Construction Cost (Year 2004 Dollars)<sup>(2)</sup></b>	<b>\$51,400,000</b>
<b>Engineering, Construction Inspection, Administration, Legal and Financial Expenses @ 30%</b>	<b>\$9,900,000</b>
<b>Total Project Cost</b>	<b>\$61,300,000</b>

Notes:

1. Land price estimate based on 740 acres @ \$25,000 per acre.
2. Cost includes 30 % contingency

# Rapid Infiltration Beds (RIB)



Falmouth, MA – 0.8 mgd facility



# Rapid Infiltration Beds

## Summary of Costs

Description	Cost
Rehoboth Beach WWTP Effluent Pump Station	\$1,000,000
Force Main to Holding Pond	\$15,500,000
Rapid Infiltration Bed System	\$18,900,000
Land Purchase Price <sup>(1)</sup>	\$7,350,000
<b>Construction Cost (Year 2004 Dollars)<sup>(2)</sup></b>	<b>\$42,750,000</b>
<b>Engineering, Construction Inspection, Administration, Legal and Financial Expenses @ 30%</b>	<b>\$10,600,000</b>
<b>Total Project Cost</b>	<b>\$53,350,000</b>

Notes:

1. Land price estimate based on 296 acres @ \$25,000 per acre.
2. Cost includes 30 % contingency. No contingency for land prices.

# Shallow Injection Well

## Advantages /Disadvantages

### Advantages

- Significantly less land requirements
- Recharge groundwater

### Disadvantages

- Nutrient transport ultimately into Inland Bays
- Complex operations
- High level of pretreatment required (drinking water standards)
- Periodic maintenance required (acid cleaning)
- Unknown aquifer hydraulic capacity
- Significant risk of mounding based on RIB data
- Potential increase of nitrates in groundwater
- No salt water intrusion aquifers available
- Pilot borings required to characterize well and aquifer

# DIW - Advantages/Disadvantages

## Advantages

- Significantly less land requirement
- No potential for ultimate discharge to surface water
- Primary drinking water standards not required

## Disadvantages

- Complex operations
- High level of pretreatment required including filtration and chlorination
- Periodic maintenance required
- Unknown subsurface below 900 ft
- Unknown aquifer hydraulic capacity
- Pilot borings required to characterize well and aquifer
- No qualified local contractor
- No groundwater recharge
- High Risk

# Deep Well Injection Summary of Costs

Description	Cost
Rehoboth Beach WWTP - Effluent Filters	\$2,680,000
Rehoboth Beach WWTP – Effluent Pump Station	\$1,000,000
Chlorination System	\$30,000
Force Main to Well Field	\$1,090,000
6,000 ft Deep Injection Well (20 wells @ \$4,000,000)	\$80,000,000
Well Field Pipe Manifold	\$760,000
Well Redevelopment	\$410,000
Land Purchase Price <sup>(1)</sup>	\$1,050,000
<b>Construction Cost (Year 2004 Dollars)<sup>(2)</sup></b>	<b>\$87,020,000</b>
<b>Engineering, Construction Inspection, Administration, Legal and Financial Expenses @ 30%</b>	<b>\$25,800,000</b>
<b>Total Project Cost</b>	<b>\$112,800,000</b>

Notes:

1. Land price estimate based on 42 acres @ \$25,000 per acre
2. Cost includes 30 % contingency. No contingency on land purchase.

# Ocean Outfall

- Location
- University of Delaware current model
- Mixing Model (CORMIX)
  - Rehoboth Beach only
  - Regional alternatives
  - Optimized diffuser design

# Ocean Outfall – Advantages/Disadvantages

## Advantages

- Minimal operation required (pumping)
- Minimal maintenance requirements (outfall inspections)
- No potential nutrient transport into Inland Bays
- Perceived as ultimate solution

## Disadvantages

- Public acceptance
- Permitting
- No groundwater recharge



# Ocean Outfall Summary of Costs

## Rehoboth Beach Only

Description	Cost
Rehoboth Beach WWTP Effluent Filters	\$2,860,000
Rehoboth Beach WWTP Effluent Pump Station	\$1,500,000
Effluent Force Main	\$2,670,000
Ocean Outfall	\$22,100,000
<b><u>Construction Cost (Year 2004 Dollars)<sup>(2)</sup></u></b>	<b>\$29,130,000</b>
<b>Engineering, Construction Inspection, Administration, Legal and Financial Expenses @ 30%</b>	<b>\$7,500,000</b>
<b>Total Project Cost</b>	<b>\$36,630,000</b>

## Regional Solution

Description	Cost
Rehoboth Beach WWTP Improvements	\$4,360,000
Wolfe Neck RWF Improvements	\$17,700,000
Rehoboth Beach Force Main	\$1,290,000
Wolfe Neck Force Main	\$3,710,000
Force Main from Tie-In to Ocean Outfall	\$1,950,000
Ocean Outfall	\$22,400,000
<b><u>Construction Cost (Year 2004 Dollars)<sup>(1)</sup></u></b>	<b>\$51,400,000</b>
<b>Engineering, Construction Inspection, Administration, Legal and Financial Expenses @ 30%</b>	<b>\$15,400,000</b>
<b>Total Project Cost</b>	<b>\$66,800,000</b>



# Alternative Comparison

Issue	Land Application	RIB	Underground Injection		Ocean Outfall
			Shallow	Deep	
Public Acceptance	+	0	-	-	-
Environmental Impacts	+	-	-	0	0
Nutrient Loading to Inland Bays	0	-	-	+	+
Permitting Issues	+	-	-	-	0
Reliability	0	0	-	-	+
Operability	0	+	-	-	+
Constructability	0	+	-	-	0
Long Term Solution	0	-	0	0	+
Groundwater Recharge	+	+	+	-	-
Land Requirement	-	-	0	0	+
Risk	+	0	-	-	+
Cost	0	0	0	-	+
<b>Summary</b>	<b>+</b>	<b>5</b>	<b>3</b>	<b>1</b>	<b>7</b>
	<b>0</b>	<b>6</b>	<b>4</b>	<b>3</b>	<b>3</b>
	<b>-</b>	<b>1</b>	<b>5</b>	<b>8</b>	<b>2</b>

# Objectives

- Identify the most cost-effective and technically feasible solution for the City of Rehoboth Beach
- Identify the most cost-effective and technically feasible Regional solution

# Conclusions

## Eliminate:

- 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

## Recommended Alternative:

- Ocean Outfall
  - Lowest PW Value
  - Regional solution

**Changes** from 2005 to 2008:

- Three alternatives that involve land application by spray irrigation are on the table: Artesian, Tidewater, Sussex County.
- Sussex County voted to not partner with Rehoboth in a regional ocean outfall project.

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