VOLUME AND CHARACTERISTICS OF COLLECTED STORM WATER DISCHARGES INTO THE LOOP SECTION OF THE ANCHORAGE CANAL, SOUTH BETHANY, DELAWARE

FINAL PROJECT REPORT

Submitted to:

The Center for the Inland Bays
467 Highway One
Lewes, DE

and

The Delaware Department of Transportation
P.O. Box 778
Dover, DE

Submitted by

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Acknowledgments

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Introduction

It is well documented that storm water discharges from urban areas can have a significant negative impact on the quality of receiving waters. These discharges contain sediment, oxygen demanding organic compounds, nutrients, toxics, and pathogenic microorganisms. The sources of these pollutants include both wet and dry atmospheric deposition, street refuse, vegetation, motor vehicle emissions, and eroded soil. While these sources of pollutants also are present in non-urban areas, attenuation in concentrations occurs during the surface runoff flow over pervious, vegetated areas. In contrast, urban areas typically have high percentages of impervious surfaces reducing the opportunity of attenuation, while increasing storm water volume and velocity.

Although the Inland Bays watershed is largely rural in character, significant areas where intensive development has occurred also exist. Included are areas on the barrier beach that separates these bays from the Atlantic Ocean. The area from the Town of Bethany Beach to the Town of Fenwick Island along DE 1, which includes the unincorporated area known as Middlesex Beach and the Town of South Bethany, is one of these intensively developed areas. DE 1 is a four-lane divided highway located parallel to the Atlantic Ocean that essentially bisects the area (Figure 1).

The area is primarily residential with single family homes on small lots being the predominate form of development. One exception is a high rise condominium complex know as Sea Colony, which is located between the ocean and DE 1 at the southern boundary of the Town of Bethany Beach. Commercial development in the area is limited and primarily is in the form of retail establishments located along the west side of DE 1 in Middlesex Beach. Given the intensity of development, the incidence of impervious surfaces; roofs, streets and highways, parking lots, etc., is high. Also, the intensity of development has resulted in the significant alteration of natural surface water drainage patterns by ditching and the installation of storm water collection systems.
Figure 1. Study location.
One example of this alteration of natural surface water drainage patterns is the storm water collection system that collects all of the surface runoff from the Sea Colony condominium complex and the area of Middlesex Beach from the western side of DE 1 to the dune line along the Atlantic Ocean. The area drained is approximately 62.5 acres. The discharge point for this storm water collection system is the Loop section of the Anchorage Canal located in the Town of South Bethany. The Anchorage Canal is a component of a rather extensive system of man-made lagoons located in the Town of South Bethany to the west of DE 1. This lagoon system is connected by Jefferson Creek and the Little Assawoman Canal to Little Assawoman Bay, a poorly flushed bay with a severely attenuated tidal range.

Since the installation of the storm water collection system described above, deterioration of water quality in the South Bethany lagoon system has occurred with the most severe impact seemingly occurring in the Anchorage Canal. Indicators of this deterioration in water quality include depressed dissolved oxygen levels, high enteric bacteria densities, algae blooms, and reductions in fin and shell fish populations. While it generally has been concluded that storm water discharges are responsible for this deterioration in water quality, supporting evidence has been lacking.

Objectives

This study had two complimentary objectives. The first was to delineate the nature of precipitation-runoff relationship in the drainage catchment discharging into the Loop Section of the Anchorage Canal and by extension for other urbanized catchments in the Inland Bays watershed. The second objective was to quantify storm water concentrations of selected pollutants associated with storms of various magnitudes to provide the basis for estimating seasonal and annual mass loadings for this catchment and again by extension for other urbanized catchments in the watershed.

Methodology

The discharge of storm water from the catchment described above into the Loop Section of the Anchorage Canal occurs through 36-inch pipe located on the west side of and running parallel to DE 1. All storm water flow
measurements and sample collection in this study occurred at the point where this pipe enters the Town of South Bethany, the intersection of Evergreen Road and DE 1. A storm water drain located directly above this pipe on the north west corner of this intersection provided the necessary access for equipment placement.

An Isco Series 6700 programmable sampling unit was used for the collection of all precipitation and storm water flow data as well as storm water samples for subsequent analysis to determine concentrations of selected physical and chemical parameters. Precipitation was measured using an Isco Model 674 tipping type rain gauge, which measures precipitation in 0.01 inch increments. An Isco Model 750 area-velocity sensor was used to determine storm water flow rate and volume based on measurements of velocity and level of flow.

The collection of precipitation and storm water flow data began in May 1998 and continued through September 1999. The collection of storm water samples began in September 1998 and also continued through September 1999.

For each storm event producing runoff, a flow composited runoff sample was collected and frozen for possible analysis to determine concentrations of nitrogen, phosphorus, and chemical oxygen demand (COD). Composite samples were collected from over 70 runoff events with 10 samples selected for analysis. Samples were selected for analysis with the objectives of achieving relatively uniform distributions of samples analyzed over the: 1) 12 month period of sample collection, and 2) range of storm sizes occurring during that period. Unfortunately, it was not possible to fully realize the first objective due the extended period of dry weather during the summer of 1999. The precipitation events that did occur in July and August of that year did not generate any significant runoff.

The concentrations of the following constituents were determined in all of the runoff samples analyzed: total Kjeldahl nitrogen, ammonia nitrogen, nitrate nitrogen, total phosphorus, soluble reactive phosphorus, and chemical oxygen demand (COD). Standard analytical methods (American Public Health Association, 1995) were used. All of these analyses were performed in
the water quality laboratory of the Department of Bioresources Engineering, University of Delaware.

In September 1999, three storm events producing runoff were sampled to characterize densities of the total and fecal coliform groups of bacteria. Again standard analytical methods (American Public Health Association, 1995) were used. These analyses were performed by Envirocorp, Inc., Harrington, Delaware.

Results and Discussion

Precipitation-Runoff Relationships

The precipitation-runoff relationship for the drainage catchment discharging into the Loop Section of the Anchorage Canal based on data collected from May 1998 through September 1999 is depicted in Figure 2. As indicated by the value for the coefficient of determination for the regression (R²), there appears to be a strong linear relationship between precipitation and runoff volume in this catchment. The regression equation indicates that: 1) the amount of precipitation necessary to generate runoff in this drainage catchment is relatively small, about 0.12 inches on average, and 2) approximately 42 percent of the precipitation falling on the catchment annually is discharged as collected runoff into the Loop Section of the Anchorage Canal. These findings are not surprising given the large fraction of the catchment covered by impervious surfaces. Using a relationship developed by the USEPA (1983), the runoff coefficient of 0.42 suggests that approximately 50 percent of this drainage catchment is covered by impervious surfaces.

On the basis of on precipitation records for Lewes and Georgetown, Delaware, average annual precipitation in South Bethany is about 44 inches per year. Thus, the average collected storm water discharge into the Loop Section of the Anchorage Canal is approximately 4,737,670 ft³ per year.

\[
4,737,670 \text{ ft}^3 \times \frac{0.028317 \text{ m}^3}{1 \text{ ft}^3} = 134,156 \text{ m}^3/\text{yr}
\]

In Figures 3 and 4, respective precipitation-runoff relationships for April through October and November through March are depicted. As indicated by the noted R² values, both of these relationships also appear to be highly linear. However, they indicate that there is a significant seasonal difference
Figure 2. Observed relationship between precipitation and runoff for the Town of South Bethany Anchorage Canal catchment.

\[ y = -12,831 + 107,966x \quad R^2 = 0.84 \]

\[ y = 149,118 \cdot 10^{-3} \times 0.62 \cdot 9317 \text{ m}^3 \quad 1.5 \text{ in. m}^3 \quad 4,222 \text{ m}^3 \text{ per 1.5 in. rain event}. \]

\[ t = \frac{V_0}{Q} \]

6 \text{ m}^3 \times 2 \text{ m depth} = 13,488 \text{ m}^3 \text{ volume of detention} \]

6 \text{ m}^3 \text{ per 4,222 m}^3 \text{ or 3.18 days detention.
$y = -9489 + 85,795x \quad R^2 = 0.89$

Figure 3. April through October relationship between precipitation and runoff for the Town of South Bethany Anchorage Canal catchment.
Figure 4. November through March relationship between precipitation and runoff for the Town of South Bethany Anchorage Canal catchment.
in the relationship between precipitation and runoff volume with approximately 51 percent of the precipitation discharged as runoff from November through March versus 34 percent from April through October. Again, this finding is not surprising given higher antecedent soil moisture levels typical during the late fall through early spring.

Runoff Characteristics

In Tables 1 through 4, the results of the analyses of flow composited runoff samples to determine concentrations of nitrogen, phosphorus, and COD are summarized. As shown in these tables, there was significant variation among samples in concentrations of all the constituents measured. Statistical analysis revealed no linear correlation of significance ($P<0.20$) between concentration and runoff volume for any constituent. This finding is consistent with the conclusion of the Nationwide Urban Runoff Program study (USEPA, 1983) that there are no significant linear correlations between event mean concentrations and runoff volume.

As also shown in Table 1, the mean concentrations of total nitrogen and total phosphorus in the runoff discharged into the Loop Section of the Anchorage Canal are lower than typical minimum values for urban runoff (Novotny and Olem, 1994). They also are lower than mean concentration values for a median urban site (USEPA, 1983). This also is true for the mean concentration of inorganic nitrogen (Table 2) and chemical oxygen demand (Table 4). Given that the land use in this catchment is predominately residential, these relatively low mean concentrations of nitrogen, phosphorus, and chemical oxygen demand are not unexpected. Unfortunately, the lack of precipitation, and thus runoff samples, during the summer of 1999 precluded the opportunity to determine if the high volume of traffic during summer months in the catchment has any impact on pollutant concentrations.

Although the concentrations of nitrogen and phosphorus in the storm water runoff discharged into the Loop Section of the Anchorage Canal are relatively low when compared to typical values for urban runoff (Table 1), the annual mass loadings, especially of nitrogen, appear significant. This is due to the
Table 1. Summary of concentrations of total nitrogen and total phosphorus in surface runoff collected at the intersection of State Highway No. 1 and Evergreen Road, South Bethany, Delaware.

<table>
<thead>
<tr>
<th>Date</th>
<th>Precipitation, in</th>
<th>Runoff, ft³</th>
<th>Total N, ppm</th>
<th>Total P, ppm</th>
</tr>
</thead>
<tbody>
<tr>
<td>10/12-13/98</td>
<td>0.44</td>
<td>7,731</td>
<td>1.62</td>
<td>0.15</td>
</tr>
<tr>
<td>11/11/98</td>
<td>0.58</td>
<td>14,725</td>
<td>1.62</td>
<td>0.12</td>
</tr>
<tr>
<td>12/23-24/98</td>
<td>0.27</td>
<td>9,025</td>
<td>1.23</td>
<td>0.08</td>
</tr>
<tr>
<td>1/8/99</td>
<td>0.15</td>
<td>8,807</td>
<td>4.28</td>
<td>0.12</td>
</tr>
<tr>
<td>2/7-8/99</td>
<td>0.55</td>
<td>68,216</td>
<td>2.57</td>
<td>0.19</td>
</tr>
<tr>
<td>2/12-13/99</td>
<td>0.37</td>
<td>39,250</td>
<td>1.32</td>
<td>0.07</td>
</tr>
<tr>
<td>3/21-24/99</td>
<td>1.30</td>
<td>217,920</td>
<td>2.14</td>
<td>0.08</td>
</tr>
<tr>
<td>4/9-10/99</td>
<td>0.72</td>
<td>59,195</td>
<td>1.53</td>
<td>0.16</td>
</tr>
<tr>
<td>4/23-24/99</td>
<td>0.63</td>
<td>64,047</td>
<td>1.94</td>
<td>0.06</td>
</tr>
<tr>
<td>6/20-21/99</td>
<td>1.43</td>
<td>75,228</td>
<td>1.76</td>
<td>0.08</td>
</tr>
<tr>
<td>Mean ± standard deviation</td>
<td>-</td>
<td>-</td>
<td>2.00±0.85</td>
<td>0.11±0.04</td>
</tr>
<tr>
<td>Median urban site mean concentration*</td>
<td>-</td>
<td>-</td>
<td>2.44-3.08</td>
<td>0.37-0.47</td>
</tr>
<tr>
<td>Typical values for urban runoff†</td>
<td>-</td>
<td>-</td>
<td>3-10</td>
<td>0.2-1.7</td>
</tr>
</tbody>
</table>

*U.S. Environmental Protection Agency, 1983.
Table 2. Partitioning of nitrogen in surface runoff collected at the intersection of State Highway No. 1 and Evergreen Road, South Bethany, Delaware.

<table>
<thead>
<tr>
<th>Date</th>
<th>Precipitation, in</th>
<th>Runoff, ft³</th>
<th>Organic N, ppm (mg/L)</th>
<th>Inorganic N, ppm (mg/L)</th>
</tr>
</thead>
<tbody>
<tr>
<td>10/12-13/98</td>
<td>0.44</td>
<td>7,731</td>
<td>1.10</td>
<td>0.52</td>
</tr>
<tr>
<td>11/11/98</td>
<td>0.58</td>
<td>14,725</td>
<td>0.84</td>
<td>0.76</td>
</tr>
<tr>
<td>12/23-24/98</td>
<td>0.27</td>
<td>9,025</td>
<td>0.58</td>
<td>0.65</td>
</tr>
<tr>
<td>1/8/99</td>
<td>0.15</td>
<td>8,807</td>
<td>1.40</td>
<td>2.88</td>
</tr>
<tr>
<td>2/7-8/99</td>
<td>0.55</td>
<td>68,216</td>
<td>1.51</td>
<td>1.06</td>
</tr>
<tr>
<td>2/12-13/99</td>
<td>0.37</td>
<td>39,250</td>
<td>1.24</td>
<td>0.08</td>
</tr>
<tr>
<td>3/21-24/99</td>
<td>1.30</td>
<td>217,920</td>
<td>1.44</td>
<td>0.70</td>
</tr>
<tr>
<td>4/9-10/99</td>
<td>0.72</td>
<td>59,195</td>
<td>1.04</td>
<td>0.49</td>
</tr>
<tr>
<td>4/23-24/99</td>
<td>0.63</td>
<td>64,047</td>
<td>1.30</td>
<td>0.64</td>
</tr>
<tr>
<td>6/20-21/99</td>
<td>1.43</td>
<td>75,228</td>
<td>0.95</td>
<td>0.81</td>
</tr>
</tbody>
</table>

Mean ± standard deviation: 1.14±0.28, 0.86±0.71

Median urban site mean concentration*: 0.76-0.96†

*U.S. Environmental Protection Agency, 1983.
†Sum of nitrite- and nitrate-nitrogen.
Table 3. Partitioning of phosphorus in surface runoff collected at the intersection of State Highway No. 1 and Evergreen Road, South Bethany, Delaware.

<table>
<thead>
<tr>
<th>Date</th>
<th>Precipitation, in</th>
<th>Runoff, ft³</th>
<th>Organic P, ppm</th>
<th>Inorganic P, ppm</th>
</tr>
</thead>
<tbody>
<tr>
<td>10/12-13/98</td>
<td>0.44</td>
<td>7,731</td>
<td>0.03</td>
<td>0.12</td>
</tr>
<tr>
<td>11/11/98</td>
<td>0.58</td>
<td>14,725</td>
<td>0.01</td>
<td>0.11</td>
</tr>
<tr>
<td>12/23-24/98</td>
<td>0.27</td>
<td>9,025</td>
<td>0.01</td>
<td>0.07</td>
</tr>
<tr>
<td>1/8/99</td>
<td>0.15</td>
<td>8,807</td>
<td>0.03</td>
<td>0.09</td>
</tr>
<tr>
<td>2/7-8/99</td>
<td>0.55</td>
<td>68,216</td>
<td>0.02</td>
<td>0.17</td>
</tr>
<tr>
<td>2/12-13/99</td>
<td>0.37</td>
<td>39,250</td>
<td>0.01</td>
<td>0.06</td>
</tr>
<tr>
<td>3/21-24/99</td>
<td>1.30</td>
<td>217,920</td>
<td>0.06</td>
<td>0.02</td>
</tr>
<tr>
<td>4/9-10/99</td>
<td>0.72</td>
<td>59,195</td>
<td>0.02</td>
<td>0.14</td>
</tr>
<tr>
<td>4/23-24/99</td>
<td>0.63</td>
<td>64,047</td>
<td>0.03</td>
<td>0.03</td>
</tr>
<tr>
<td>6/20-21/99</td>
<td>1.43</td>
<td>75,228</td>
<td>0.05</td>
<td>0.03</td>
</tr>
<tr>
<td>Mean ± standard deviation</td>
<td>-</td>
<td>-</td>
<td>0.03±0.02</td>
<td>0.08±0.05</td>
</tr>
</tbody>
</table>
Table 4. Chemical oxygen demand concentrations and loadings in surface runoff collected at the intersection of State Highway No. 1 and Evergreen Road, South Bethany, Delaware.

<table>
<thead>
<tr>
<th>Date</th>
<th>Precipitation, in</th>
<th>Runoff, ft³</th>
<th>COD, ppm</th>
</tr>
</thead>
<tbody>
<tr>
<td>10/12-13/98</td>
<td>0.44</td>
<td>7,731</td>
<td>34</td>
</tr>
<tr>
<td>11/11/98</td>
<td>0.58</td>
<td>14,725</td>
<td>52</td>
</tr>
<tr>
<td>12/23-24/98</td>
<td>0.27</td>
<td>9,025</td>
<td>29</td>
</tr>
<tr>
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<td>0.15</td>
<td>8,807</td>
<td>28</td>
</tr>
<tr>
<td>2/7-8/99</td>
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<td>68,216</td>
<td>22</td>
</tr>
<tr>
<td>2/12-13/99</td>
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<td>39,250</td>
<td>27</td>
</tr>
<tr>
<td>3/21-24/99</td>
<td>1.30</td>
<td>217,920</td>
<td>24</td>
</tr>
<tr>
<td>4/9-10/99</td>
<td>0.72</td>
<td>59,195</td>
<td>7</td>
</tr>
<tr>
<td>4/23-24/99</td>
<td>0.63</td>
<td>64,047</td>
<td>54</td>
</tr>
<tr>
<td>6/20-21/99</td>
<td>1.43</td>
<td>75,228</td>
<td>9</td>
</tr>
<tr>
<td>Mean ± standard deviation</td>
<td>-</td>
<td>-</td>
<td>29±15</td>
</tr>
<tr>
<td>Median urban site mean concentration*</td>
<td>-</td>
<td>-</td>
<td>73-92</td>
</tr>
</tbody>
</table>

*U.S. Environmental Protection Agency, 1983.
volume of storm water collected and discharged in this drainage catchment. On the basis of on the mean concentration of total nitrogen of 2 mg per L and an average storm water discharge volume of 4,737,670 ft$^3$ in a year with an average amount of precipitation, an estimated 592 lb of nitrogen is discharged annually into the Loop Section of the Anchorage Canal. Forty-three percent of the nitrogen discharged is inorganic nitrogen, the sum of ammonia and nitrite and nitrate nitrogen. The estimated mass of phosphorus discharged is 33 lb per year with 38 percent being inorganic forms of phosphorus.

On the basis of on the mean COD concentration of 29 mg per L (Table 4), the average potential oxygen demand of the organic compounds in the storm water discharged into the Loop Section of the Anchorage Canal is 8,580 lb annually. On the basis of on the work of Ellis (1986), it is probable that the actual oxygen demand exerted will be only a small fraction, approximately one-eighth, of the estimated mass of COD discharged annually. However, the magnitude of this discharge, 1,072 lb of biochemical oxygen demand (BOD) per year, is not insignificant. It is equal to an annual discharge of over 500,000 gal of untreated domestic sewage with a BOD of 250 mg per L. This translates into a discharge of slightly more than 1,400 gal per day.

Table 5 summarizes the results of the estimates of total and fecal coliform densities expressed as colony forming units (CFU) per 100 ml. The observed variability in both total and fecal coliform densities is characteristic of urban storm water runoff. Typically, total coliform densities in urban runoff are in the range of $10^3$ to $10^8$ CFU per 100 ml (Novotny and Olem, 1994). As the values in Table 5 indicate, all of the observed densities are within the lower half of this range of values.

Summary and Conclusions

The results of this study indicate that the Sea Colony to South Bethany storm water drainage catchment discharging into the Loop Section of the Anchorage Canal has a relatively high runoff coefficient of 0.42. This is a reflection of the density of development in the catchment and the associated fraction covered by impervious surfaces. Although the area of the catchment is relatively small, approximately 62.5 acres, average volume of storm water discharged
Table 5. Results of analyses of surface runoff discharged into the Anchorage Canal to determine total and fecal coliform densities, colony forming units per 100 ml.

<table>
<thead>
<tr>
<th>Date</th>
<th>Precipitation, in</th>
<th>Runoff, ft³</th>
<th>First flush*</th>
<th>Composite†</th>
</tr>
</thead>
<tbody>
<tr>
<td>9/9/99</td>
<td>1.27</td>
<td>89,349</td>
<td>90,000</td>
<td>36,363</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>35,000</td>
<td>1,272</td>
</tr>
<tr>
<td>9/15-16/99</td>
<td>3.41</td>
<td>315,457</td>
<td>&gt;800,000</td>
<td>44,545</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>63,333</td>
<td>7,217</td>
</tr>
<tr>
<td>9/21/99</td>
<td>0.76</td>
<td>63,361</td>
<td>700,000</td>
<td>6,000</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>3,000</td>
<td>3,000</td>
</tr>
</tbody>
</table>

*First 1,000 ft³ of runoff.
†Remaining flow at 4,000 ft³ intervals up to 88,000 ft³.
into the Loop Section of the Anchorage Canal is approximately 4,737,670 ft$^3$
per year.

The concentrations of nitrogen, phosphorus, COD, and the total and fecal
coliform groups of bacteria in the storm water discharged into the Loop
Section of the Anchorage Canal are relatively low when compared to typical
concentrations in urban runoff. However, the volume of storm water
discharged annually results in significant inputs of nitrogen, COD, and enteric
microorganisms to the Anchorage Canal. Assessing the impacts of these
inputs on ambient water quality was not within the scope of this study. It
seems reasonable to conclude, however, that the impacts of these pollutant
discharges are significant given that poorly flushed man-made lagoon
systems inherently have limited assimilative capacity. An additional factor
exacerbating the water quality problem in the South Bethany lagoon system is
the deteriorated water quality status of the Inland Bays. Thus, tidal exchange
probably does not significantly dilute pollutant concentrations in the lagoon
system.

**Recommendations**

The available options for ameliorating the impact of the storm water
discharges into the Loop Section of the Anchorage Canal appear to be limited
due to the limited land area currently available between the DE 1 right-of-way
and the head of the Anchorage Canal. To be effective, either rapid sand
filtration or use of a constructed wetland also would require construction of a
flow equalization basin to moderate peak runoff event flows. Even if the
Loop Section of the Canal could be utilized in addition to the land area
currently available for flow equalization and treatment, the size of the site
still might be adequate. The development of a preliminary design of a storm
water capture and treatment system would be the only way to realistically
assess the feasibility of this option.

Another option would be to redirect the storm water collected in this
drainage catchment directly to the Little Assawoman Canal. The feasibility of
this option would depend, in part, on the results of an assessment of the
impact of the discharge on ambient water quality in the Canal and the
potential for treatment if necessary. Finally, the option of ocean discharge, which may be the most logical option, should be considered.

References


SOUTH BETHANY STORM WATER DRAINAGE AND WATER QUALITY MEETING

Wednesday, April 25, 2001
9:00 a.m.

AGENDA

Introductions (Sal Aiello)

Opening Remarks (Sal Aiello)

9:00 a.m. ✓

9:10 a.m. ✓

9:20 a.m. ✓

9:20 a.m. ✓

9:35 a.m. ✓

10:05 a.m. ✓

10:35 a.m. ✓

10:45 a.m. ✓

11:15 a.m. ✓

12:00 Noon ✓

12:45 p.m. ✓

1:30 p.m. ✓

2:45 p.m. ✓

3:00 p.m. ✓

✓

Brief History of South Bethany Canals Including Installation of Storm Water (Sal Aiello and Joe Farrell)

Presentation of Study – Final Project Report (Dr. Jack Martin)

Discussion of Conclusions of Study (Dr. Martin, Joe Farrell, Dr. Richards)

Break

Comments by Secretary DiPasquale, John Hughes, Randy Greer, Rob McCreary, Allan Redden, Salvador Palalay, and Others

Understanding the Problems of the South Bethany Canals

Lunch (Supplied by South Bethany)

Visit Site

Potential Solutions – Cost and Impact

Summary and Recommendations

Close

Note: This is a suggested agenda and changes can be made by all parties involved.

P.S. Saal Palalay, please add any other people you deem necessary.

SVA:ie:Storm Water Drainage and Water Quality Meeting Agenda

4/6/01

Note: According to an agreement reached with the people in attendance at this meeting from DelDOT and DNREC, because of their limited time, no one from South Bethany will speak except Councilman Sal Aiello.

Richard Ronan, Acting Mayor
AGENDA

Wednesday, April 25, 2001
9:00 a.m.

9:00 a.m.   Introductions (Sal Aiello)
9:10 a.m.   Opening Remarks (Sal Aiello)
9:20 a.m.   Brief History of South Bethany Canals Including Installation of Storm Water (Sal Aiello and Joe Farrell)
9:35 a.m.   Presentation of Study – Final Project Report (Dr. Jack Martin)
10:05 a.m.  Discussion of Conclusions of Study (Dr. Martin, Joe Farrell, Dr. Richards)
10:35 a.m.  Break
10:45 a.m.  Comments by Secretary DiPasquale, John Hughes, Randy Greer, Rob McCleary, Allan Redden, Salvador Palalay, and Others
11:15 a.m.  Understanding the Problems of the South Bethany Canals
12:00 Noon Lunch (Supplied by South Bethany)
12:45 p.m.  Visit Site
1:30 p.m.   Potential Solutions – Cost and Impact
2:45 p.m.   Summary and Recommendations
3:00 p.m.   Close

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P.S. Saal Palalay, please add any other people you deem necessary.

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SVA:lc:Storm Water Drainage and Water Quality Meeting Agenda
4/6/01

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Richard Ronan, Acting Mayor
10 January 2001

Dr. Bruce Richards
The Center for the Inland Bays
467 Highway One
Lewes, Delaware 19958

Mr. Rob McCleary
The Delaware Department of Transportation
Field Service Section
P.O. Box 778
Dover, Delaware 19903

Gentlemen:

Enclosed is the final report for the project, "Assessment of the Significance of Urban Storm Water Discharges in the Inland Bays Watershed." The financial support by the Center for the Inland Bays and the Delaware Department of Transportation is sincerely appreciated.

If there are any questions, please do not hesitate to contact me.

Yours truly,

John H. Martin, Jr.

enclosure

cc: S. Aiello, Town of South Bethany
    C. Balascio, University of Delaware
    J. Farrell, University of Delaware