Section 4
May River Watershed Analysis

This section describes the physical features of the May River watershed, water quantity and water quality problems, modeling results, alternatives evaluation, and recommendations.

4.1 Overview

The May River watershed is located south of the Broad River (see **Figure 4-1**). For the purposes of this study, the area included in the watershed analysis includes open water, tidal marsh and upland area in Bluffton Township and the Town of Bluffton that is tributary to the May River. Major May River tributaries included in the analysis are Bull Creek and Bass Creek.

For the hydrologic and hydraulic analysis of the Primary Stormwater Management System (PSMS), the watershed includes several "hydrologic" basins. These are listed in **Table 4-1**, and presented in **Figure 4-2**. Table 4-1 lists the basin names, tributary areas, number of subbasins, and average subbasin size. Hydrologic and hydraulic model calculations were completed to evaluate peak flows and water elevations within the PSMS. The model results were compared to critical water elevations (e.g., roadway elevations) to identify potential problem areas and evaluate alternative management strategies.

For the analysis of pollution loads and receiving water quality, the watershed was subdivided into "water quality" basins, and the tidal receiving waters were subdivided into receiving water "segments". These are listed in **Table 4-2**, and presented in **Figure 4-3**. Pollution loads were calculated for each of the water quality basins. For fecal coliform bacteria, tidal river water quality model calculations were completed to evaluate river bacteria concentrations. The model results were compared to the tidal river bacteria standards to identify potential problem areas and evaluate alternative management strategies.

4.2 Hydrologic and Hydraulic Analysis

CDM and T&H used the Interconnected Pond Routing Model (ICPR), Version 3 for the hydrologic and hydraulic analyses of the PSMS in the May River watershed. The analyses included modeling of 24-hour design storms with return periods of 2 years, 10 years, 25 years, and 100 years. Analyses were conducted for existing and future land use conditions, with and without alternative management strategies.

The ICPR model is a "link-node" model, representing the PSMS as a series of nodes (stream locations) connected by links (open channels, pipes, culverts). Figures in Appendix B show model schematics of the May River PSMS basins, with a separate schematic for each basin.

4.2.1 Hydrologic and Hydraulic Parameters

In the hydrologic model development, each May River basin consisted of one of more subbasins. Section 2.2 of this report describes how appropriate parameter values were developed for model subbasins. These parameters include hydrologic basin area, curve number, and time of concentration.

Table 4-3 lists the hydrologic parameter values for the May River PSMS subbasins. Each model subbasin is identified by an ICPR model ID number. Curve number and time of concentration values are presented for existing land use and future land use conditions. The future land use values generally show a higher curve number and lower time of concentration than the existing land use as a result of anticipated future development.

Hydraulic summary information for the May River PSMS basins is presented in **Table 4-4**. For each basin, the table lists data regarding open channel sections, stream crossings, and other hydraulic features. Open channel data includes the number of defined open channel segments, and the total length of the channel segments. Stream crossing data includes the number of stream crossings, the total number of culverts associated with those crossings, and the number of crossings that are actually bridge openings rather than culverts. Other features data includes the number of storage nodes, weirs, and tide gates that are part of the PSMS. Note that the number of weirs includes actual weir structures (e.g., inline weir across channel) as well as roadways that act as weirs if road overtopping is occurring.

Details regarding the stream crossings are presented in **Table 4-5**. For each stream crossing, the table presents the road name, ICPR model link ID, culvert dimensions and length, invert elevation, roadway elevation, and appropriate level of service.

Details regarding specific open channel segments, storage areas, weirs and tide gates are presented in Appendix B.

4.2.2 Model Results

Tables in Appendix B list the peak flow values for the May River subbasins. Each table lists peak flows for one of the return periods analyzed in this study, which include 2-year, 10-year, 25-year, and 100-year return periods. In each of the tables, the peak flows are listed by subbasin for various land cover and stormwater management controls, which include the following:

- Undeveloped land
- Existing land use without peak shaving controls
- Existing land use with existing peak shaving controls
- Future land use without peak shaving controls

- Future land use with existing and future peak shaving controls

It should be noted that the tables include values for "uncontrolled" and "controlled" peak flows for the 2-year, 10-year and 25-year design storms. The "uncontrolled" peak flow assumes no peak shaving facilities in the subbasin. In contrast, the "controlled" value accounts for peak shaving facilities in the subbasin.

For existing land use, aerial maps and local information were used to estimate the percentage of existing urban development that is served by peak shaving facilities. The "controlled" peak flow value was then calculated by considering the difference in peak flow between totally undeveloped conditions and existing conditions with no controls. For example, suppose that a subbasin of 100 acres has an undeveloped 2-year peak flow of 20 cfs, and an uncontrolled existing peak flow of 50 cfs, and further suppose that 60 percent of the urban development is controlled by peak shaving facilities. In this case, it is assumed that the existing peak flow is reduced by 60 percent of the difference between undeveloped and developed peak flow (50 – 20 = 30 cfs; 60 percent of 30 cfs = 18 cfs reduction due to peak shaving), and therefore the maximum controlled peak flow will be 32 cfs (50 – 18).

For future land use, the "controlled" peak flow is set equal to the "controlled" peak flow for existing land use, because new development is subject to State and County peak flow regulations. Note, however, that the future condition will still generate more stormwater runoff volume, even though the peak flow is the same. The result is that the peak flow rate will be sustained for a longer period of time under future conditions.

Tables in Appendix B list the peak water elevation values for model node locations along the May River PSMS. Each table lists peak stages for one of the return periods analyzed in this study, which include 2-year, 10-year, 25-year, and 100-year return periods. In each of the tables, the peak stages are listed for existing and future land use conditions, with the existing stormwater hydraulic system.

Specific problem areas identified by the modeling are listed in **Table 4-6** and presented in **Figure 4-4**. For each area, the table identifies the road crossing, associated model ID, design storm, "critical elevation" (e.g., top-of-road elevation), and maximum water elevation for the listed design storm. As discussed earlier in Section 2, roads considered evacuation routes were evaluated with the 100-year design storm, and other roads were evaluated for the 25-year design storm.

Structural flooding was also considered for the 100-year design storm. In locations where the PSMS evacuation route crossings are overtopped by the 100-year design storm, figures were developed showing the approximate area of inundation upstream of the overtopped road. These figures are presented in Appendix B. In addition, the peak 100-year water elevations were compared to Federal Emergency Management Agency (FEMA) base flood elevations, and results showed that the FEMA elevations (based on storm surge) are always greater than the modeled 100-year peak stages, suggesting that structures built in accordance with the FEMA base flood elevations should not be flooded.

Table 4-6 indicates that five road crossings are being overtopped by the design storm events. Five of the hydrologic and hydraulic basins have no problems, and the rest have one or two problem areas.

Evaluation of solutions to prevent these problems is discussed in the next section of this report.

4.2.3 Management Strategy Alternatives

The problems areas listed in Table 4-6 were evaluated by modifying the culverts in the ICPR hydraulic model. The ICPR model for existing conditions was modified to either add one or more culverts to the existing culvert(s), or to replace the existing culvert(s) with one or more new culverts. Replacement was typically considered if the model results showed that the existing culvert or culverts passed a small fraction of the peak flow, and most of the peak flow passed over the road for the design storm. In contrast, addition of one or more culverts was typically assumed in cases where the existing system was able to pass most of the peak flow, and a small fraction of the peak flow is passed over the road.

The resulting improvements are presented in **Table 4-7**. The table presents the size of the existing culverts, plus the size of the added or replacement culvert(s). For the analysis, box culverts were used as the added or replacement culverts. There is no reason that a different culvert shape could not be used, as long as the conveyance capacity of the culvert(s) remains the same. Also, the depth of the added or replacement culverts was usually assumed to be equal to the depth of the existing culvert(s), because there was often little freeboard between the crown of the existing culvert(s) and the top of the road. The depth of the added or replacement culvert(s) was greater than that of the original culvert(s) only when there was sufficient freeboard.

For a few locations (e.g., Ulmer Road in Alljoy Landing basin), the proposed solution also included raising the road. In that case, the existing road elevation (5.8 ft NAVD) is only 0.2 feet higher than the assumed tailwater condition (mean annual high tide of 5.6 ft NAVD). In general, “low” roads such as Ulmer Road were raised so that the road elevation was 2 feet above the 1-year mean high tide, in this case to 7.6 feet NAVD.

4.3 Water Quality Analysis

CDM and T&H used the Watershed Management Model (WMM) and the Water Quality Analysis Simulation Program (WASP) for the water quality analysis of the May River watershed. WMM was used to calculate average annual flows and average annual loads of various water quality constituents, including fecal coliform bacteria, total nitrogen (total N), total phosphorus (total P), BOD, lead, zinc and total suspended solids (TSS). WMM was also used to calculate the geometric mean bacteria concentration of the flows from the watershed to the tidal river system. The flow and geometric mean concentration data were used as input to the WASP model, which accounted for tidal mixing and bacteria loss rates, to evaluate bacteria concentrations in the tidal river system for existing and future conditions. Measured salinity and bacteria concentrations were used to calibrate key model parameters such as tidal mixing coefficients and bacteria loss rates for existing conditions. The same parameter values were used for evaluation of future conditions, which reflect higher flows and loads from the watershed.

4.3.1 Land Use and BMP Coverage

Table 4-8 presents the existing land use and future land use estimates for the May River water quality basins. The existing land use data were gathered from a number of sources, including February 2002 aerials, County existing land use and tax parcel maps, National Wetlands Inventory (NWI) and USGS quadrangle maps, plus local knowledge of development completed between February 2002 and June 2003. The future land use map was developed by "filling in" the existing land use map and by replacing undeveloped area with anticipated urban development. The anticipated future development was characterized based on the Beaufort County and Hilton Head Island future land use maps and zoning maps.

Under existing land use conditions, 26 percent of the May River watershed area consists of urban systems (e.g., residential, commercial, golf course) and 74 percent consists of natural systems (e.g., forest, water/wetlands, tidal open water/marsh). Based on the imperviousness values assigned to urban land uses, urban impervious area covers about 5 per cent of the watershed.

Under future land use conditions, 55 percent of May River watershed area consists of urban systems, and 45 percent consists of natural systems. The major change in land use distribution is the conversion of forest/rural land to low and medium density residential land uses. As a result of projected future development, urban imperviousness increases to about 11 percent of the watershed.

Estimates of BMP coverage for existing and future land use in presented in **Table 4-9**. The existing land use values reflect local knowledge of development with respect to the implementation of BMPs in Beaufort County in accordance with the County BMP Manual. Future BMP coverage was estimated presuming that all new development would be treated by BMPs in accordance with the County BMP Manual. Values are presented for developed urban land uses. The "total" value for each water quality basin is based on the total urban area served by BMPs relative to the total urban land area. The overall "total" BMP coverage (lower right corner value in the two tables) reflects the percentage of all urban land in the watershed that is served by BMPs.

Under existing land use conditions, 17 percent of the urban systems in the watershed served by BMPs. Under future land use conditions, 66 percent of the urban systems are served by BMPs. This large increase from existing to future reflects both the substantial increase in urban land use and the 100 percent coverage of the new development with BMPs in accordance with the County BMP Manual.

4.3.2 Septic Tanks and Point Sources

Estimates of septic tank usage for existing and future land use in presented in **Table 4-10**. The existing land use values reflect areas that are not designated as "sewered" areas by the Beaufort-Jasper Water & Sewer Authority. For future development, areas that are zoned "rural" or "conservation" were assumed to be served by septic tanks, and other areas were assumed to be served by sewer.

Values are presented for developed urban land uses. The "total" value for each water quality basin is based on the total urban area served by septic tanks relative to the total urban land area. The overall "total" septic tank coverage (lower right corner value in the two tables) reflects the percentage of all urban land in the watershed that is served by septic tanks.

For existing land use conditions, 53 percent of the urban systems in the watershed (e.g., residential, commercial) are served by septic. Under future land use conditions, 27 percent of the urban systems are served by septic tanks. This reflects the presumption that most of the new development will be sewered.

Based on available data, the estimated wastewater discharge under existing conditions is 0.3 million gallons per day (mgd) of land application (e.g., golf course irrigation), and the future discharge is expected to be 0.8 mgd based on increase in residential land between existing and future conditions. There are no direct discharges to receiving waters in the watershed.

4.3.3 Model Annual Pollution Load Results

Average annual constituent loads were calculated for the May River water quality basins using the methodology described in Section 2.4 of the report. Loads were calculated for existing and future (build-out) land use conditions. The loads were tabulated and compared to evaluate the relative changes in loads due to new development, assuming that the new development is controlled by BMPs in accordance with the County BMP Manual.

The results are presented in **Table 4-11** for existing and future land use conditions. For each water quality basin and land use condition, the table lists the basin tributary area, total average annual flow in acre-feet, and the average annual loads for each of the seven constituents considered in the study. With the exception of fecal coliform bacteria, the loads are presented in units of pounds per year. Fecal coliform results are presented in units of counts per year (#/yr).

An overall comparison of the WMM modeling results (Table 4-11) indicates that future flows and constituent loads generally increase over their existing counterparts.

Specifically, future flow is 7 percent greater than for existing conditions and the increase in loads ranges from 22 percent for BOD to 2 percent for fecal coliform bacteria. It should also be noted that the increase for several constituents (e.g., total N, zinc) are limited because direct rainfall on the open water/tidal wetland area provides a significant fraction of the total load to the May River. In addition, several of the basins (e.g., Bull Creek) have little or no change in land use from existing to future conditions.

For individual water quality basins, the greatest changes in flows and loads occur in the May River 4 and May River 5 basins. This is because these two basins are anticipated to have the greatest amount of future development, and because these basins have the smallest fraction of open water and tidal wetland land use. Load increases in these basins are typically 18 to 30 percent, with BOD having the greatest increases (48 to 50 percent) and TSS having the smallest increases (9 to 14 percent). Despite these increases, the "per acre" loads for these basins are comparable to the loads in the other water quality basins.

Wastewater discharges account for a very small fraction of the total watershed load for all constituents, particularly fecal coliform bacteria. As shown previously in Table 2-9, the existing discharge of wastewater is limited to roughly 0.3 mgd of land application (e.g., golf course irrigation), and the future discharge is expected to be higher (0.8 mgd). Using the values in Table 2-9, the wastewater load for existing conditions accounts for 0.3 to 0.5 percent of the total watershed load for nutrients (total nitrogen and total phosphorus) and 0.0 to 0.1 percent of the load for other constituents. In the future condition, the wastewater load for existing conditions accounts for 1 to 2 percent of the total watershed load for nutrients (total nitrogen and total phosphorus) and 0.0 to 0.3 percent of the load for other constituents.

4.3.4 Model Tidal River Water Quality Results

The WASP model was applied to evaluate geomean concentrations of fecal coliform bacteria in the May River watershed. The model actually includes Calibogue Sound, May River, Colleton River, and Chechessee River watersheds because they are interconnected at several points. Only the May River will be discussed in this section. A schematic of the model is presented as **Figure 4-5**.

Existing conditions for bacteria concentrations in the May River are presented in **Table 4-12**. For each water quality basin river reach, the table lists the DHEC stations for which the 1990s bacteria data were analyzed, the concentrations calculated in the analysis, and the "level of service" associated with these concentrations (as discussed in Section 2.6.2. As shown in the table, DHEC data were only available in three of the river model segments. For both the long-term and the 36-sample maximum values, the geomean and 90th percentile bacteria concentrations meet the water quality standards, and so these segments have an "A" level of service.

For informational purposes, **Figure 4-6** presents a map of the level of service based on the monitoring data analysis, compared to the Department of Health and Environmental Control (DHEC) "shellfish classification" (based on the 2002 DHEC reports for shellfish area 19). The shellfish classification is based on data from a specific 3-year monitoring period that is different than the period of data used to develop the level of service, so there may not be a direct relationship between level of service and shellfish classification presented in the map. In general, however, segments with an "A" level of service are expected to have the lowest probability of receiving a "restricted" classification, and segments with a "D" level of service are expected to have the highest probability of receiving a "restricted" classification.

Physical characteristics assigned to the model reaches are presented in **Table 4-13**. The average segment volume is listed, as well as tidal dispersion information. This information includes the segments between which mixing is simulated, and parameters used to calculate dispersion, such as the cross-sectional area, the "characteristic length" (typically the distance between segment midpoints) and a dispersion coefficient. The area and length are based on physical data (e.g., bathymetric data), whereas the dispersion coefficient was established through calibration of the modeled salinity to average salinity values calculated from the DHEC monitoring data.

Other key model input includes the average flows and geomean bacteria concentrations, and net advective flows between river segments. **Tables 4-14** and **4-15** show the values used in the existing and future condition models.

A review of Table 4-14 shows that there is little change in flow or concentration between existing and future land use for many of the basins. For flow, this is because much of the flow to the tidal river segments comes from direct rainfall on the open water and tidal wetlands, as opposed to stormwater runoff and baseflow, and some of the basins have very little change in land use from existing to future conditions. Concentration remain relatively constant because of the substantial amount of open water/tidal wetland area and the relatively limited development in some basins, as well as the BMPs for new development, which are assumed to have a high level of treatment efficiency. May River 4 and May River 5 show the greatest increases in flow and concentration.

Table 4-15 shows the net advective flows between segments, which also do not change substantially from existing to future land use. In both cases, the hydrodynamic model (SWMM) indicates that there is a substantial net flow from the May River (May River 2) to Bull Creek. The May River Baseline Study also found this flow pattern from the May River to Bull Creek.

The final key input parameter for bacteria modeling is the first-order loss rate. The value of this parameter was adjusted so that the measured geomean concentrations and modeled geomean concentrations were in agreement, for those river segments that had measured data. In general, a loss rate of 1.0/day was assumed initially, and values were then adjusted to achieve a better match between modeled and measured data. The final calibration values will be discussed below.

Figure 4-7 is a graph showing a comparison between measured and modeled salinity data along the May River main stem (the only watershed river reaches with monitoring data). The figure shows that the salinity data calculated by the model is very close to the average measured value, and is in all cases well within the 90 percent confidence interval of the mean of the salinity data.

The comparison of measured geomean bacteria concentrations and modeled bacteria concentration is presented in **Figure 4-8**. The graph shows very good agreement between the measured values and the model results.

The first-order loss rates assigned to the river segments, and the concentrations calculated by the model, are presented in **Table 4-16**. The loss rates ranged from 0.5/day to 2.8/day. The lowest values are applied at the downstream end of the May River, and the highest values are applied at the upstream end of the May River. This makes sense if it is presumed that bacteria loss is in part due to light mortality, because the water depths are much greater at the downstream end of the May River, and therefore light would be less of a factor relative to the shallower reaches at the upstream end of May River.

After the model was applied for existing conditions, it was the applied for future conditions. The physical characteristics and first-order loss rate from the existing land use model were kept the same in the future land use model. The only changes were the net advective flows and the bacteria loads.

The bacteria concentrations calculated under future land use conditions are presented in Table 4-16 as well. A comparison of concentrations under existing and future land use conditions shows little difference, with the exception of May River 4 and May River 5. According to the model, all river reaches will have the same level of service in the future as they do under existing conditions.

In order to estimate the degree to which stormwater management measures are expected to affect instream bacteria concentrations, two sensitivity runs were conducted. The first was run for the existing land use condition, and represents a "best-case" scenario in which all existing development is controlled by BMPs. The second was run for the future land use condition, and represents a "worst-case" condition in which no development is served by BMPs. Analyzing the results of these scenarios indicate the benefits of retrofitting existing development with BMPs, and the potential degradation of river segments if BMPs fail.

The results of the analysis are presented in **Table 4-17**. This table is similar to Table 4-16, in this case showing water quality basin segment fecal coliform concentrations for the "best case" and "worst case" analyses. Segments that show change (e.g., better LOS for the "best case" or degraded LOS for the "worst case") are highlighted.

A review of the "best-case" scenario indicates that none of the model segments show improvement in the existing level of service. With the exception of the May River 5 segment, all of the segments have an "A" level of service for existing conditions, and therefore cannot show an increased level of service with 100 percent BMPs for development. The May River 5 segment is a small segment that will often be completely freshwater at low tide conditions, and it has a "D" level of service regardless of the extent of BMP implementation.

A review of the "worst-case" scenario indicates that two model segments show degradation in the future level of service when no BMPs are assumed. The segments are May River 3 (drops from an "A" to a "B" level) and May River 4 (drops from an "A" to a "D" level of service). This change in level suggests that the stormwater controls for new development in May River 4 and other May River water quality basins (e.g., May River 5, May River 3) will be critical to protecting water quality.

Based on water quality sampling data and model results, the following recommendations are made:

- Consider monitoring major tributary areas to the May River 4 water quality segment and surrounding segments (May River 3, May River 5). Major tributaries include Rose Dhu Creek and Stoney Creek. Part of Palmetto Bluff also discharges to May River 4 and May River 3 river segments.

- Request that DHEC add an ambient monitoring station in the water quality segment May River 4.

More discussion of the overall recommended monitoring program for Beaufort County is presented in Section 16 of this report.

4.3.5 Management Strategy Alternatives

The results of the water quality analysis suggest that the limited amount of future development in the watershed, combined with the effectiveness of required BMPs in reducing bacteria loads from new development, will maintain the existing high level of service (level A) in most of the reaches. In the extreme headwater reach of the May River (May River 5), the level of service is "D"under both existing and future land use conditions. At low tide, this reach is essentially all freshwater, and therefore is not capable of supporting shellfish or other saltwater species. Monitoring of the May River 4 tributary inflows and open water is recommended to validate that the BMPs for existing and new development are protecting water quality in that sensitive segment.

Elements of the water quality management plan for the May River watershed are presented in **Figure 4-9**. Sampling stations shown in the figure include existing DHEC sites, as well as the additional open water site and sites on Rose Dhu Creek and Stoney Creek that are recommended as discussed in Section 4.3.4 above. Also identified are "priority" water quality basins. Sensitivity analysis results suggest that load changes in these basins are most likely to result in an improved or degraded LOS in the receiving waters.

For informational purposes, the areas with "A" and "B" type soils are presented in **Figure 4-10**. In general, these soils are more suitable for infiltration BMPs than areas with "C" and "D" type soils, though high water table conditions may still limit the effectiveness of infiltration BMPs in these areas. The figure is provided to indicate areas where new development BMP design should consider infiltration BMPs as a primary or secondary treatment method.

4.4 Planning Level Cost Estimates for Management Alternatives

Table 4-18 lists potential projects identified in the hydrologic and hydraulic analysis of the PSMS in the May River watershed. As shown in the table, the five projects are estimated to have a total cost of $0.9 million based on December 2004 dollars. Details of the cost estimate for each project are shown in Appendix B.

The prioritization of these projects, and projects identified for other watersheds, is discussed in Section 16 of this report.

TABLE 4-1
HYDROLOGIC BASINS
MAY RIVER WATERSHED

Basin Name	Tributary Area (acres)	Number of Subbasins	Average Subbasin Size (acres)
Alljoy Landing	307	1	307
Bluffton East	469	2	235
Buckingham	539	2	270
Buck Island	326	3	109
Bluffton West	190	3	63
May River	400	1	400
Rose Dhu Creek	3,755	16	235
Stoney Creek	4,935	14	352
Ulmer	506	2	253
TOTAL	11,428	44	260

TABLE 4-2
WATER QUALITY BASINS
MAY RIVER WATERSHED

Basin Name	Tributary Area (acres)
May River 1	1,688
May River 2	4,163
May River 3	5,165
May River 4	5,703
May River 5	6,187
Bass Creek	2,186
May River Trib	1,739
Bull Creek	824
TOTAL	27,654

TABLE 4-3
HYDROLOGIC SUBBASIN CHARACTERISTICS
MAY RIVER WATERSHED

ICPR Subbasin ID	Tributary Area (acres)	Existing Land Use		Future Land Use	
		Curve Number	Time of Concentration (minutes)	Curve Number	Time of Concentration (minutes)
Alljoy Landing Basin					
AL_M1	307	71	168	79	134
Bluffton East Basin					
BE_M1	237	85	94	87	85
BE_M2	232	88	79	89	75
Buckingham Basin					
BH_M1	241	78	82	78	82
BH_M2	298	82	91	83	89
Buck Island Basin					
BI_M1	47	65	80	71	68
BI_M2	73	79	51	79	51
BI_M3	205	79	137	82	126
Bluffton West Basin					
BW_M1	52	73	39	74	38
BW_M2	42	87	43	87	43
BW_T1	96	86	77	86	76
May River Basin					
MR_M1	400	72	137	78	115
Rose Dhu Creek Basin					
RDC_M1	329	69	196	71	185
RDC_M2	141	71	130	76	113
RDC_M3A	85	87	52	89	48
RDC_M3B	87	87	52	89	49
RDC_M4	376	76	164	80	145
RDC_M5	270	75	626	83	491
RDC_M6	302	79	151	85	123
RDC_M7	182	82	132	86	113
RDC_M8	32	87	52	87	52
RDC_T1A	232	77	118	80	107
RDC_T1B	54	76	52	84	40
RDC_T2	458	72	176	77	153
RDC_T3A	260	75	138	83	107
RDC_T3B	122	75	116	78	106
RDC_T4	628	73	125	81	99
RDC_T5	198	77	118	83	97
Stoney Creek Basin					
SC_M1	150	69	99	75	82
SC_M2	209	70	146	76	124
SC_M3	245	86	84	88	77
SC_M4	432	86	139	89	122
SC_M5	285	78	141	85	111
SC_T1A	483	82	162	86	143
SC_T1B	273	81	138	82	132
SC_T1C	1,065	77	267	81	230
SC_T1D	349	67	216	71	192
SC_T2	516	79	177	82	160
SC_T3	241	87	109	89	100
SC_T4A	276	75	131	82	105
SC_T4B	111	75	91	80	78
SC_T5	299	83	139	87	120
Ulmer Basin					
U_M1	265	76	98	80	87
U_M2	241	81	90	86	75
Average	260	78	130	82	113

TABLE 4-4
HYDRAULIC DATA SUMMARY
MAY RIVER WATERSHED

Basin Name	Open Channels		Stream Crossings			Other Features		
	Number	Length (feet)	Number	Number of Culverts	Number of Bridges	Storage Nodes	Weirs	Drop Structures
Alljoy Landing	5	5,641	1	2	0	0	1	0
Bluffton East	4	3,480	2	2	1	1	1	0
Buckingham	8	7,689	2	2	0	2	1	2
Buck Island	5	5,909	2	4	0	0	1	0
Bluffton West	7	3,002	6	6	1	3	1	0
May River	1	508	2	6	0	1	2	0
Rose Dhu Creek	58	55,903	24	65	1	13	42	3
Stoney Creek	59	61,666	2	2	0	3	0	0
Ulmer	3	2,653	3	5	0	1	2	0
TOTAL	150	146,451	44	94	3	24	51	5

TABLE 4-5
CULVERT DATA FOR HYDROLOGIC BASINS
MAY RIVER WATERSHED

Road Crossing	ICPR Model Link ID	Culvert Dimensions (in x in)	Culvert Length (ft)	Invert Elevation (ft NAVD)	Roadway Elevation (ft NAVD)	Level of Service
Alljoy Landing Basin						
Ulmer Road	AL_M-1A	36"x36"	37	1.7	5.8	25
	1B	30"x30"	37	1.9		
Bluffton East Basin						
Bridge Street	BE_M-1	Bridge	44	0.8	19.4	25
Bruin Road	BE_M-4A	36"x36"	58	13.1	19.0	25
	4B	36"x36"	58	13.2		
Buckingham Basin						
Buckingham Plantation Drive	BH_M-3	48"x48"	230	0.5	8.3	25
Buckingham Plantation Drive	BH_M-5	20"x20"	65	4.7	7.5	25
Buck Island Basin						
May River Road (State Hwy 46)	BI_M-2	60"x60"	40	1.3	13.3	100
Haigler Boulevard	BI_M-4A	48"x48"	65	-0.2	11.6	25
	4B	48"x48"	65	-0.2		
	4C	24"x24"	65	-0.1		
Bluffton West Basin						
Bridge Street	BW_M-1	Bridge	30	0.2	15.0	25
Lawrence Street	BW_M-4	48"x48"	100	2.9	17.6	25
May River Road (State Hwy 46)	BW_M-6	42"x42"	78	13.2	21.2	100
Lawrence Street	BW_T1-3	2 - 18"x18"	60	15.2	20.5	25
Wharf Street	BW_T1-6	30"x30"	54	16.5	21.6	25
May River Road (State Hwy 46)	BW_T1-8	24"x24"	70	18.3	24.3	100
May River Basin						
Palmetto Bluff Road	MR_M-1A	48"x48"	50	-0.8	6.8	25
	1B	48"x48"	50	-0.7		
	1C	36"x36"	50	1.3		
New Palmetto Bluff Road	MR_M-3A	36"x36"	60	3.3	11.5	25
	3B	60"x60"	80	1.7		
	3C	60"x60"	80	1.7		
Rose Dhu Creek Basin						
Windmill Road	RDC_M-2A	144"x90"	35	2.0	11.3	25
	2B	144"x90"	35	2.0		
Sedgewick Avenue	RDC_M-5	2 - 42"x42"	1058	5.0	14.0	25
Farnsleigh Avenue	RDC_M-8A	48"x48"	190	5.0	15.0	25
	8B	48"x48"	203	5.0		

TABLE 4-5
CULVERT DATA FOR HYDROLOGIC BASINS
MAY RIVER WATERSHED

Road Crossing	ICPR Model Link ID	Culvert Dimensions (in x in)	Culvert Length (ft)	Invert Elevation (ft NAVD)	Roadway Elevation (ft NAVD)	Level of Service
Farm Lake Drive	RDC_M-10	48"x48"	767	7.6	16.6	25
Cattle Run Way	RDC_M-11A	24"x24"	181	7.5	16.1	25
	11B	24"x24"	235	9.0		
Farm Lake Drive	RDC_M-11.1A	48"x48"	522	7.5	16.2	25
	11.1B	30"x30"	392	9.3		
Cattle Run Way	RDC_M-12	36"x36"	331	11.0	16.2	25
Old Bridge Drive	RDC_M-15	2 - 24"x24"	64	13.0	18.0	25
Old Bridge Drive	RDC_M-17	2 - 36"x36"	100	13.2	20.3	25
Hampton Hall Boulevard	RDC_M-23A	42"x42"	70	14.7	21.2	25
	23B	36"x36"	72	17.0		
Buckwalter Parkway	RDC_M-25A	36"x36"	200	17.2	23.3	25
	23B	36"x36"	200	17.2		
	23C	36"x36"	200	17.2		
	23D	36"x36"	200	17.2		
	23E	36"x36"	200	17.2		
	23F	36"x36"	200	17.2		
Hampton Hall Boulevard	RDC_T1-1.1	Bridge	45	5.4	15.8	25
Buckwalter Parkway	RDC_T1-23A	36"x36"	120	16.9	22.2	25
	23B	36"x36"	120	16.9		
	23C	36"x36"	120	16.9		
	23D	36"x36"	120	16.9		
	23E	36"x36"	120	16.9		
	23F	36"x36"	120	16.9		
Farm Lake Drive	RDC_T3-1	48"x48"	375	7.8	17.5	25
Farm Lake Drive	RDC_T3-3	48"x48"	100	10.0	21.8	25
Unknown (The Farm)	RDC_T3-4	48"x48"	350	16.0	23.0	25
Farm Lake Drive	RDC_T3-6	48"x48"	116	18.1	24.1	25
Buckwalter Parkway	RDC_T3-8	60"x60"	160	18.0	24.6	25
Unknown (Pine Ridge)	RDC_T3-11	42"x42"	450	15.5	24.0	25
Unknown (Pine Ridge)	RDC_T3-14	42"x42"	530	19.5	23.0	25
Hampton Hall Boulevard	RDC_T6-2	36"x36"	46	14.0	19.6	25
Farnsleigh Avenue	RDC_T6-4	36"x36"	44	15.0	19.5	25
Buckwalter Parkway	RDC_T7-1	24"x24"	750	21.0	28.0	25
Buckwalter Parkway	RDC_T9-3	36"x36"	350	20.5	24.0	25

TABLE 4-5
CULVERT DATA FOR HYDROLOGIC BASINS
MAY RIVER WATERSHED

Road Crossing	ICPR Model Link ID	Culvert Dimensions (in x in)	Culvert Length (ft)	Invert Elevation (ft NAVD)	Roadway Elevation (ft NAVD)	Level of Service
Stoney Creek Basin						
May River Road (State Hwy 46)	SC_T1-4	72"x48"	30	-0.8	18.1	100
Old Miller Road	SC_T6-2	42"x42"	70	7.3	15.0	25
Ulmer Basin						
Alljoy Road	U_M-1	48"x48"	140	5.3	15.3	25
Confederate Avenue	U_M-3A	36"x36"	40	10.2	15.5	25
	3B	36"x36"	40	10.2		
Ulmer Road	U_M-6A	36"x36"	40	12.6	16.8	25
	6B	36"x36"	40	12.7		

TABLE 4-6
PROBLEM AREAS IDENTIFIED BY ICPR MODEL
MAY RIVER WATERSHED

Road Crossing	ICPR Model Node ID	Roadway Elevation (ft NAVD)	Level of Service	Existing Peak Water Elevation (ft NAVD)	Future Peak Water Elevation (ft NAVD)
Alljoy Landing Basin					
Ulmer Road	AL_M-1	5.8	25	6.4	6.5
Bluffton East Basin					
Bruin Road	BE_M-21	19.0	25	19.8	19.8
Buckingham Basin					
No Overtopping					
Buck Island Basin					
No Overtopping					
Bluffton West Basin					
No Overtopping					
May River Basin					
Palmetto Bluff Road	MR_M-1	6.8	25	7.1	7.2
Rose Dhu Creek Basin					
No Overtopping					
Stoney Creek Basin					
No Overtopping					
Ulmer Basin					
Alljoy Road	U_M-2	15.3	25	15.8	15.9
Confederate Avenue	U_M-13	15.5	25	16.1	16.2

TABLE 4-7
RECOMMENDED CULVERT IMPROVEMENTS
MAY RIVER WATERSHED

Road Crossing	ICPR Model Link ID	Existing Culvert Dimensions (in x in)	Recommended Improvements
Alljoy Landing Basin			
Ulmer Road	AL_M-1A 1B	36"x36" 30"x30"	Raise road from elevation 5.8 to elevation 7.6 NAVD (length of 1,200 ft), Replace culverts with one 8 ft by 4 ft box culvert
Bluffton East Basin			
Bruin Road	BE_M-4A 4B	36"x36" 36"x36"	Replace culverts with two 5 ft by 5 ft box culverts and set box culvert inverts to match U/S & D/S channel inverts
Buckingham Basin			
No improvements required			
Buck Island Basin			
No improvements required			
Bluffton West Basin			
No improvements required			
May River Basin			
Palmetto Bluff Road	MR_M-1A 1B 1C	48"x48" 48"x48" 36"x36"	Add two 48-inch RCP culverts to existing culverts
Rose Dhu Creek Basin			
No improvements required			
Stoney Creek Basin			
No improvements required			
Ulmer Basin			
Alljoy Road	U_M-1	48"x48"	Replace culvert with one 5 ft by 5 ft box culvert
Confederate Avenue	U_M-3A 3B	36"x36" 36"x36"	Replace culverts with two 8 ft by 4 ft box culverts

TABLE 4-8

WATER QUALITY BASIN LAND USE DISTRIBUTION

MAY RIVER WATERSHED

Land Use Type	May River 1 Existing	May River 2 Existing	May River 3 Existing	May River 4 Existing	May River 5 Existing	Bass Creek Existing	May River Trib Existing	Bull Creek (May) Existing	TOTAL Existing
Agricultural/Pasture	0	0	0	0	0	0	0	0	0
Commercial	0	0	111	0	2	38	0	0	150
Forest/Rural Open	108	508	1,138	2,617	3,050	116	706	0	8,243
Golf Course	0	43	0	557	0	621	0	0	1,221
High Density Residential	0	149	218	249	0	53	0	0	669
Industrial	0	57	183	199	170	39	0	0	648
Institutional	0	0	42	95	1	1	0	0	139
Low Density Residential	0	456	605	663	969	43	0	0	2,736
Medium Density Residential	0	89	578	84	28	0	0	0	779
Open Water/Tidal	1,469	2,541	1,586	623	427	1,228	862	645	9,381
Silviculture	0	0	0	0	0	0	0	0	0
Urban Open	0	44	313	294	222	18	47	0	939
Wetland/Water	110	276	392	321	1,319	29	124	179	2,750
TOTAL	1,688	4,163	5,165	5,703	6,187	2,186	1,739	824	27,655
Urban Imperviousness (%)	0%	4%	11%	7%	4%	4%	0%	0%	5%

Land Use Type	May River 1 Future	May River 2 Future	May River 3 Future	May River 4 Future	May River 5 Future	Bass Creek Future	May River Trib Future	Bull Creek (May) Future	TOTAL Future
Agricultural/Pasture	0	0	0	0	0	0	0	0	0
Commercial	0	0	155	0	3	44	0	0	202
Forest/Rural Open	108	0	18	23	1	28	0	0	178
Golf Course	0	43	0	558	0	620	0	0	1,222
High Density Residential	0	149	222	249	0	52	0	0	673
Industrial	0	57	184	201	173	38	0	0	652
Institutional	0	0	73	271	1	1	0	0	346
Low Density Residential	0	767	1,444	1,525	3,107	43	704	0	7,590
Medium Density Residential	0	314	1,066	1,923	1,132	98	0	0	4,533
Open Water/Tidal	1,468	2,542	1,587	622	427	1,230	862	645	9,384
Silviculture	0	0	0	0	0	0	0	0	0
Urban Open	0	15	25	8	24	2	48	0	123
Wetland/Water	111	276	391	321	1,319	30	125	179	2,753
TOTAL	1,688	4,163	5,165	5,703	6,187	2,186	1,739	824	27,655
Urban Imperviousness (%)	0%	7%	16%	18%	12%	5%	4%	0%	11%

TABLE 4-9

WATER QUALITY BASIN BMP COVERAGE

MAY RIVER WATERSHED

Land Use Type	May River 1 Existing	May River 2 Existing	May River 3 Existing	May River 4 Existing	May River 5 Existing	Bass Creek Existing	May River Trib Existing	Bull Creek (May) Existing	TOTAL
Commercial	0%	0%	0%	0%	0%	0%	0%	0%	0%
Golf Course	0%	0%	0%	39%	0%	0%	0%	0%	18%
High Density Residential	0%	2%	0%	51%	100%	0%	0%	0%	19%
Industrial	0%	0%	0%	36%	0%	0%	0%	0%	11%
Institutional	0%	0%	0%	78%	0%	0%	0%	0%	54%
Low Density Residential	0%	60%	9%	32%	1%	0%	0%	0%	20%
Medium Density Residential	0%	0%	0%	57%	0%	0%	0%	0%	6%
TOTAL	0%	35%	3%	40%	1%	0%	0%	0%	17%

Land Use Type	May River 1 Future	May River 2 Future	May River 3 Future	May River 4 Future	May River 5 Future	Bass Creek Future	May River Trib Future	Bull Creek (May) Future	TOTAL
Commercial	0%	0%	29%	0%	47%	13%	0%	0%	26%
Golf Course	0%	2%	0%	39%	100%	0%	0%	0%	18%
High Density Residential	0%	2%	2%	50%	0%	0%	0%	0%	20%
Industrial	0%	0%	1%	36%	2%	0%	0%	0%	12%
Institutional	0%	100%	42%	92%	0%	0%	0%	0%	81%
Low Density Residential	0%	76%	62%	70%	69%	0%	100%	0%	71%
Medium Density Residential	0%	72%	46%	98%	98%	100%	0%	0%	84%
TOTAL	0%	61%	46%	77%	74%	12%	100%	0%	66%

TABLE 4-10

WATER QUALITY BASIN SEPTIC TANK COVERAGE

MAY RIVER WATERSHED

Land Use Type	May River 1 Existing	May River 2 Existing	May River 3 Existing	May River 4 Existing	May River 5 Existing	Bass Creek Existing	May River Trib Existing	Bull Creek (May) Existing	TOTAL
Commercial	0%	0%	76%	0%	59%	4%	0%	0%	57%
High Density Residential	0%	54%	27%	0%	0%	1%	0%	0%	21%
Industrial	0%	100%	76%	26%	45%	45%	0%	0%	53%
Institutional	0%	0%	62%	0%	0%	0%	0%	0%	19%
Low Density Residential	0%	27%	90%	56%	48%	99%	0%	0%	57%
Medium Density Residential	0%	100%	76%	43%	100%	0%	0%	0%	76%
TOTAL	0%	47%	74%	35%	49%	36%	0%	0%	53%

Land Use Type	May River 1 Future	May River 2 Future	May River 3 Future	May River 4 Future	May River 5 Future	Bass Creek Future	May River Trib Future	Bull Creek (May) Future	TOTAL
Commercial	0%	0%	54%	0%	32%	3%	0%	0%	43%
High Density Residential	0%	54%	27%	0%	0%	1%	0%	0%	21%
Industrial	0%	99%	76%	26%	45%	44%	0%	0%	52%
Institutional	0%	0%	36%	0%	0%	0%	0%	0%	8%
Low Density Residential	0%	16%	38%	24%	29%	99%	0%	0%	26%
Medium Density Residential	0%	28%	46%	19%	18%	0%	0%	0%	26%
TOTAL	0%	27%	43%	19%	27%	22%	0%	0%	27%

TABLE 4-11

AVERAGE ANNUAL LOADS FOR MAY RIVER WATERSHED WATER QUALITY BASINS

EXISTING LAND USE

Water Quality Basin ID	Area (acres)	Flow (acre-feet)	BOD (lb/yr)	TSS (lb/yr)	Total P (lb/yr)	Total N (lb/yr)	Lead (lb/yr)	Zinc (lb/yr)	Fecal Coliform (#/yr)
May River 1	1,688	5,625	45,394	105,000	2,418	19,793	88	2,120	4.35E+14
May River 2	4,163	11,507	108,000	463,000	5,466	44,272	189	3,890	1.33E+15
May River 3	5,165	11,054	137,000	1,040,000	6,286	50,967	219	2,976	2.28E+15
May River 4	5,703	8,612	91,702	663,000	4,435	31,671	105	1,333	7.89E+14
May River 5	6,189	8,796	88,382	766,000	4,048	32,895	98	959	9.80E+14
Bass Creek	2,186	5,683	52,394	238,000	3,423	21,641	97	1,916	5.00E+14
May River Trib	1,739	4,096	32,112	109,000	1,704	14,080	53	1,246	2.86E+14
Bull Creek (May)	824	2,637	20,923	57,343	1,112	9,258	39	934	2.02E+14
TOTAL	27,656	58,010	575,907	3,441,343	28,892	224,577	888	15,374	6.80E+15

FUTURE LAND USE

Water Quality Basin ID	Area (acres)	Flow (acre-feet)	BOD (lb/yr)	TSS (lb/yr)	Total P (lb/yr)	Total N (lb/yr)	Lead (lb/yr)	Zinc (lb/yr)	Fecal Coliform (#/yr)
May River 1	1,688	5,621	45,363	105,000	2,416	19,781	88	2,118	4.35E+14
May River 2	4,163	11,725	115,000	475,000	5,579	44,661	194	3,944	1.31E+15
May River 3	5,165	11,702	158,000	1,070,000	6,546	52,010	233	3,134	2.13E+15
May River 4	5,703	10,159	138,000	758,000	5,311	37,345	137	1,679	9.64E+14
May River 5	6,189	10,014	131,000	838,000	4,839	37,150	129	1,265	1.10E+15
Bass Creek	2,186	5,762	54,416	242,000	3,462	21,900	98	1,934	5.10E+14
May River Trib	1,739	4,265	39,333	118,000	1,828	14,487	58	1,301	3.02E+14
Bull Creek (May)	824	2,634	20,901	57,336	1,111	9,249	39	932	2.02E+14
TOTAL	27,656	61,882	702,013	3,663,336	31,092	236,583	976	16,307	6.95E+15
Percent Increase over Existing Land Use		7%	22%	6%	8%	5%	10%	6%	2%

TABLE 4-12

EXISTING LEVEL OF SERVICE IN WATER QUALITY BASINS
MAY RIVER WATERSHED

Water Quality Basin ID	DHEC Station(s)	Fecal Coliform Concentrations: Long-Term Average: Geomean (#/100 ml)	Fecal Coliform Concentrations: Long-Term Average: 90th Percentile (#/100 ml)	Fecal Coliform Concentrations: Maximum 36-Sample Values: Geomean (#/100 ml)	Fecal Coliform Concentrations: Maximum 36-Sample Values: 90th Percentile (#/100 ml)	Level of Service
May River 1	None	NA	NA	NA	NA	-----
May River 2	19-12, 19-01	3.8	11	4.4	13	A
May River 3	19-16, 19-18	4.9	17	6.0	17	A
May River 4	19-19	5.5	17	7.1	20	A
May River 5	None	NA	NA	NA	NA	-----
Bass Creek	None	NA	NA	NA	NA	-----
May River Trib	None	NA	NA	NA	NA	-----
Bull Creek (May)	None	NA	NA	NA	NA	-----

TABLE 4-13

TIDAL RIVER SEGMENT PHYSICAL CHARACTERISTICS

MAY RIVER WATERSHED

Water Quality Basin ID	South WASP Segment	Volume (m^3)	Exchange with Water Quality Basin ID	Tidal Dispersion Values Area (m^2)	Length (m)	Coefficient (m^2/s)
May River 1	26	1.82E+07	Calibogue Sound 2	5,185	3,356	300
May River 2	27	2.20E+07	May River 1	3,695	5,504	150
May River 3	28	7.53E+06	May River 2	2,617	8,513	150
May River 4	29	1.67E+06	May River 3	497	6,373	450
May River 5	30	1.22E+05	May River 4	110	3,154	75
Bass Creek	31	2.97E+06	May River 1	1,077	4,408	225
May River Trib	32	2.20E+06	May River 2	808	3,356	300
Bull Creek (May)	33	1.88E+06	May River 2	473	2,763	300
			Savage Creek 1	648	2,012	225

TABLE 4-14

AVERAGE FLOWS AND GEOMEAN FECAL COLIFORM CONCENTRATION FROM WMM
FOR MAY RIVER WATER QUALITY BASINS

Water Quality Basin ID	South WASP Segment	EXISTING LAND USE		FUTURE LAND USE	
		Flow (cfs)	Fecal Coliform (#/100 ml)	Flow (cfs)	Fecal Coliform (#/100 ml)
May River 1	26	7.7	1,359	7.7	1,360
May River 2	27	15.8	1,328	16.1	1,332
May River 3	28	15.1	1,387	16.0	1,383
May River 4	29	11.8	825	13.9	927
May River 5	30	12.0	854	13.7	929
Bass Creek	31	7.8	1,251	7.9	1,252
May River Trib	32	5.6	1,118	5.8	1,131
Bull Creek (May)	33	3.6	1,333	3.6	1,334

TABLE 4-15

TIDAL RIVER ADVECTIVE FLOW EXCHANGES

MAY RIVER WATERSHED

From Water Quality Basin ID	To Water Quality Basin ID	Net Advective Flow (cfs)	
		Existing	Future
May River 1	Calibogue Sound 2	15	20
May River 2	May River 1	0.6	4.4
May River 3	May River 2	39	44
May River 4	May River 3	24	28
May River 5	May River 4	12	14
Bass Creek	May River 1	7.8	7.9
May River Trib	May River 2	5.6	5.8
May River 2	Bull Creek (May)	60	61
Bull Creek (May)	Savage Creek 1	64	65

TABLE 4-16

FECAL COLIFORM MODELING RESULTS

MAY RIVER WATERSHED

Water Quality Basin ID	Bacteria Loss Rate (1/day)	Modeled Geomean Conc (#/100 ml)		Modeled Level of Service	
		Existing	Future	Existing	Future
May River 1	0.5	3.6	3.7	A	A
May River 2	1.0	3.9	4.0	A	A
May River 3	2.0	4.7	5.1	A	A
May River 4	2.8	5.6	6.9	A	A
May River 5	2.8	40.5	49.9	D	D
Bass Creek	1.0	5.3	5.4	A	A
May River Trib	1.0	4.7	4.9	A	A
Bull Creek (May)	1.0	4.5	4.6	A	A

TABLE 4-17

SENSITIVITY ANALYSIS RESULTS

MAY RIVER WATERSHED

Water Quality Basin ID	Bacteria Loss Rate (1/day)	Modeled Geomean Conc (#/100 ml)		Modeled Level of Service	
		Best Case	Worst Case	Best Case	Worst Case
May River 1	0.5	3.4	3.9	A	A
May River 2	1.0	3.5	4.5	A	A
May River 3	2.0	3.6	7.1	A	B
May River 4	2.8	4.4	12.8	A	D
May River 5	2.8	32.5	116.0	D	D
Bass Creek	1.0	4.7	5.6	A	A
May River Trib	1.0	4.4	5.7	A	A
Bull Creek (May)	1.0	4.3	4.9	A	A

NOTES:

1. Best case represents existing land use with wet detention BMPs serving all existing development.
2. Worst case represents future land use with no BMPs.
3. Water quality segments that show change from base model results (e.g., improved LOS for best case or degraded LOS for worst case) are highlighted.

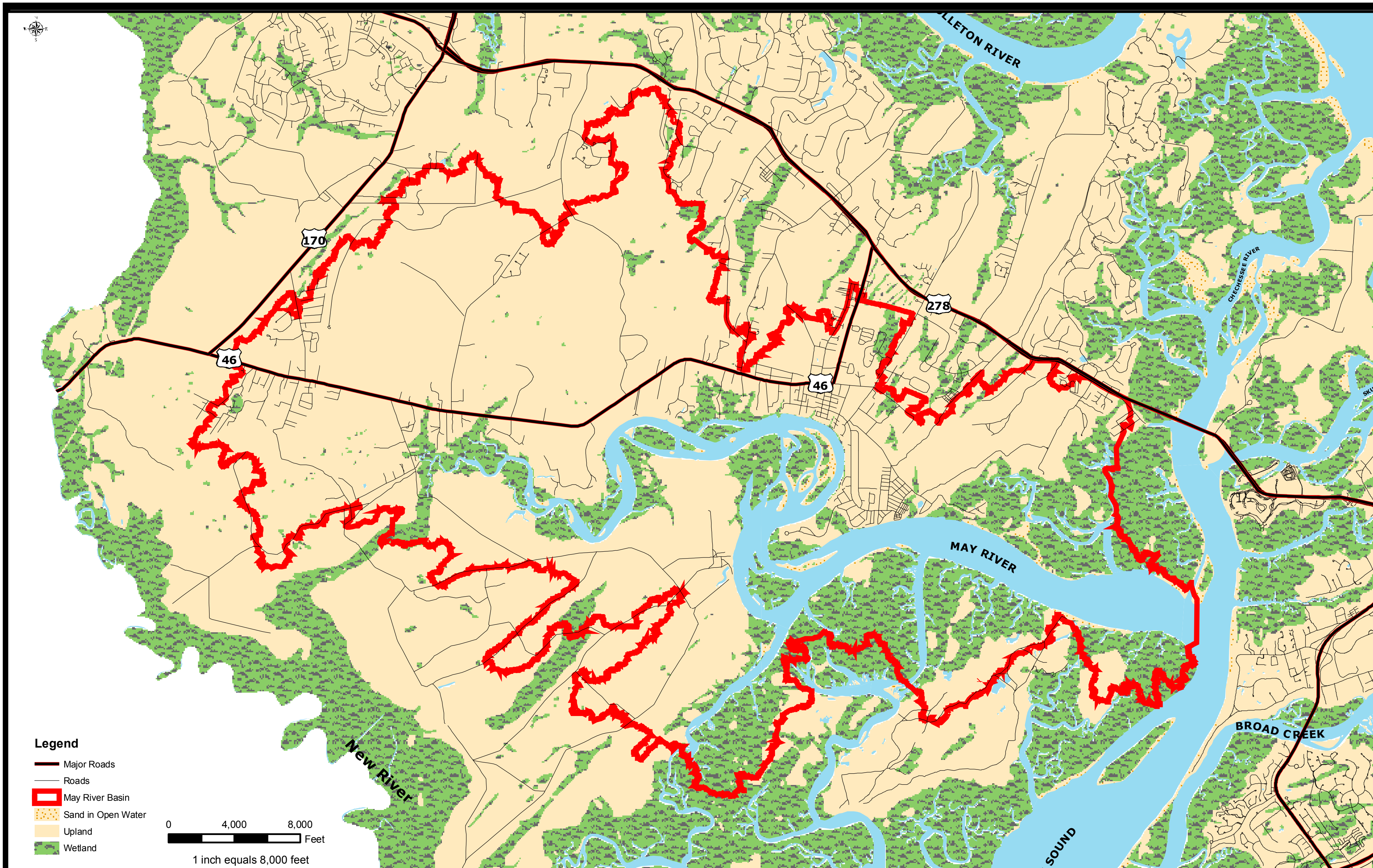
TABLE 4-18

PLANNING LEVEL COST ESTIMATES FOR
MAY RIVER WATERSHED

MODEL CONDUIT	PROJECT	ESTIMATED COST
AL_M-1	Road overtopping at Ulmer Road Replace existing 1 - 36" RCP and 1 - 30" RCP with 1 - 8'x4' box culvert Raise road 1.8 ft (length of 1,200 ft)	$499,000
BE_M-4	Road overtopping at SC 46 Replace existing 2 - 36" CMP with 2 - 5'x5' box culverts	$103,000
MR_M-1	Road overtopping at Palmetto Bluff Road Add 2 48-in RCP culverts to existing 2 - 48" and 1 - 36" RCP	$44,000
U_M-1	Road overtopping at Alljoy Road Replace existing 1 - 48" CMP with 1 - 5'x5' box culvert	$140,000
U_M-3	Road overtopping at Confederate Avenue Replace existing 2 - 36" RCP with 2 - 8'x4' box culverts	$114,000
	TOTAL	$900,000

Costs are in December 2004 dollars.

See Appendix B for basis of cost estimates.



May River Watershed

Figure 4-1

THOMAS & HUTTON ENGINEERING CO.
50 PARK OF COMMERCE WAY
SAVANNAH, GEORGIA 31405
(912) 234-5300

CDM Camp Dresser & McKee Inc.

Job Number: 15178.00	Scale: 1" = 8,000'	Projection: South Carolina Stateplane, I' Feet	Datum: NAD83
Produced: May 22, 2005	Produced by: GIS	Modified:	Modified by:
File: U:\J-15178_BeaufortCo_Stormwater\Task2000_WatershedPlan\documentation\TheReport\mxd\MayRiverWatershed_figure4-1.mxd			Vertical Datum: NAVD88

Disclaimer
Thomas & Hutton Engineering Co. compiled the map information only from the following sources:

DATA	SOURCE	DATE
Roads	Beaufort County	2002
Land Use / Land Cover	USGS	

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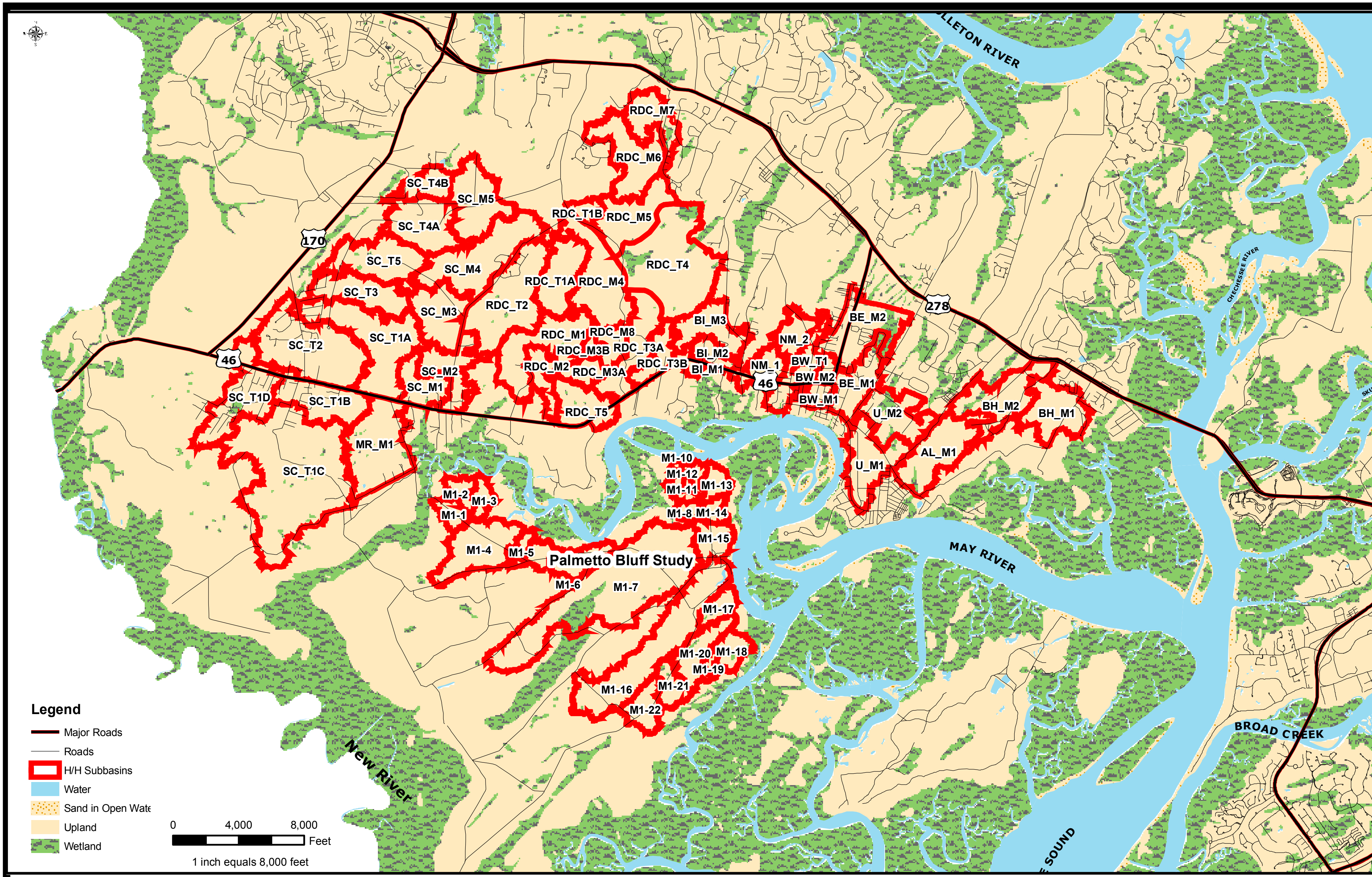
DATA	SOURCE	DATE
Basins	T&H / CDM	2004
Subbasins	T&H / CDM	2004



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May River Watershed Hydrologic Model Subbasins

Figure 4-2

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Land Use / Land Cover	USGS	

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DATA	SOURCE	DATE
Basins	T&H / CDM	2004
Subbasins	T&H / CDM	2004

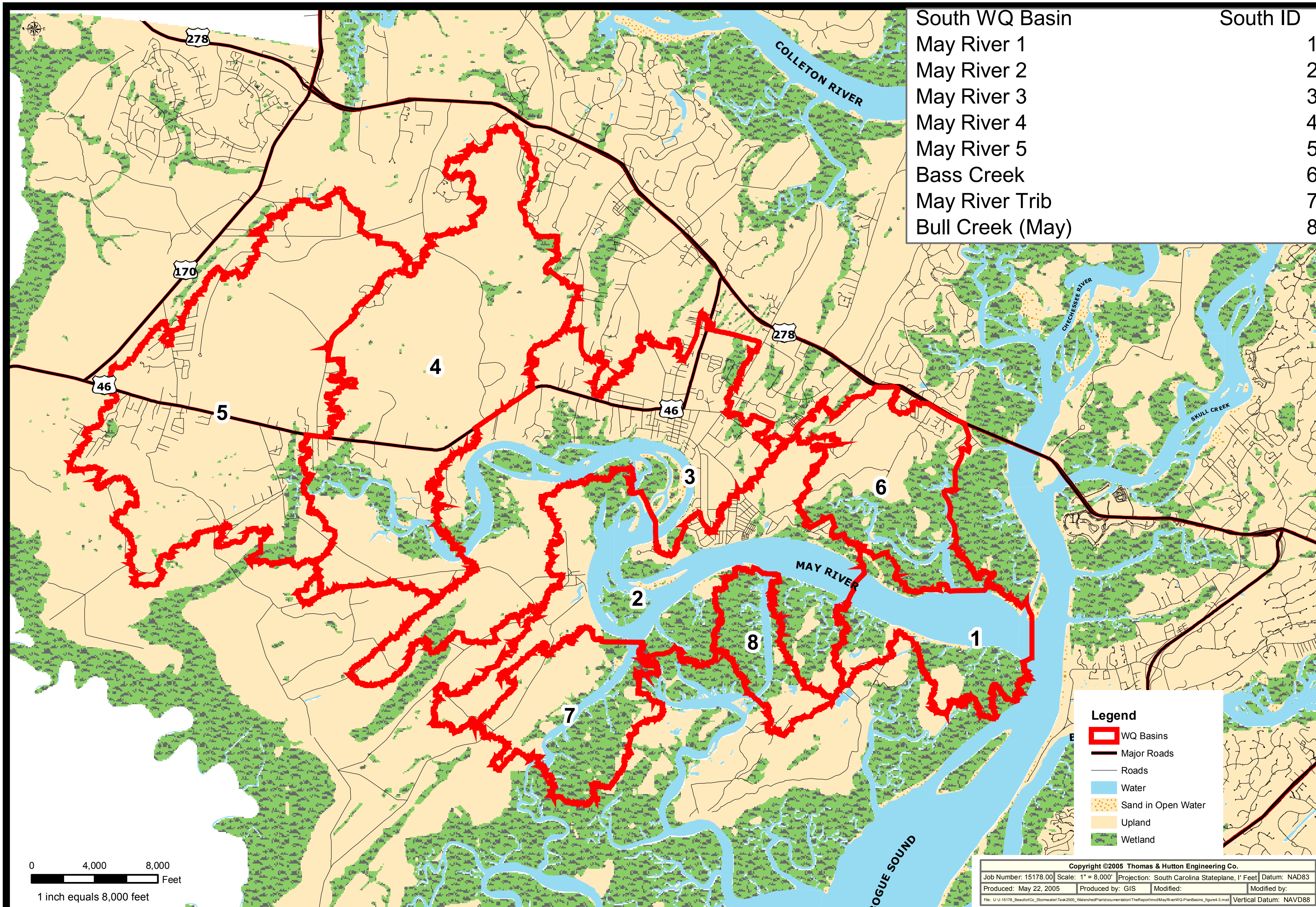

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Figure 4-3

May River Watershed Water Quality Basins

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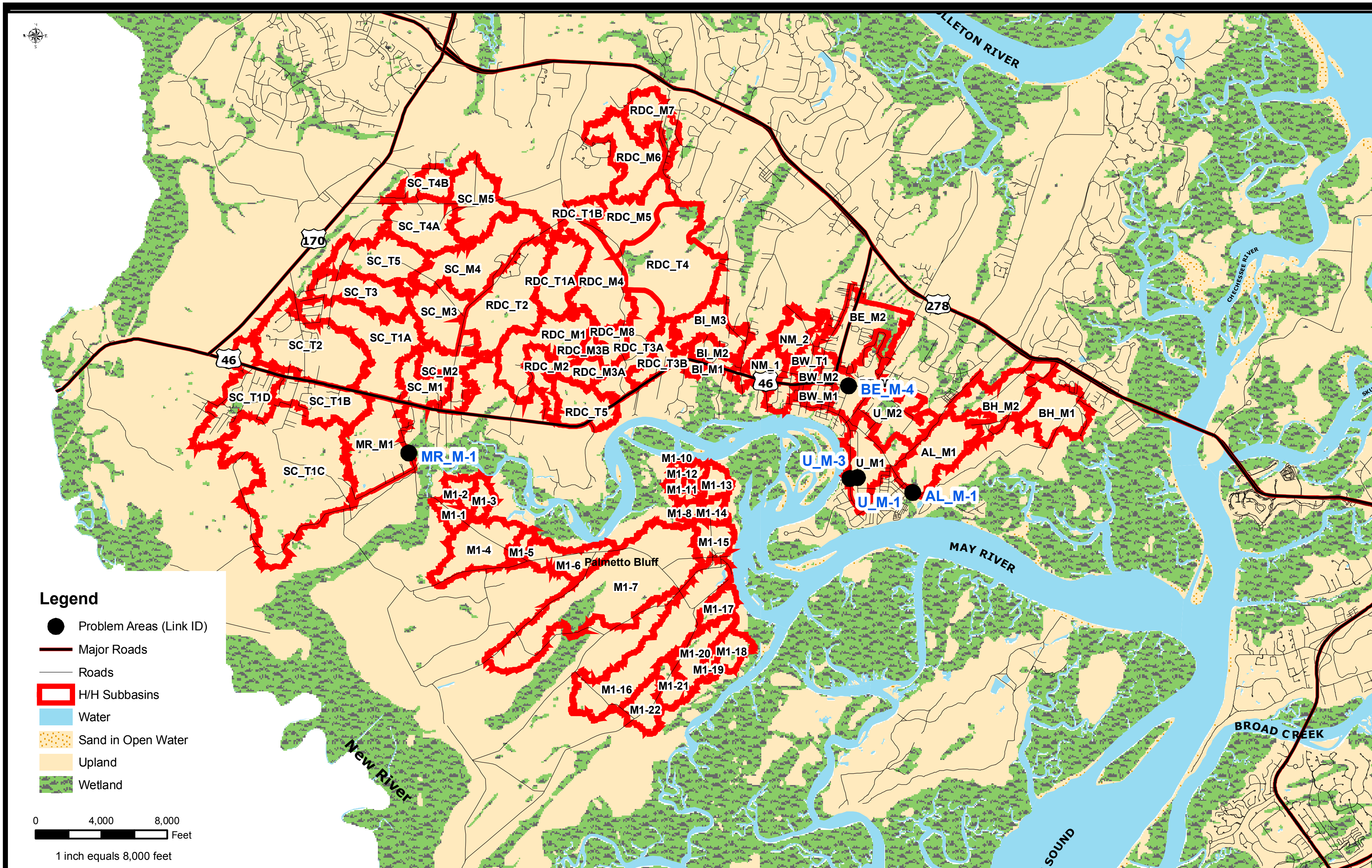
DATA	SOURCE	DATE
Basins	T&H / CDM	2004
Subbasins	T&H / CDM	2004



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Job Number: 15178.00	Scale: 1" = 8,000'	Projection: South Carolina Stateplane, I' Feet	Datum: NAD83
Produced: May 22, 2005	Produced by: GIS	Modified:	Modified by:
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Land Use / Land Cover	USGS	

Thomas & Hutton used the above data "as is", and has made no independent investigation of the data nor makes any representation as to the accuracy or completeness of the data. Please see each source for available documentation of its respective data sets.

DATA	SOURCE	DATE
Basins	T&H / CDM	2004
Subbasins	T&H / CDM	2004

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May River Watershed
PSMS Problem Areas

Figure 4-4

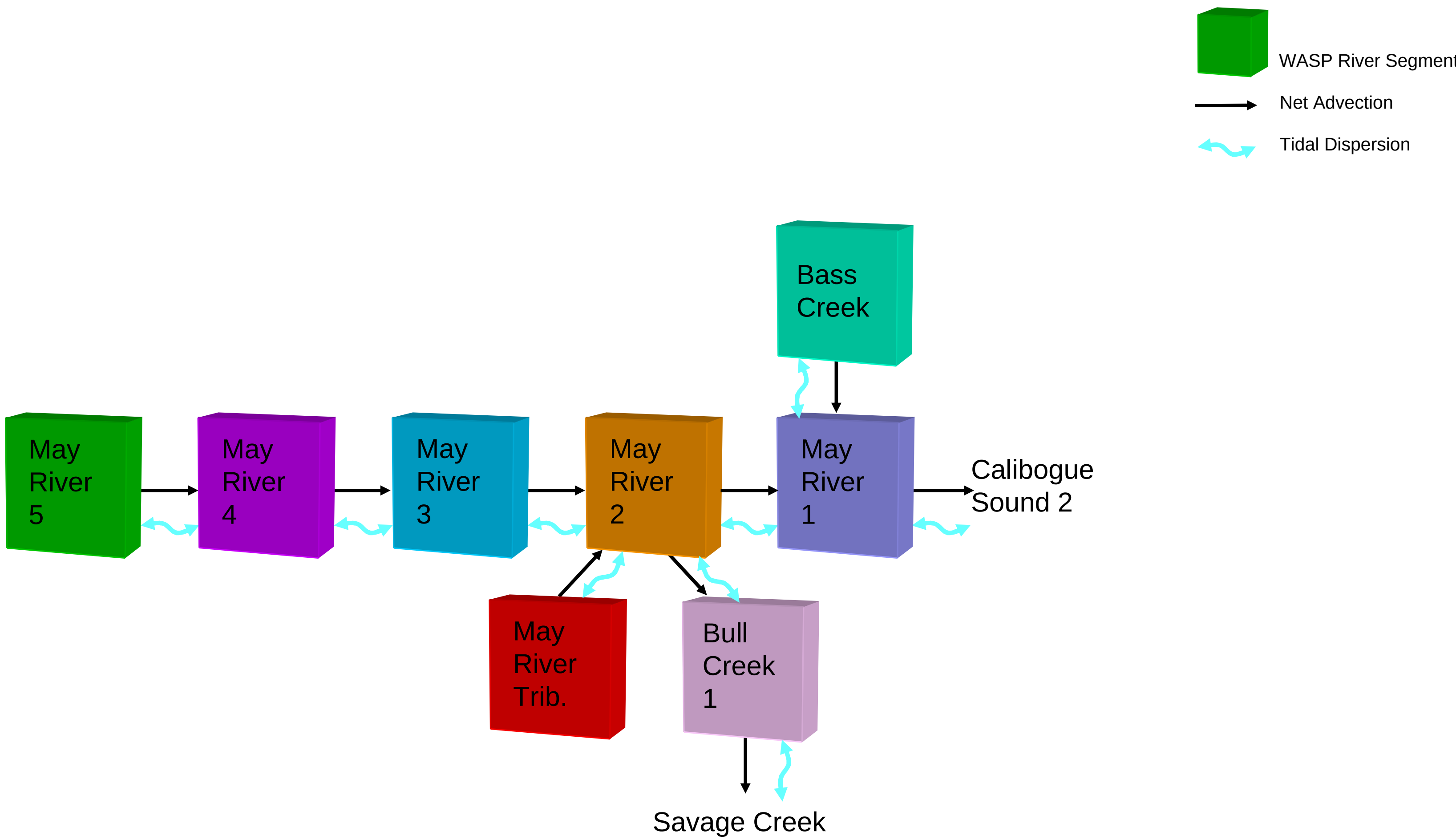

Figure 4-5
WASP Model Schematic for May River Watershed

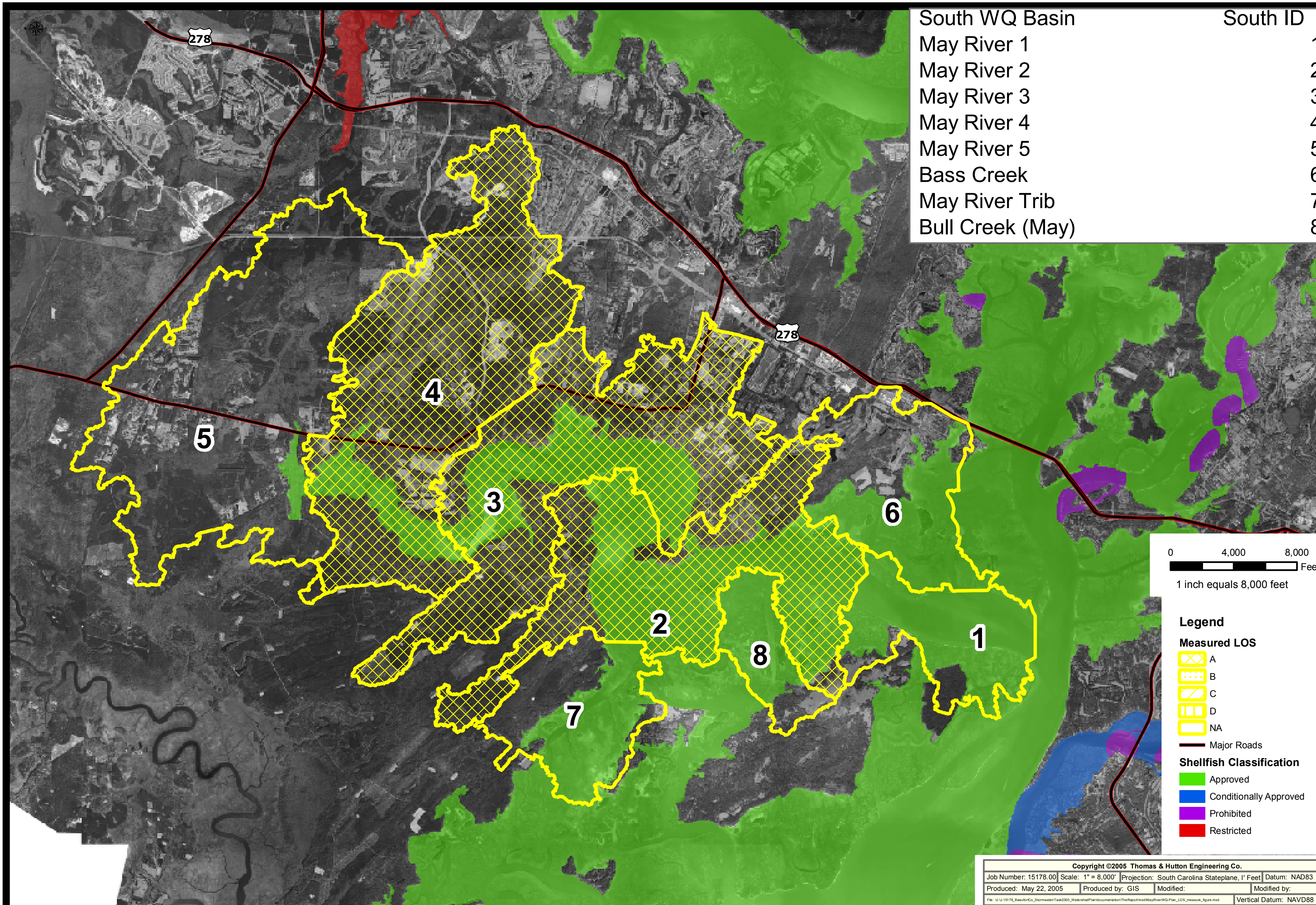

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Figure 4-6

May River Watershed
Shellfish Classification and Existing Level of Service

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DATA	SOURCE	DATE
Roads	Beaufort County	2002
Aerial Photography	Beaufort County	2002
Shellfish Classifications	SCDHEC	2004

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DATA	SOURCE	DATE
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Subbasins	T&H / CDM	2004

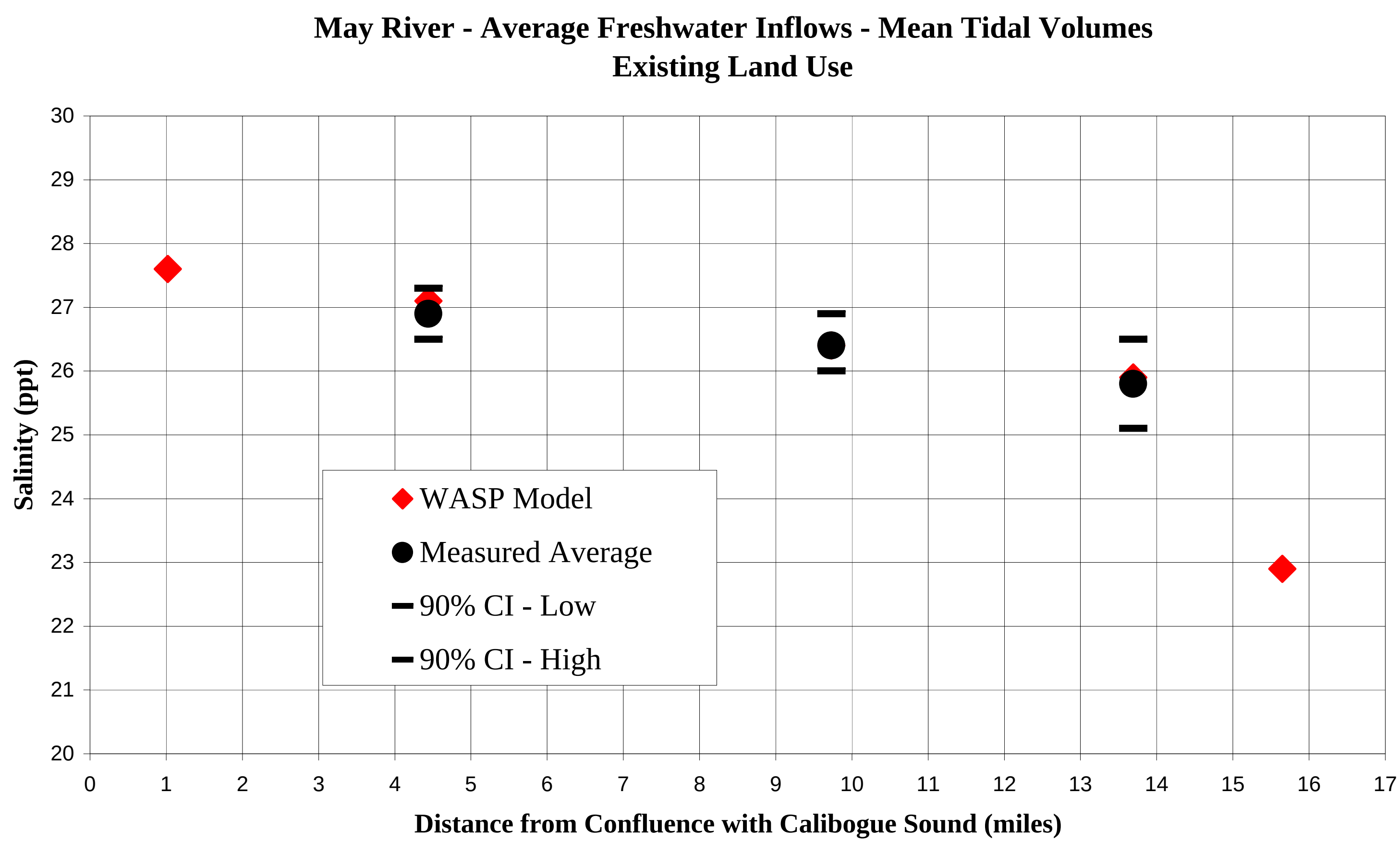

Figure 4-7. Comparison of WASP Model Results with Long-Term Monitoring Data - Salinity

Note: 90% CI = 90% confidence interval for the measured mean based on statistical analysis of monitoring data.

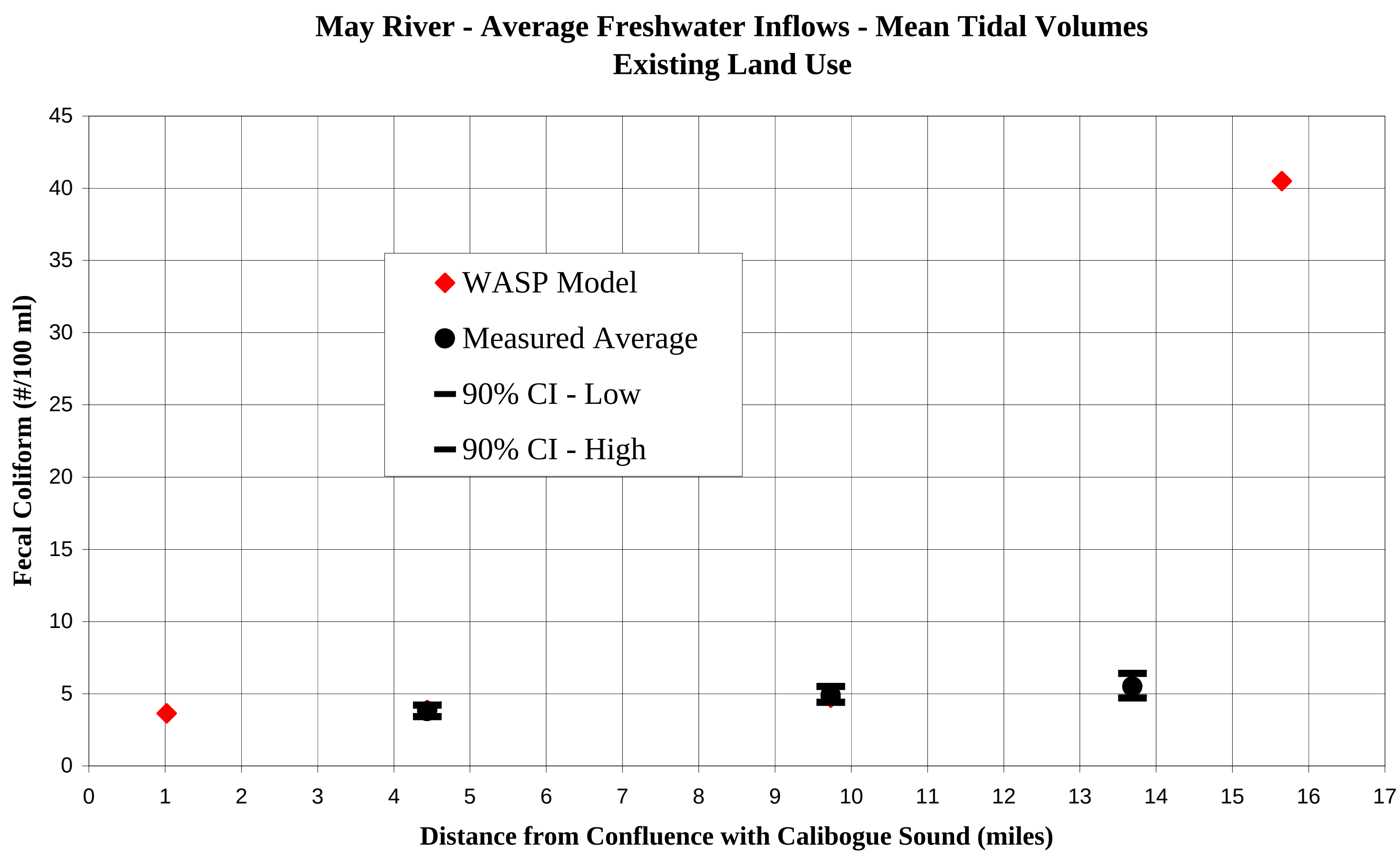

Figure 4-8. Comparison of WASP Model Results with Long-Term Monitoring Data - Fecal Coliform Bacteria

Note: 90% CI = 90% confidence interval for the measured mean based on statistical analysis of monitoring data.

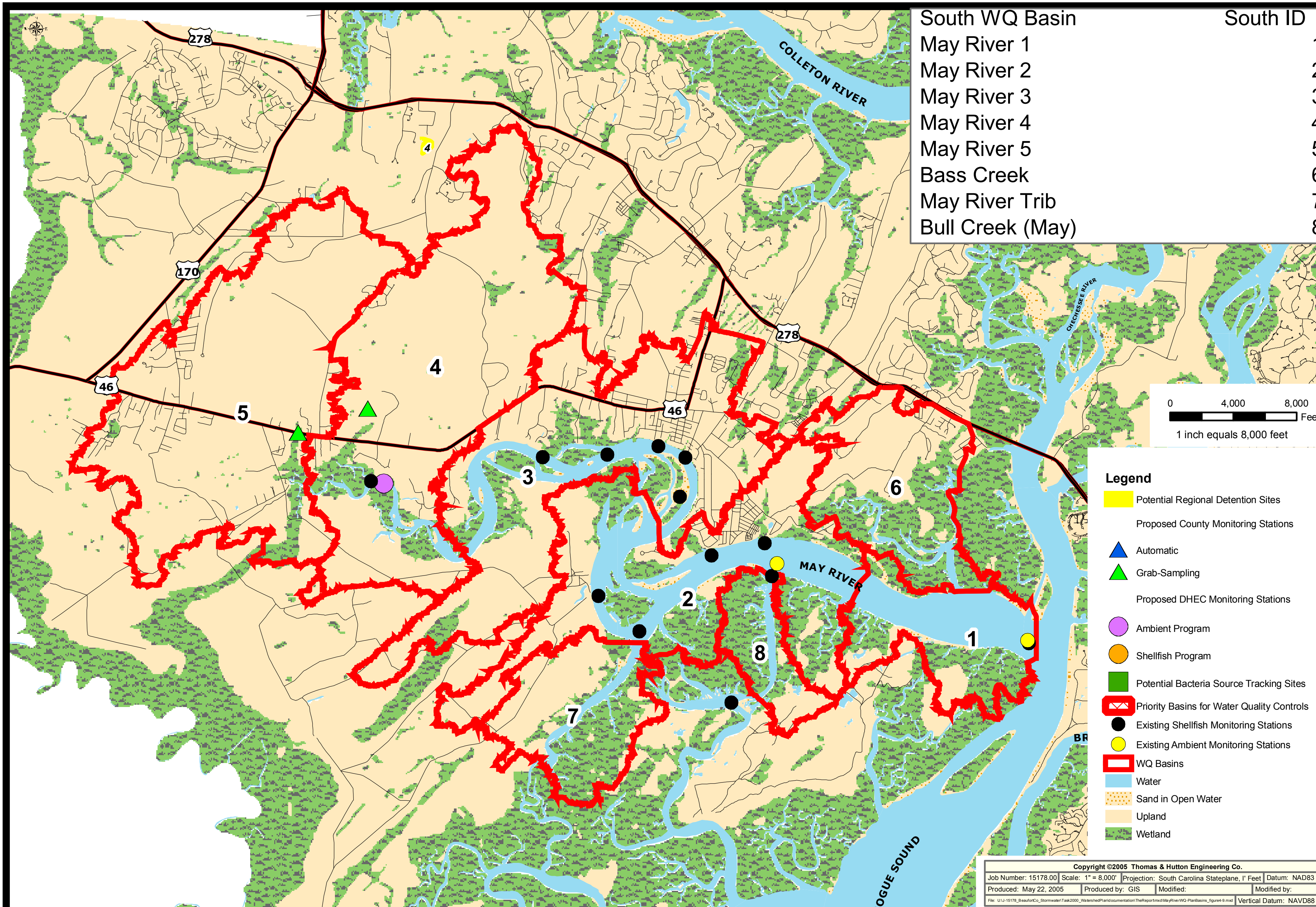

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Figure 4-9

May River Watershed
Water Quality Plan Elements

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Land Use / Land Cover	USGS	
WQ Existing Information	SC DHEC	2005

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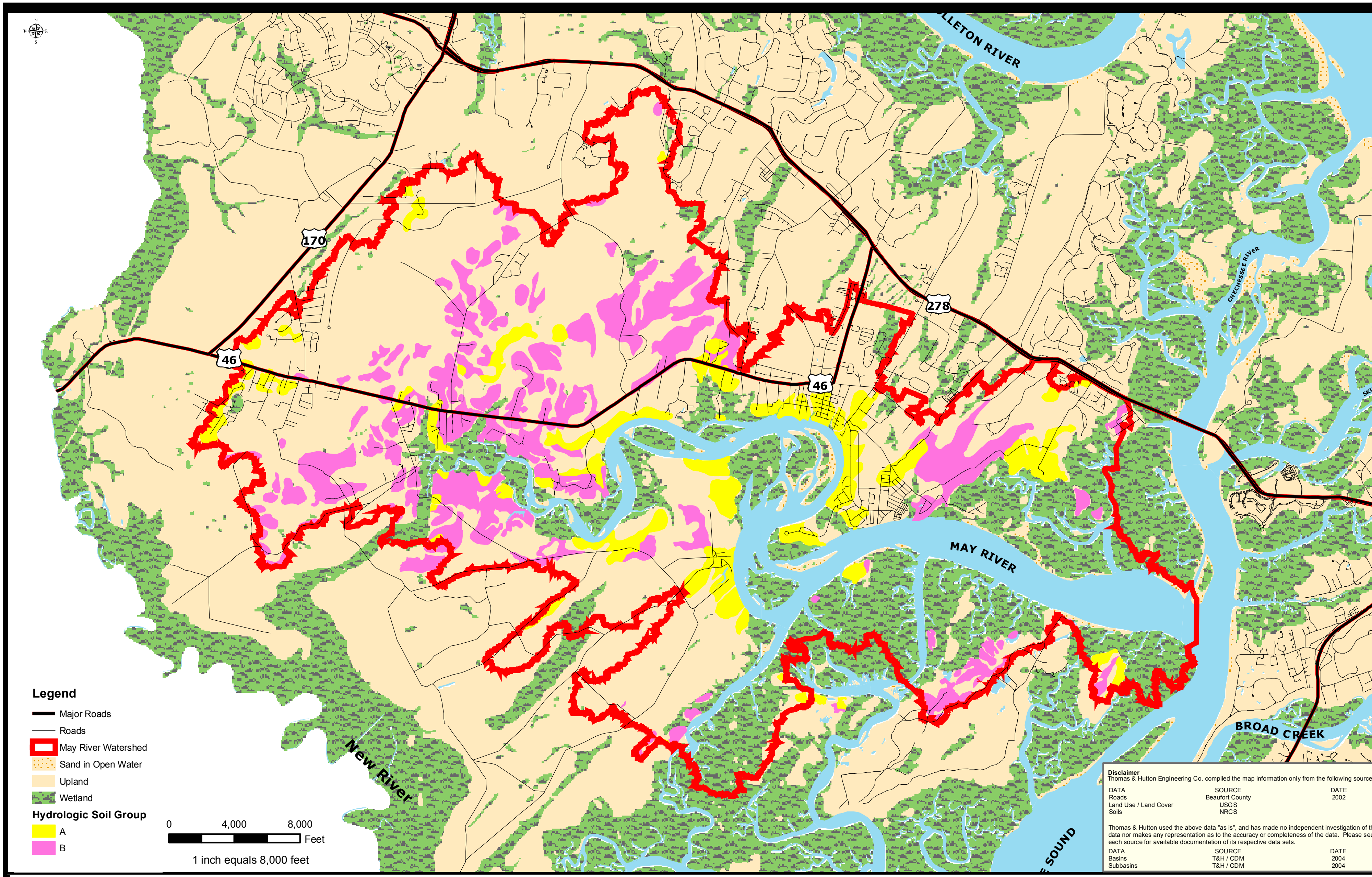
DATA	SOURCE	DATE
Basins	T&H / CDM	2004
WQ Recommendations	T&H / CDM	2004



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Produced: May 22, 2005	Produced by: GIS	Modified:	Modified by:
File: U:\J-15178_BeaufortCo_Stormwater\Task2000_WatershedPlan\documentation\TheReport\mxd\MayRiverSoils_figure4-10.mxd			Vertical Datum: NAVD88

May River Watershed
Potential Locations for Infiltration BMPs based on A and B Soils

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Figure 4-10