

FINAL
TOTAL MAXIMUM DAILY LOAD (TMDL)

For
Dissolved Oxygen

In Savannah Harbor
Savannah River Basin

Chatham and Effingham Counties, Georgia

Prepared by:

US EPA Region 4
61 Forsyth Street SW
Atlanta, Georgia 30303

October 2006



In compliance with the provisions of the Federal Clean Water Act, 33 U.S.C §1251 et.seq., as amended by the Water Quality Act of 1987, P.L. 400-4, the U.S. Environmental Protection Agency is hereby establishing Total Maximum Daily Load (TMDL) for Dissolved Oxygen in Savannah Harbor in the Savannah River Basin. Subsequent actions must be consistent with this TMDL.

James D. Giattina, Director
Water Management Division

Date

Melville _____ Godfrey _____ Baschon _____ Bartlett _____ Giattina _____

Savannah Harbor Dissolved Oxygen TMDL Executive Summary

This report establishes a Total Maximum Daily Load (TMDL) for dissolved oxygen (DO) for the Savannah Harbor from Fort Pulaski (River Mile 0) to the Seaboard Coastline Railway Bridge (River Mile 27.4). The Savannah Harbor is located at the mouth of the Savannah River where it discharges to the Atlantic Ocean. The Savannah River, including the Harbor, serves as the boundary between Georgia and South Carolina.

The Environmental Protection Agency Region 4 (EPA R4) is establishing this TMDL to satisfy a consent decree obligation established in Sierra Club v. EPA, Civil Action No: 94-CV-2501-MHS (N.D.GA). The consent decree required the Georgia EPD or EPA to propose TMDLs for waterbodies identified as impaired on the 2002 Section 303(d) list in the Savannah and Ogeechee River Basins by August 30, 2004. This milestone was achieved by EPA and now EPA is finalizing the TMDL in accordance with the regulations and to complete the requirements under the Consent Decree.

In the absence of the consent decree obligation, EPA would not have chosen to propose this TMDL at this time due to concerns surrounding the existing site-specific DO criterion for the Harbor. The protective water quality criterion is a fundamental component of a meaningful TMDL since the criterion establishes the target upon which the TMDL is based. In this case, the applicable DO site-specific criteria for the Harbor established by the State “are minimum instantaneous and will apply throughout the water column. The dissolved oxygen criteria is no less than 3.0 mg/l in June, July, August, September, and October; no less than 3.5 mg/l in May and November; and no less than 4.0 mg/l in December, January, February, March, and April.” EPA disapproved these criteria in 1989 as not protective of the coastal fishing aquatic life use of the Harbor. The criteria are under-protective of aquatic species in the upper part of the water column and over-protective of aquatic species in the lower part of the water column. A concentration of 3 mg/l of DO in the lower part of the water column cannot be attained without injecting DO into the Harbor, even if all discharges of oxygen-demanding wastes are removed. Until the DO criteria are revised, the TMDL establishes a 100% reduction of oxygen-demanding substances from all continuous NPDES-regulated discharges in the watershed (from the Thurmond Dam near Augusta, Georgia to the Savannah Harbor) in order to attain the existing, applicable site-specific criterion.

Pursuant to the Consent Decree in Sierra Club v. EPA, after EPA proposes a TMDL, that TMDL must be established within a reasonable timeframe. Since the existing State water quality standard is the applicable water quality standard for Clean Water Act purposes, EPA must use that standard to establish this TMDL. EPA acknowledges that the water quality standard for the lower Savannah River must be revised and is working with the Georgia Environmental Protection Department and the South Carolina Department of Health and Environmental Control to develop and adopt an appropriate water quality standard for the Harbor. The States may administratively continue any NPDES permits

that are due to be reissued while the water quality standards adoption process is completed.

Table of Contents

1.	Introduction.....	1
2.	Watershed Characterization.....	1
3.	Target Identification.....	3
3.1	Applicable Water Quality Standard for Dissolved Oxygen.....	3
4.	Modeling Approach.....	3
4.1	Hydrodynamic and Water Quality Model for Savannah Harbor.....	4
5.	Source Assessment.....	4
5.1	Point Sources Discharging Oxygen Demanding Substances.....	5
5.2	Background Sources and Nonpoint Sources.....	7
6.	Dissolved Oxygen TMDL for Savannah Harbor.....	7
6.1	Critical Conditions.....	8
6.2	TMDL Numeric Target.....	8
6.3	Wasteload Allocation (WLA).....	9
6.4	Load Allocation (LA).....	9
6.5	Margin of Safety.....	10
6.6	Seasonal Variation.....	10
6.7	TMDL.....	10
6.7.1	TMDL Implementation.....	11
	REFERENCES.....	12

List of Tables

Table 1	Savannah Harbor Current Permit Limits and Calculated Loads.....	5
Table 2	Savannah Harbor 1999 Summer Oxygen Demanding Loads.....	6
Table 3	Natural Background Oxygen Demanding Substance Loads in TBODu.....	7

List of Figures

Figure 1	Savannah Harbor Location Map.....	2
----------	-----------------------------------	---

1. Introduction

Total Maximum Daily Loads (TMDLs) are required for impaired waters on a State's Section 303(d) list according to Section 303(d) of the Federal Clean Water Act (CWA) and implementing regulation, 40 CFR 130. A TMDL establishes the maximum amount of a pollutant a waterbody can assimilate without exceeding the applicable water quality standard. The TMDL then allocates the total allowable load to individual sources or categories of sources through wasteload allocations (WLAs) for facilities regulated by the National Pollutant Discharge Elimination System (NPDES) program and through load allocations (LAs) for all other sources. In the TMDL, the WLAs and LAs provide a basis for states to reduce pollution that will lead to the attainment of water quality standards and protection of the waterbody's designated use.

The TMDL for the Savannah Harbor in the Savannah River Basin satisfies a consent decree obligation established in Sierra Club v. EPA, Civil Action No: 94-CV-2501-MHS (N.D.GA). This TMDL was proposed on August 30, 2004, and received significant public comments regarding the appropriateness of the Georgia water quality standard for the lower Savannah River and the water quality model used to conduct the TMDL load allocations. The TMDL load allocations were re-evaluated using an enhanced version of the River model funded by the Corps of Engineers. This re-evaluation did not produce any significant changes in the pollutant load reduction requirements to achieve the water quality standard.

2. Watershed Characterization

The Savannah River Basin is located on the border of eastern Georgia and western South Carolina and has a drainage area of 10,577 square miles. The portions of the Savannah River Basin impacted by this TMDL are the middle and lower watersheds encompassing the area from Thurmond Dam to the Atlantic Ocean. Land uses within these watersheds are mostly forestlands, wetlands and agriculture.

The area of concern for this TMDL is the Savannah Harbor located at the mouth of the Savannah River where the Savannah River discharges to the Atlantic Ocean. The Savannah River serves as the boundary between Georgia and South Carolina, and the Harbor is also shared by both states. The Savannah Harbor from Fort Pulaski (Mile 0) to Seaboard Coastline R/R Bridge (River Mile 27.4) is the segment identified on the State of Georgia's Section 303(d) list as impaired for dissolved oxygen. The hydrodynamic and water quality model used to develop the TMDL extends upstream on the Savannah River to River Mile 61.0 near Clyo, Georgia at USGS station 02198500. The downstream end of the model extends approximately 19 miles offshore from Oyster Island to cover the navigational channel of Savannah Harbor. The modeling study covers the Savannah River, the Front River, the Middle River, the Little Back River, the Back River, the South Channel, and the offshore portions in the Atlantic Ocean. Figure 1 is a map that shows the model's extent and overall location of the study area.

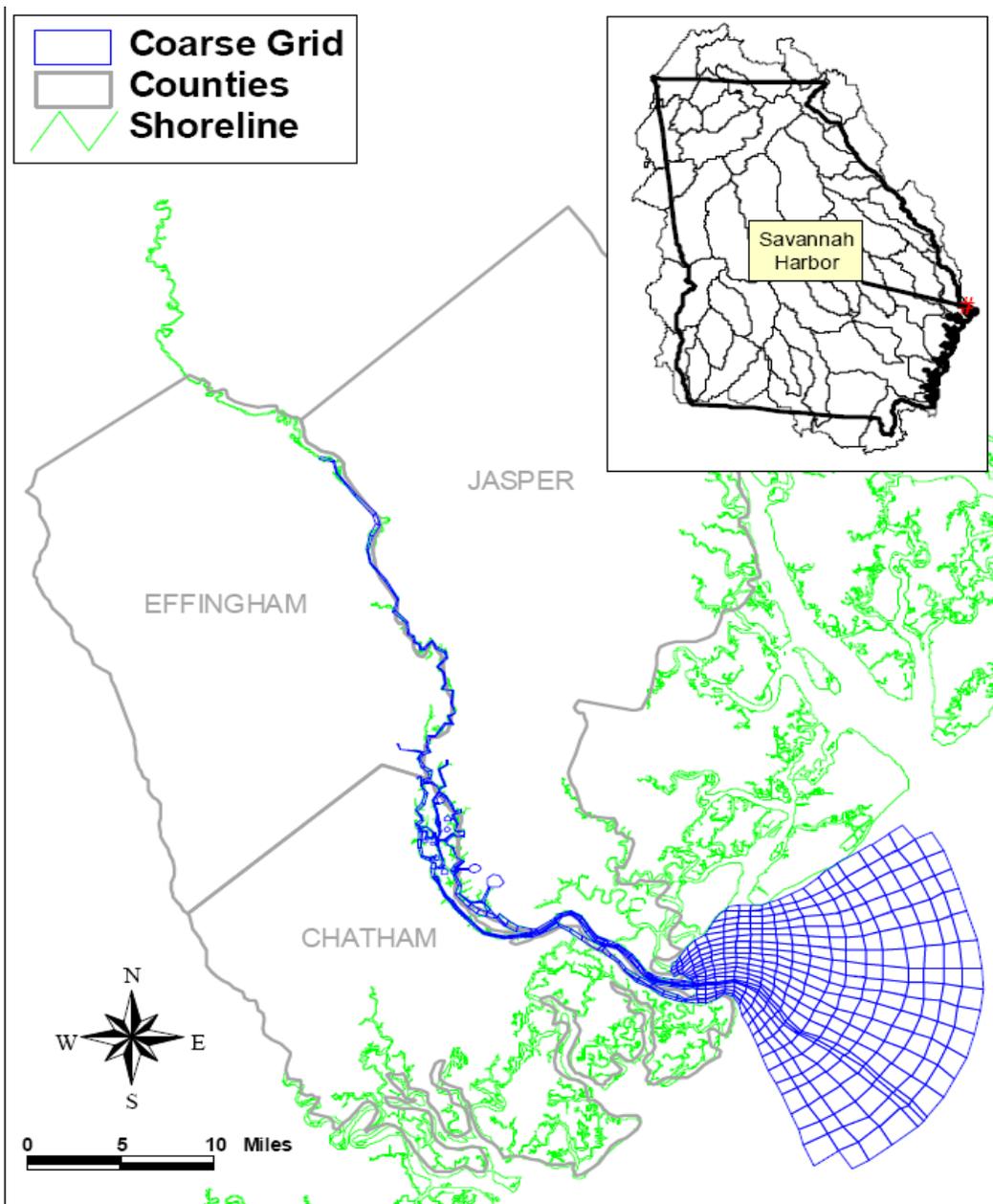


Figure 1 Savannah Harbor Location Map

The Savannah Harbor from Fort Pulaski (River Mile 0) to Seaboard Coastline R/R Bridge (River Mile 27.4) was listed on Georgia’s 2002 Section 303(d) list for failing to meet the dissolved oxygen (DO) criterion associated with the State of Georgia’s Coastal Fishing water quality use designation based on data collected in the summers of 1997 and 1999.

Water quality studies, conducted over the past ten years, were used to develop the TMDL. The purpose of the field studies was to characterize the dissolved oxygen (DO)

regime of the harbor, to determine the principle causes of impairment, and to provide sufficient data and information to develop a complex water quality model. The data used in the calibration and confirmation of the hydrodynamic and water quality models were collected by the Georgia Ports Authority (GPA), the U.S. Geological Survey (USGS), the Georgia Environmental Protection Division (GAEPD), the U.S. Army Corps of Engineers (USACE), and the USEPA. An extensive amount of data analyses were performed by the GPA through their contractor, Applied Technology and Management, Inc. Additional details on the hydrodynamic modeling can be found in *Development of the Hydrodynamic and Water Quality Model for the Savannah Harbor Expansion Project, January 2006 (TetraTech 2006)*.

3. Target Identification

3.1 Applicable Water Quality Standard for Dissolved Oxygen

The designated water use classification for the Savannah River from Fort Pulaski (River Mile 0) to Seaboard Coastline R/R Bridge (River Mile 27.4) is coastal fishing. The coastal fishing classification is established in Georgia's Rules and Regulations for Water Quality Control Chapter 391-3-6-.03(6)(c)(iv)(f). In 1989, site-specific dissolved oxygen (DO) criteria were established by GaEPD for this section of the Savannah River. The site-specific criteria "are minimum instantaneous and will apply throughout the water column. The dissolved oxygen criteria is no less than 3.0 mg/l in June, July, August, September, and October; no less than 3.5 mg/l in May and November; and no less than 4.0 mg/l in December, January, February, March, and April."

States are required under the CWA to submit newly-adopted or revised water quality standards to EPA for review pursuant to section 303(c) of the CWA. In 1989, GaEPD submitted the site-specific criterion for the Savannah Harbor to EPA Region 4 (EPA R4). Upon review, EPA R4 disapproved this site-specific criterion for CWA purposes as not protective of the coastal fishing designated use. The instantaneous minimum of 3 mg/l (the criterion that applies during the critical summertime conditions) is not protective of aquatic life in the upper part of the water column and has now been shown to be over-protective of aquatic life in the lower parts of the water column. However, until such time that a replacement criterion is adopted, the existing criterion (even though it is disapproved) remains in effect. Since the CWA requires TMDLs to be established to attain the applicable water quality criterion, the instantaneous minimum DO of "no less than 3.0 mg/l in June, July, August, September, and October" is the numeric target for calculation of the TMDL.

4. Modeling Approach

EPA R4 and its contractor, Tetra Tech, Inc. (Tetra Tech), have developed a calibrated hydrodynamic and water quality model for the Savannah Harbor System. The models were calibrated to data collected from the year 1997 to the present. These models were used to determine the appropriate DO TMDL for Savannah Harbor. The Corps of Engineers enhanced version of the original model was used to assess the pollutant load

impacts as well as the structural impacts including dredging on the dissolved oxygen regime in the Savannah Harbor waterbodies (TetraTech 2006). The enhanced models outputs were similar to the original EPA TMDL modeling results.

4.1 Hydrodynamic and Water Quality Model for Savannah Harbor

Tetra Tech was contracted by the EPA Region 4 and the Corps of Engineers to support the development of a dissolved oxygen model in the Savannah Harbor Estuary. To support the development of the model, Tetra Tech was tasked to setup and run a hydrodynamic model that met the following criteria:

- Captures key hydrodynamic processes of transport in the estuary,
- Is public domain and whose code has been peer reviewed on other TMDLs,
- Links the hydrodynamic model to a water quality model,
- Delivers the model to the federal agencies involved in the TMDL process and,
- Can be run to model for multiple hydrologic periods to examine point and nonpoint sources.

In January 2004, the United States Army Corps of Engineers (USACE), Savannah District, contracted with Tetra Tech to provide a hydrodynamic modeling report and deliver the report in March 2004. The model code, modeling results, in both time series and statistical formats, and a database (containing model comparison data) are all readily available for peer review and are provided with the report, “Development of the EFDC Hydrodynamic Model for the Savannah Harbor, March 2004.”

Tetra Tech and EPA R4 have updated the original March 2004 model (2004 Tetra Tech) to address legitimate comments and concerns provided by reviewers. The model has been updated to include, among others, improvement of channel configuration and direct inclusion of temperature impacts from the Savannah Electric power plants’ thermal discharges and the City of Savannah storm water flows. These updates are detailed in the report entitled, “Development of the Hydrodynamic and Water Quality Model for the Savannah Harbor Expansion Project, January 2006” (2006 Tetra Tech).

This updated hydrodynamic model is calibrated with a higher resolution grid and includes the pollutant and hydrodynamic transport mechanisms necessary for the subsequent development of the Savannah Harbor water quality model.

5. Source Assessment

A TMDL evaluation examines the known potential sources of the pollutant of concern in the watershed, including facilities regulated by the National Pollutant Discharge Elimination System (NPDES) program, non-point sources, other sources of pollution, and background levels of the pollutant in the affected waterbody.

5.1 Point Sources Discharging Oxygen Demanding Substances

Discharge from municipal and industrial facilities may contribute oxygen-demanding substances to receiving waters as ultimate carbonaceous biochemical oxygen demanding (CBODu) substances and ammonia. Total Ultimate BOD (TBODu) equals the sum of CBODu and the multiplication of ammonia times a conversion factor of 4.57.

The cumulative oxygen-demanding substances load for facilities authorized by NPDES permits to discharge into the Harbor, expressed as TBODu, is 367,000 lbs/day. Of this authorized 367,000 lbs/day, facilities were cumulatively discharging 99,000 lbs/day of TBODu in the summer of 1999. The permitted NPDES discharges are shown in Table 1 as a facility's "Current Permit Limits and Calculated Loads"; the loads discharged by the facilities for the critical year 1999 are shown in Table 2 as the "Oxygen Demanding Load Summer 1999."

Table 1 Savannah Harbor Current Permit Limits and Calculated Loads

Facility name	NPDES	Current Permit Limits and Calculated Loads						
		Flow	BOD5	BOD5	NH3	NH3	F_ratio	TBODu
Georgia		mgd	mg/l	lbs/day	mg/l	lbs/day		lbs/day
Hardeville	SC0034584	1.0	30.0	253		85	2.0	894
Fort James	GA0046973	0.8		10850		22	5.0	54350
Weyerhauser	GA0002798	0.1	0.0	6700			4.5	30150
Garden City	GA0031038	2.0	30.0	1125	17.4	290	2.4	4026
Whilshire	GA0020443	4.5	30.0	1126	17.4	653	2.5	5799
Travis Field	GA0020447	1.5	20.0	250	11.6	145	2.3	1239
President Street	GA0025348	27.0	18.5	4166	12.9	2905	3.9	29522
International Paper	GA0001998	1.3		25000			10.7	269328
Englehard	GA0048330					400		1828
Kerr McGee*	GA0003646	0.6						

* Kerr McGee has an iron oxygen-demanding load to the system which exerts 44,000 lbs/day of immediate oxygen demand.

Table 2 Savannah Harbor 1999 Summer Oxygen Demanding Loads

		Oxygen Demanding Load - Summer 1999				
Facility name	NPDES	Flow	BOD5	NH3	F_ratio	TBODu
Georgia		mgd	lbs/day	lbs/day		lbs/day
Hardeville	SC0034584	0.5	12.6	0	2.0	25
Fort James	GA0046973	19.3	762	22	5.0	3911
Weyerhaeuser	GA0002798	2.6	180	2	4.5	819
Garden City	GA0031038	1.1	51	0	2.4	122
Whilshire	GA0020443	3.1	295	117	2.5	1272
Travis Field	GA0020447	0.8	56	0	2.3	129
President Street	GA0025348	18.8	1128	93	3.9	4824
International Paper	GA0001998	30	8100	125	10.7	87241
Englehard	GA0048330	1	0	66		302
Kerr McGee*	GA0003646	13				

* Kerr McGee has an iron oxygen-demanding load to the system that exerts 44,000 lbs/day of immediate oxygen demand.

Oxygen-demanding loads from the City of Savannah municipal storm water, industrial storm water and the heat loads from the three Savannah Electric power facilities were evaluated in the model and shown to have no measurable impact on the DO levels in the critical areas of concern. The storm water loads are considered to have equivalent oxygen demanding CBODu and ammonia concentrations to natural background and are included in the background loads. This is estimated to be around 2.0 mg/l BOD5. Therefore, the permitted storm water discharges are not considered significant sources of oxygen-demanding wastes.

Loadings of oxygen-demanding substances from sources upstream of the Harbor, below Thurmond Dam, also impact the Harbor DO levels. The majority of these dischargers are in the Augusta, Georgia area. The total loading of oxygen-demanding substances for the upstream sources authorized by NPDES permit is 358,000 lbs/day TBODu. The total loading of existing oxygen-demanding substances actually discharged in the summer of 1999 was 135,000 lbs/day TBODu.

The loads from these discharges impact the DO concentration in the Harbor and are taken into account in the Savannah Harbor TMDL. The transport of the oxygen-demanding substances through the River system is calculated using the Savannah River EPD-RIV1 model. According to EPA's modeling, approximately 75% or 100,000 lbs/day TBODu of the oxygen-demanding substances discharged in the summer of 1999 around Augusta reach the upstream portion of the Savannah Harbor. Figure 1 illustrates the Savannah River segments covered by the EPD-RIV1 model and the segment covered by the Savannah Harbor Model.

5.2 Background Sources and Nonpoint Sources

The vast majority of the non-NPDES loadings of oxygen-demanding substances are from natural background sources including detritus transported in the stream, detritus from marsh areas flowing directly into the Harbor, and tidally- transported detritus from the ocean. The natural background, nonpoint source loads, and residual loads from point sources discharging to the tributaries are based upon the water quality monitoring and flow data from the tributary mouths and main stem of the Savannah River.

These background loadings were developed from site specific data and information. The ocean CBODu and ammonia background values were developed from numerous long-term BOD samples collected by the Savannah Harbor Committee in 2003 and USEPA data collected in 1997. The headwater boundary CBOD, nitrogenous biochemical oxygen demanding (NBOD) and dissolved oxygen values were developed from field measurements and results of an upstream water quality model used by USEPA Region 4, an adaptation of the EPDRIV1 Savannah River water quality model developed by Georgia. The marsh CBODu loadings were based on maximum literature export coefficient and the long-term CBOD data collect in 1999. The combined TBODu loads from these sources serve as the natural background oxygen demanding loads in the water quality model. Table 3 provides an estimate of the various background loadings to the system.

Table 3 Natural Background Oxygen Demanding Substance Loads in TBODu

	Oxygen Demanding Substance Loads, TBODu
Marsh	145,000 lbs/day
Upstream	85,000 lbs/day
Ocean	CBODu = 5 mg/l; Ammonia = 0.07 mg/l

6 Dissolved Oxygen TMDL for Savannah Harbor

A TMDL establishes the total pollutant load that a waterbody can assimilate and still achieve the applicable water quality standard. The components of a TMDL include a wasteload allocation (WLA) for facilities and sources regulated by the NPDES program, a load allocation (LA) for all other sources (including natural background), and a margin of safety (MOS) to either implicitly or explicitly to account for uncertainty in the analysis. Conceptually, a TMDL is defined by the equation:

$$\text{TMDL} = \Sigma \text{WLA} + \Sigma \text{LA} + \text{MOS}$$

The TMDL for the Savannah Harbor in the Savannah River Basin is in terms of oxygen-demanding substances expressed as TBOD_u, where:

- TBOD_u = CBOD_u + NBOD_u
 - CBOD_u = BOD₅ multiplied times a f-ratio
 - NBOD_u = ammonia multiplied times 4.57 conversion factor

6.1 Critical Conditions

Critical conditions as established in Georgia's *Rules and Regulations for Water Quality Control* Chapter 391-3-6 are the "collection of conditions for a particular waterbody used to develop Total Maximum Daily Loads (TMDLs), determine NPDES permit limits, or assess the protection of water quality standards. The GaEPD considers appropriate critical conditions to represent the event that would occur once in ten years on the average or less often, unless otherwise stated."

In May 2000 and May 2003 letters, Georgia and South Carolina set the critical conditions for Savannah Harbor as:

- Upstream boundary determined by the States' Savannah River Model;
- Harbor model kinetic rates and parameters as determined by the Savannah Harbor Model calibration;
- 1999 harbor channel bathymetric physical conditions;
- Critical flow equivalent to the seven-day ten-year low-flow (7Q10), taking into account the low-flow release from Thurmond Dam;
- Meteorological and tidal conditions based on 1999 data; and
- Dischargers at NPDES limits expressed as monthly averages.

For an estuarine TMDL, critical conditions are more complex than the critical conditions typically considered for a river system (e.g., summer temperatures and the 7Q10 flow). Tidal dynamics play an important role in the DO levels of the Savannah Harbor. Therefore, critical conditions applied to the Savannah Harbor DO TMDL are based on model runs for August of 1999 incorporating the existing harbor physical conditions and the upstream 7Q10 low flow as well as actual historic tidal regimes, temperature and other meteorological conditions measured during these periods. Heat loads from the electrical facilities were also considered in calculating the TMDL.

The critical segment of the Savannah Harbor system is defined as the segment of the Harbor with the lowest daily DO average. This segment is a four mile segment around the Savannah Harbor sediment basin (River Mile 9.3 to 14.3).

6.2 TMDL Numeric Target

Pursuant to the CWA, TMDLs are established to attain the applicable water quality standard for the waterbody. This existing, applicable criterion is the end-point or target to which the TMDL is established. For the critical condition in the Savannah Harbor (i.e., summertime conditions), the existing, applicable numeric criterion for DO is an instantaneous minimum of not less than 3.0 mg/l in June, July, August, September, and October. This TMDL is established to achieve this criterion throughout the water column during critical conditions.

The modeling conducted to establish this TMDL demonstrates that the existing DO criterion is unattainable under any conditions (including natural conditions in the Harbor) without an artificial injection of DO. This outcome of the TMDL (i.e., the applicable water quality standard cannot be attained even with the elimination of all oxygen-demanding substances) is due to the inappropriateness of the site-specific criterion of 3 mg/l to the deepest parts of the Harbor. Under natural conditions, the deeper parts of the Harbor exhibit a minimum DO concentration of less than 3 mg/l.

6.3 Wasteload Allocation (WLA)

The wasteload allocation is the portion of the total load that is provided to the NPDES facilities. This TMDL provides the WLA as oxygen-demanding substances, expressed as TBODu, of zero lbs/day. The WLA is derived to prevent discharges from NPDES facilities to cause or to contribute to exceedences of the DO criterion in the Harbor. The WLA for permitted storm water dischargers is established at background loading conditions and/or concentrations such that they will not cause or contribute to further lowering of dissolved oxygen in the Harbor.

6.4 Load Allocation (LA)

The load allocation is the portion of the total load that is provided to the non-NPDES sources of oxygen-demanding substances, including non-point source discharges and natural background sources. The majority of the non-NPDES loadings are from natural background sources. Non-point sources are a very minor contributor of oxygen consuming wastes under critical low flow conditions because of the absence of stormwater runoff. Therefore, the non-point source contribution is aggregated with the natural background loads in this TMDL. If, at a later date, a significant upstream non-point source is identified, the TMDL will be revised to account for this source.

The natural background loadings to the harbor are as follows:

- Upstream loads from natural riverine TBODu = 85,000 lbs/day
- Marsh loadings = 145,000 lbs/day
- Ocean boundary conditions for CBODu = 5 mg/l and Ammonia = 0.07 mg/l causes Savannah Harbor's natural DO levels to decrease due to the tidal flux for CBODu and ammonia into the Harbor system

6.5 Margin of Safety

A margin of safety (MOS) is a required component of a TMDL to account for the uncertainty in the relationship between the pollutant loads and the quality of the receiving waterbody. For Savannah Harbor, the amount of uncertainty is considered to be low. This system has been the subject of extensive study, including extensive data collection, and model development by various state and federal agencies. The Savannah Harbor MOS is incorporated into the conservative critical condition assumptions used to develop the TMDL.

6.6 Seasonal Variation

Seasonal variation is incorporated in the Savannah Harbor TMDL by evaluating multiple years of data. For the hydrodynamic model, the years of 1997 through 2002 were evaluated. For the water quality model, summer time conditions for 1997, 1999, 2001 and 2002 were evaluated, including a complete 1999 annual model run.

6.7 TMDL

The site-specific DO criteria for the Savannah Harbor, is defined as: “Site specific criteria for this classification are minimum instantaneous and will apply throughout the water column. The dissolved oxygen criteria is no less than 3.0 mg/l in June, July, August, September, and October; no less than 3.5 mg/l in May and November; and no less than 4.0 mg/l in December, January, February, March, and April.” Based upon the modeling results, these criteria cannot be attained even if all discharges of oxygen-demanding substances are eliminated. Therefore, the TMDL for the Harbor is:

- TMDL = 230,000 lbs/day (natural background including MS4 discharge)
 - LA = 230,000 lbs/day (natural background includes MS4 discharge)
 - Ocean Boundary Conditions of CBOD_u = 5 mg/l and Ammonia = 0.07 mg/l
 - WLA = 0 lbs/day for continuous point sources
 - WLA_{stormwater} = natural background load/concentration (consistent with the load allocation)
 - Reduction = 100% of existing NPDES loads

The Savannah Harbor cannot accept any discharges of oxygen-demanding substances and still attain the applicable criterion. Removal of the direct NPDES dischargers identified in Table 1 improves the dissolved oxygen concentration in the upper fresh water layer of the Savannah River by 0.7 mg/l under 1999 critical conditions. However, this improvement is not sufficient to achieve the current water quality criterion in the lower saline portion of the River. See Section 3 for an explanation of the criterion. The preliminary model results also indicate that the existing Savannah Harbor deepening and

control structures depress the dissolved oxygen in the upper water zone on the Savannah River by approximately 1 mg/l as compared to the model results using the 1854 River bathymetry. The U.S. Corps of Engineers are further examining these scenarios through their expansion and restoration projects.

6.7.1 TMDL Implementation

EPA acknowledges that appropriate water quality criteria for dissolved oxygen should be adopted for the lower Savannah River. Currently, the States of Georgia and South Carolina and EPA are engaged in a process to fully assess options for developing and adopting appropriate criteria for this waterbody. The parties will examine multiple options for developing the criteria. Since the existing Harbor deepening and control structures have depressed the dissolved oxygen in the River, the biological impacts of this depressed dissolved oxygen regime and the ability to mitigate its impacts will be factors in the development of an appropriate dissolved oxygen criterion for the Savannah Harbor. Any revisions to the water quality criteria will be made available to the public for review and comment.

TMDLS are implemented by authorized states through various state non-point and point source programs. The waste load allocations contained in TMDLs are implemented through NPDES permits. States may use any administrative or regulatory tools available in their NPDES rules to provide flexibility in such implementation. EPA intends to work closely with the States of Georgia and South Carolina to fully explore and utilize available flexibility in implementing this TMDL.

EPA also embraces the concept of trading in watersheds with multiple sources. Trading is allowed under this TMDL as long as the total TMDL is not exceeded.

REFERENCES

Development of the EFDC Hydrodynamic Model for the Savannah Harbor, March 2004. Report prepared for U.S.A.C.E. Savannah District and EPA Region 4. (Tetra Tech, Inc.)

Development of the Hydrodynamic and Water Quality Model for the Savannah Harbor Expansion Project, January 2006. Report prepared by U.S.A.C.E. Savannah District. (Tetra Tech Inc.)

Dissolved Oxygen Diffusion Study and Sediment Oxygen Demand Study, Savannah River, August 1999. Prepared by EPA Region 4 Science and Ecosystem Support Division. (1999 EPA Region 4)

Georgia Rules and Regulations for Water Quality Control, Chapter 391-3-6-.03, Water Use Classifications and Water Quality Standards, July 2000

Savannah Harbor Expansion Project TMDL 1999 River and Marsh Long-term Biochemical Oxygen Demand Results, June 2004. Report prepared for the Savannah Harbor Committee. (2004a MACTEC)

Draft Savannah Harbor Water Quality Model, August 2004. Prepared by EPA Region 4. (EPA Region 4)

Sierra Club v. EPA & Hankinson USDC-ND-GA Atlanta Div. #1: 94-CV-2501-MHS, 1998.

Wastewater Characterization Study, Lower Savannah River, Final Report, May 2000. Report prepared for the Savannah Harbor Committee. (MACTEC formerly LAWGIBB Group)

