RHODE ISLAND
DEPARTMENT OF ENVIRONMENTAL MANAGEMENT
235 Promenade Street, Providence, RI 02908-5767 TDD 401-222-4462

RECEIVED
JAN 14 2010
WOODARD & CURRAN, INC.
DEDHAM, MASS

January 6, 2010

CERTIFIED MAIL

Mr. C. Richard Paduch, Town Manager
Town of Warren
514 Main Street
Warren, RI 02885-4369

RE: 14-Day Draft Permit; RIPDES Application No. RI0100056

Dear Mr. Paduch,

In accordance with regulations adopted pursuant to Chapter 46-12 of the General Laws of Rhode Island, as amended, the Rhode Island Department of Environmental Management (DEM) intends to reissue a Rhode Island Pollutant Discharge Elimination System (RIPDES) Permit to the Warren Wastewater Treatment Facility (WWTF) in the near future.

The enclosed draft permit has been developed by the DEM and contains effluent limitations and conditions to assure that the WWTF's discharge receives adequate treatment and will not violate water quality standards. Also, enclosed are the Fact Sheet and Permit Development Document, which describe the basis for the permit conditions, and a report titled *Evaluation of Nitrogen Targets and Load Reductions for the Palmer River*, which is referenced in the Permit Development Document. The Town of Warren (Town) is encouraged to closely review all terms and conditions contained in this draft permit. If the Town believes the permit does not accurately describe the WWTF's discharge, it should notify the DEM, in writing by February 5, 2010. Particular attention should be given to the following sections:

- Effluent Limitations and Monitoring Requirements

  This section contains listings of effluent characteristics, discharge limitations and monitoring requirements. Please note that monitoring for Total Cadmium, Total Chromium, Total Lead, Total Zinc, Total Nickel, and Total Aluminum is being required quarterly as part of the DEM's list of standard parameters, for discharges to salt waters, that must be measured as part of the bioassay procedures. Also note that limits for Total Nitrogen have been included in the permit based on a nutrient loading analysis that the DEM performed on the Palmer River. The basis for the Total Nitrogen limits are included in the enclosed Permit Development Document and the report titled *Evaluation of Nitrogen Targets and Load Reductions for the Palmer River*.

- Monitoring and Reporting

This section contains your responsibilities for reporting monitoring results.

The law requires public notice to be given of the preparation of a draft permit to allow opportunity for public comments and a public hearing. If the DEM does not receive any comments from the Town by February 5, 2010, it will initiate the public comment period by proceeding to publish public notice of the proposed issuance of this permit. In order to preserve the right to a formal hearing to contest provisions in a final permit, all persons, including the Town, who believe any condition of the draft is inappropriate, must raise all reasonably ascertainable issues and submit all reasonably available arguments and factual grounds supporting their position by the close of the public comment period. Following the public comment period, a public hearing will be held, after which the final permit will be issued providing no new substantial questions are raised. If new questions develop during the comment period or public hearing, it may be necessary to draft a new permit, revise the Fact Sheet, and/or reopen the public comment period.

On January 1, 1996 a state law (R.I.G.L. 42-17.4-12) was enacted regarding public notices and public hearings for RIPDES Permits. This law requires a public hearing for the reissuance of all major RIPDES permits and requires that the public notice for the hearing be in the form of a display advertisement in the newspaper to be paid for by the facility. In addition, the law states that the stenographer is also to be paid for by the facility. Unless notified to the contrary, the DEM will provide the Providence Journal and the stenographer with the address above for billing and ask that they bill the Town directly.

As the Town is aware, the WWTF routinely violates its flow limit and, as a result, the Town is in the process of conducting inflow removal activities. In addition, the WWTF will not be able to immediately comply with the Total Nitrogen permit limits in the attached draft permit. Therefore, subsequent to permit issuance, the DEM intends to enter into a consent agreement with the Town that will establish a schedule for the Town to complete its inflow removal activities and construct the upgrades that will be necessary for the WWTF to comply with the Total Nitrogen limits. This Consent Agreement will include interim limits for flow and Total Nitrogen and a schedule for the completion of the inflow removal work, submittal of a Facilities Plan Amendment, and construction of the necessary upgrades to meet final limits. If the Facilities Plan Amendment includes a proposal to re-rate the WWTF's design flow to a flow that is greater than the permitted flow limit established in this permit, then the Facilities Plan Amendment must indicate that pollutant loadings will not be increased and the Town agrees not to appeal a permit modification that establishes concentration limits that insure compliance with this requirement (i.e., concentration limits that are decreased proportional to the flow increase). In order to enter into this Consent Agreement, the Town will have to appeal its flow and Total Nitrogen limits within thirty (30) days after the DEM's issues the final permit. At that time, a draft Consent Agreement will be developed and sent to the Town for review.

In addition to transmitting the Town's draft permit, this letter is also being written in response to the December 4, 2009 letter that Woodard and Curran submitted to the DEM on behalf of the Town. After review of the December 4th letter, the DEM is approving the Town's extension request to submit its Final Inflow Report. Therefore, in accordance with the approved extension request, the Town must submit it's Final Inflow Report to the DEM by September 14, 2010 and its Facilities Plan Amendment for a flow re-rating to the DEM by April 26, 2011.

The DEM has also reviewed the alternative large building inspection threshold of 24,000 ft^2 that was proposed in the December 4th letter. Although the DEM may be willing to establish an alternative large building inspection threshold, the DEM has some concerns regarding the methodology used to establish the 24,000 ft^2 threshold. Specifically, the DEM is concerned that the proposed methodology does not take into account the true cost to treat stormwater runoff because it did not account for the increased cost that will be required to meet the new limits proposed in this permit (i.e., the Total Nitrogen limits), it did not account for any localized impacts of inflow on flow limited sewers, and it did not account for the recurring cost to treat stormwater vs. the one-time cost to inspect a building. Therefore, prior to DEM's approval of an alternative large building inspection threshold, the Town must submit an analysis that includes the following: the number of large buildings that fall into 5,000 ft^2 size tiers (i.e., 5,000 – 10,000 ft^2, 10,000 – 15,000 ft^2, 15,000 – 20,000 ft^2, and 20,000 – 24,000 ft^2); an estimate of the total combined inflow volume that would be generated by the buildings in each tier during a six hour, one-year storm event with a total rainfall of 1.72 inches; a map with color-coded locations of the buildings that fall into each size tier with capacity limited sewers identified; and a recommendation of an alternative large building inspection threshold based on the anticipated total gallons of inflow that could be removed from buildings in each size tier. This analysis must be submitted by February 5, 2010. Once the DEM reviews this revised analysis, a decision will be made regarding the final large building inspection threshold.

If the Town has any questions or would like to meet to discuss the draft permit or the revised large building inspection threshold analysis requirements, do not hesitate to contact Joseph Haberek, P.E. at 401-222-4700, extension 7715.

Sincerely,

Eric A. Beck, P.E.
Supervising Sanitary Engineer

cc: Heidi Travers, DEM
Jonathan Himlan, Woodard & Curran
David Komeiga, United Water

AUTHORIZATION TO DISCHARGE UNDER THE RHODE ISLAND POLLUTANT DISCHARGE ELIMINATION SYSTEM

In compliance with the provisions of Chapter 46-12 of the Rhode Island General Laws, as amended, the

Town of Warren
514 Main Street
Warren, RI 02885

is authorized to discharge from a facility located at the

Warren Wastewater Treatment Facility
427 Water Street
Warren, RI 02885

to receiving waters named the

Warren River

in accordance with effluent limitations, monitoring requirements and other conditions set forth herein.

This permit shall become effective on ____________________________.

This permit and the authorization to discharge expire at midnight, five (5) years from the effective date.

This permit supersedes the permit issued on September 30, 2002.

This permit consists of 21 pages in Part I including effluent limitations, monitoring requirements, etc. and 10 pages in Part II including General Conditions.

Signed this __________ day of __________________________, 2010.

DRAFT

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Angelo S. Liberti, P.E., Chief of Surface Water Protection
Office of Water Resources
Rhode Island Department of Environmental Management
Providence, Rhode Island

PART I

A. EFFLUENT LIMITATIONS AND MONITORING REQUIREMENTS

1. During the period beginning on the effective date of this permit and lasting through permit expiration, the permittee is authorized to discharge from outfall serial number 001 (Final Discharge from the WWTF After All Treatment Processes).

   Such discharges shall be limited and monitored by the permittee as specified below:

Effluent Characteristic	Discharge Limitations: Quantity - lbs./day		Discharge Limitations: Concentration - specify units			Monitoring Requirement	
	Average Monthly	Maximum Daily	Average Monthly *(Minimum)	Average Weekly *(Average)	Maximum Daily *(Maximum)	Measurement Frequency	Sample Type
Flow	2.01 MGD	--- MGD				Continuous	Recorder
BOD_5	502	838	30 mg/l	45 mg/l	50 mg/l	3/Week	24-Hr. Comp.
BOD_5 - % Removal			85%			1/Month	Calculated
TSS	502	838	30 mg/l	45 mg/l	50 mg/l	3/Week	24-Hr. Comp.
TSS - % Removal			85%			1/Month	Calculated
Settleable Solids				--- ml/l	--- ml/l	1/Day	Grab

--- Signifies a parameter that must be monitored and data must be reported; no limit has been established at this time.

Sampling for TSS and BOD_5 shall be performed Tuesday, Thursday, and either Saturday or Sunday. All BOD_5 and TSS samples shall be taken on the influent and effluent with appropriate allowances for hydraulic detention (flow-through) time.

Sampling for Flow and Settleable Solids shall be performed Sunday-Saturday.

Samples taken in compliance with the monitoring requirements specified above shall be taken at the following location: Outfall 001A (Final Discharge from the WWTF After All Treatment Processes).

PART I

A. **EFFLUENT LIMITATIONS AND MONITORING REQUIREMENTS**

2. During the period beginning on the effective date of this permit and lasting through permit expiration, the permittee is authorized to discharge from outfall serial number 001 (Final Discharge from the WWTF After All Treatment Processes).

Such discharges shall be limited and monitored by the permittee as specified below:

Effluent Characteristic	Discharge Limitations					Monitoring Requirement	
	Quantity - lbs./day		Concentration - specify units				
	Average Monthly	Maximum Daily	Average Monthly *(Minimum)	Average Weekly *(Average)	Maximum Daily *(Maximum)	Measurement Frequency	Sample Type
Fecal Coliform			200 MPN[1] 100 ml	400 MPN[1] 100 ml	400 MPN[1] 100 ml	3/Week	Grab
Total Residual Chlorine (TRC)			455 ug/l [2]		455 ug/l [2]	Daily	Grab[2]
pH			(6.5 SU)		(8.5 SU)	2/Day	Grab

[1]Two (2) of the three (3) Fecal Coliform samples are to be taken on Tuesday and Thursday. All three (3) of the Fecal Coliform samples shall be taken at the same time of day as the second TRC sample. The Geometric Mean shall be used to obtain the "weekly average" and the "monthly average."

[2] The use of a continuous TRC recorder after chlorination and prior to dechlorination is required to provide a record that proper disinfection was achieved at all times. Compliance with the permit limitations shall be determined by taking three grab samples of the final effluent (after dechlorination) Monday - Friday (except holidays), equally spaced over one (1) eight (8) hour working shift with a minimum of three hours between grabs, and on Saturdays, Sundays, and Holidays by taking at least two (2) grab samples each day with a minimum of two (2) hours between grabs. The maximum daily and average monthly values are to be computed from the averaged grab sample results for each day. The following methods may be used to analyze the grab samples: (1) DPD spectrophotometric, EPA No. 330.5 or Standard Methods (18th Edition) No.4500-Cl G; (2) DPD Titrimetric, EPA No. 330.4 or Standard Methods (18th Edition) No. 4500-Cl F; (3) Amperometric Titration, EPA No. 330.1 or Standard Methods (18th Edition) No. 4500-Cl D or ASTM No. D1253-86(92).

*Values in parentheses () are to be reported as Minimum/Maximum for the reporting period rather than Average Monthly/Maximum Daily.

Sampling for pH and Chlorine Residual shall be performed Sunday-Saturday.

Samples taken in compliance with the monitoring requirements specified above shall be taken at the following location: Outfall 001A (Final Discharge from the WWTF After All Treatment Processes).

PART I

A. EFFLUENT LIMITATIONS AND MONITORING REQUIREMENTS

3. During the period beginning on the effective date of this permit and lasting through permit expiration, the permittee is authorized to discharge from outfall serial number 001 (Final Discharge from the WWTF After All Treatment Processes).

Such discharges shall be monitored by the permittee as specified below:

Effluent Characteristic	Discharge Limitations					Monitoring Requirement	
	Quantity - lbs. per day		Concentration - specify units				
	Average Monthly	Maximum Daily	Average Monthly	Average Weekly	Maximum Daily	Measurement Frequency	Sample Type
Oil and Grease					--- mg/l	1/Month	3 Grabs[1]
Nitrate, Total (as N)							
(Nov. 1 – April 30)			--- mg/l		--- mg/l	1/Week	24-Hr. Comp.
(May 1 – Oct. 31)			--- mg/l		--- mg/l	1/Week	24-Hr. Comp.
Nitrite, Total (as N)							
(Nov. 1 – April 30)			--- mg/l		--- mg/l	1/Week	24-Hr. Comp.
(May 1 – Oct. 31)			--- mg/l		--- mg/l	1/Week	24-Hr. Comp.
Total Kjeldahl Nitrogen - TKN (as N)							
(Nov. 1 – April 30)			--- mg/l		--- mg/l	1/Week	24-Hr. Comp.
(May 1 – Oct. 31)			--- mg/l		--- mg/l	1/Week	24-Hr. Comp.
Nitrogen, Total (TKN + Nitrate + Nitrite, as N)							
(Nov. 1 – April 30)	239.7 lbs/d		14.3 mg/l		--- mg/l	1/Week	Calculated
(May 1 – Oct. 31)	83.8 lbs/d		5.0 mg/l		--- mg/l	1/Week	Calculated

[1]Three (3) grab samples shall be equally spaced over the course of an eight (8) hour shift with a minimum of three (3) hours between grabs. Each grab sample must be analyzed individually and the maximum values reported.

--- signifies a parameter that must be monitored and data must be reported; no limit has been established at this time.

Samples taken in compliance with the monitoring requirements specified above shall be taken Monday through Friday at the following location: Outfall 001A (Final Discharge from the WWTF After All Treatment Processes).

PART I

A. **EFFLUENT LIMITATIONS AND MONITORING REQUIREMENTS**

4. During the period beginning on the effective date of this permit and lasting through permit expiration, the permittee is authorized to discharge from outfall serial number 001 (Final Discharge from the WWTF After All Treatment Processes).

Such discharges shall be monitored by the permittee as specified below:

Effluent Characteristic	Discharge Limitations: Quantity - lbs. per day		Concentration - specify units			Monitoring Requirement	
	Average Monthly	Maximum Daily	Average Monthly	Average Weekly	Maximum Daily	Measurement Frequency	Sample Type
Copper, Total[1]			50 ug/l		162 ug/l	1/Month	24-Hr. Comp.
Cyanide[1]			28 ug/l		28 ug/l	1/Month	Composite[2]
Cadmium, Total[1]			708 ug/l		1127 ug/l	1/Quarter	24-Hr. Comp.
Chromium, Total[1]			4028 ug/l		31017 ug/l	1/Quarter	24-Hr. Comp.
Lead, Total[1]			681 ug/l		6183 ug/l	1/Quarter	24-Hr. Comp.
Zinc, Total[1]			2664 ug/l		2664 ug/l	1/Quarter	24-Hr. Comp.
Nickel, Total[1]			663 ug/l		2093 ug/l	1/Quarter	24-Hr. Comp.
Aluminum, Total[1]			--- ug/l		--- ug/l	1/Quarter	24-Hr. Comp.

[1] Sampling of influent and effluent shall be done to account for hydraulic detention (flow-through) time.

[2] Three (3) grab samples shall be equally spaced over one (1) eight (8) hour shift, with a minimum of three (3) hours between grabs. All three (3) samples shall be composited, then analyzed for available Cyanide.

Samples taken in compliance with the monitoring requirements specified above shall be taken Monday through Friday at the following locations: Outfall 001A (Final Discharge from the WWTF After All Treatment Processes).

PART I

A. **EFFLUENT LIMITATIONS AND MONITORING REQUIREMENTS**

5. During the period beginning on the effective date of this permit and lasting through permit expiration, the permittee is authorized to discharge from outfall serial number 001 (Final Discharge from the WWTF After All Treatment Processes).

   Such discharges shall be monitored by the permittee as specified below:

Effluent Characteristic	Discharge Limitations					Monitoring Requirement	
	Quantity - lbs. per day		Concentration - specify units				
	Average Monthly	Maximum Daily	Average Monthly	Average Weekly	Maximum Daily	Measurement Frequency	Sample Type
Mysidopsis bahia							
LC50[1]					100% or Greater[2]	1/Quarter	24-Hr. Comp.

[1]LC_{50} is defined as the concentration of wastewater that causes mortality to 50% of the test organisms.

[2]The 100% or greater limit is defined as a sample which is composed of 100% effluent.

Samples taken in compliance with the monitoring requirements specified above shall be taken at the following locations: Outfall 001A (Final Discharge from the WWTF After All Treatment Processes) in accordance with I.B. of the permit.

6. a. The pH of the effluent shall not be less than 6.5 nor greater than 8.5 standard units at any time, unless these values are exceeded due to natural causes or as a result of the approved treatment processes.

b. The discharge shall not cause visible discoloration of the receiving waters.

c. The effluent shall contain neither a visible oil sheen, foam, nor floating solids at any time.

d. The permittee's treatment facility shall maintain a minimum of 85 percent removal of both total suspended solids and 5-day biochemical oxygen demand. The percent removal shall be based on monthly average values.

e. When the effluent discharged for a period of 90 consecutive days exceeds 80 percent of the permitted monthly average flow, the permittee shall submit to the Department of Environmental Management a projection of loadings up to the time when the design capacity of the treatment facility will be reached, and a program for maintaining satisfactory treatment levels consistent with approved water quality management plans.

f. The permittee shall analyze its effluent annually for the EPA Priority Pollutants as listed in 40 CFR 122, Appendix D, Table II and III. The results of these analyses shall be submitted to the Department of Environmental Management by January 15th of each year for the previous calendar year. All sampling and analysis shall be done in accordance with EPA Regulations, including 40 CFR, Part 136; grab and composite samples shall be taken as appropriate.

g. This permit serves as the State's Water Quality Certificate for the discharges described herein.

B. BIOMONITORING REQUIREMENTS AND INTERPRETATION OF RESULTS

1. General

Beginning on the effective date of the permit, the permittee shall perform four (4) acute toxicity tests per year on samples collected from discharge outfall 001 (Final Discharge from the WWTF After All Treatment Processes). The permittee shall conduct the tests during dry weather periods (no rain within forty-eight (48) hours prior to or during sampling unless approved by RIDEM) according to the following test frequency and protocols. Acute data shall be reported as outlined in Part I.B.9. The State may require additional screening, range finding, definitive acute or chronic bioassays as deemed necessary based on the results of the initial bioassays required herein. Indications of toxicity could result in requiring a Toxicity Reduction Evaluation (TRE) to investigate the causes and to identify corrective actions necessary to eliminate or reduce toxicity to an acceptable level.

2. Test Frequency

On four (4) sampling events, (one (1) each calendar quarter) the permittee will conduct forty-eight (48) hour acute definitive toxicity tests on the species listed below, for a total of four (4) acute toxicity tests per year. This requirement entails performing one (1-) species testing as follows:

Species	Test Type	Frequency
Mysids (Mysidopsis bahia)	Definitive 48-Hour Acute Static (LC_{50})	Quarterly

3. Testing Methods

Acute definitive toxicity tests shall be conducted in accordance with protocols listed in the EPA document: Cornelius I. Weber, et. al., 1991. Methods for Measuring the Acute Toxicity of Effluents to Freshwater and Marine Organisms, Fourth Edition (or the most recent edition), Office of Research and Development, Cincinnati, OH (EPA-600/4-90-027), incorporating any deviations from protocol listed herein, or additional methods if approved by the Director of RIDEM.

4. Sample Collection

For each sampling event a twenty-four (24) hour flow proportioned composite final effluent sample shall be collected during dry weather (no rain forty-eight (48) hours prior to or during sampling unless approved by RIDEM). This sample shall be kept cool (at 4°C) and testing shall begin within twenty-four (24) hours after the last sample of the composite is collected. In the laboratory, the sample will be split into two (2) subsamples, after thorough mixing, for the following:

A: Chemical Analysis
B: Acute Toxicity Testing

All samples held overnight shall be refrigerated at 4°C. Grab samples must be used for pH and temperature.

5. Salinity Adjustment

Prior to the initiation of testing, the effluent must be adjusted to make the salinity of the effluent equal to that of the marine dilution water. The test solution must be prepared by adding non-toxic dried ocean salts to a sufficient quantity of 100% effluent to raise the salinity to the desired level. After the addition of the dried salts, stir gently for thirty (30) to sixty (60) minutes, preferably with a magnetic stirrer, to ensure that the salts are in solution. It is important to check the final salinity with a refractometer or salinometer. Salinity adjustments following this procedure and in accordance with EPA protocol will ensure that the concentrations (% effluent) of each dilution are real and allow for an accurate evaluation with the acute permit limit and acute monitoring requirements.

6. Dilution Water

Dilution water used for marine acute toxicity analyses should be of sufficient quality to meet minimum acceptability of test results (See Part I.B. 7). Natural seawater shall be used as the dilution water. This water shall be collected from Narragansett Bay off the dock at the URI's Graduate School of Oceanography on South Ferry Road, Narragansett. It is noted that the University claims no responsibility for the personal safety on this dock. The permittee shall observe the rules posted at the dock. If this natural seawater diluent is found to be, or suspected to be toxic or unreliable, an alternate source of natural seawater or, deionized water mixed with hypersaline brine or artificial sea salts of known quality with a salinity and pH similar to that of the receiving water may be substituted AFTER RECEIVING WRITTEN APPROVAL FROM RIDEM.

7. Effluent Toxicity Test Conditions for Mysids[1] (Mysidopsis bahia)

a.	Test Type	48-Hour Static Acute Definitive
b.	Salinity	25 ppt ± 10% for all dilutions
c.	Temperature (C)	25° ± 1°C
d.	Light Quality	Ambient laboratory illumination
e.	Photoperiod	8 - 16 Hour Light/24-Hour
f.	Test Chamber Size	250 ml
g.	Test Solution Volume	200 ml
h.	Age of Test Organisms	1 - 5 Days
i.	No. Mysids Per Test Chamber	10
j.	No. of Replicate Test Chamber Per Concentration	2
k.	Total No. Mysids Per Test Concentration	20
l.	Feeding Regime	Light feeding (two (2) drops concentrated brine shrimp nauplii, approximately 100 nauplii per mysid twice daily).
m.	Aeration	None, unless dissolved oxygen falls below 40% of saturation at which time gentle single-bubble aeration should be started.
n.	Dilution Water	Narragansett Bay water as discussed above.
o.	Dilutions	Five (5) dilutions plus a control: 100%, 50%, 25%, 12.5%, 6.25% and 0% effluent.
p.	Effect Measured and Test	Mortality - no movement of body test duration or appendages on gentle prodding, 48-hour LC_{50} and NOAEL.
q.	Test Acceptability	90% or greater survival of test organisms in control solution.
r.	Sampling Requirements	Samples are collected and used within 24 hours after the last sample of the composite is collected.
s.	Sample Volume Required	Minimum four (4) liters

[1]Adapted from EPA/600/4-90/027

8. Chemical Analysis

The following chemical analysis shall be performed for every sampling event.

Parameter	Effluent	Saline Diluent	Detection Limit (mg/l)
pH	X	X	---
Specific Conductance	X	X	---
Total Solids and Suspended Solids	X	X	---
Ammonia	X		0.1
Total Organic Carbon	X		0.5
Cyanide	X		0.01
Total Phenols	X		0.05
Salinity	X	X	PPT(0/00)

During the first, second, and fourth calendar quarter bioassay sampling events the following chemical analyses shall be performed:

Total Metals	Effluent	Saline Diluent	Detection Limit (µg/l)
Total Copper	X	X	20.0
Total Cadmium	X	X	1.0
Total Chromium	X	X	5.0
Total Lead	X	X	3.0
Total Zinc	X	X	20.0
Total Nickel	X	X	10.0
Total Aluminum	X	X	20.0

The above metal analyses may be used to fulfill, in part or in whole, monthly monitoring requirements in the permit for these specific metals.

During the third calendar quarter bioassay sampling event, the final effluent sample collected during the same twenty-four (24) hour period as the bioassay sample, shall be analyzed for priority pollutants (as listed in Tables II and III of Appendix D of 40 CFR 122). The bioassay priority pollutant scan shall be a full scan and may be coordinated with the priority pollutant scan requirements in Part I.A.6.f.

9. Toxicity Test Report Elements

A report of results will include the following:

- Description of sample collection procedures and site description.
- Names of individuals collecting and transporting samples, times, and dates of sample collection and analysis.

- General description of tests: age of test organisms, origin, dates and results of standard toxicant tests (quality assurance); light and temperature regime; dilution water description; other information on test conditions if different than procedures recommended.

- The method used to adjust the salinity of the effluent must be reported.

- All chemical and physical data generated (include detection limits).

- Raw data and bench sheets.

- Any other observations or test conditions affecting test outcome.

Toxicity test data shall include the following:

- Survival for each concentration and replication at time twenty-four (24) and forty-eight (48) hours.

- LC_{50} and 95% confidence limits shall be calculated using one of the following methods in order of preference: Probit, Trimmed Spearman Karber, Moving Average Angle, or the graphical method. All printouts (along with the name of the program, the date, and the author(s)) and graphical displays must be submitted. When data is analyzed by hand, worksheets should be submitted. The report shall also include the No Observed Acute Effect Level (NOAEL) which is defined as the highest concentration of the effluent (in % effluent) in which 90% or more of the test animals survive.

- The Probit, Trimmed Spearman Karber, and Moving Average Angle methods of analyses can only be used when mortality of some of the test organisms are observed in at least two (2) of the (percent effluent) concentrations tested (i.e., partial mortality). If a test results in a 100% survival and 100% mortality in adjacent treatments ("all or nothing" effect), an LC_{50} may be estimated using the graphical method.

10. Special Condition

Due to the fact that the suggested dilution water for this facility to use in conducting the bioassays is from the end of the dock at the URI's Narragansett Bay Campus, a Letter of Agreement must be signed and submitted to the Graduate School of Oceanography. Requests to use another source of dilution water will have to be approved by the Department of Environmental Management, Office of Water Resources.

11. Reporting of Bioassay Testing

Bioassay Testing shall be reported as follows:

Quarter Testing to be Performed	Report Due No Later Than	Results Submitted on DMR for
January 1 - March 31	April 15	March
April 1 - June 30	July 15	June
July 1 - September 30	October 15	September
October 1 - December 31	January 15	December

Bioassay testing following the protocol described herein shall commence during the first calendar quarter that the permit becomes effective and the first report shall be submitted to RIDEM in accordance with the schedule above.

Bioassay reports shall be submitted to the:

Office of Water Resources
RIPDES Program
Rhode Island Department of Environmental Management
235 Promenade Street
Providence, Rhode Island 02908-5767

C. INDUSTRIAL PRETREATMENT PROGRAM

1. Definitions

For the purpose of this permit, the following definitions apply.

a. 40 CFR 403 and sections thereof refer to the General Pretreatment regulations, 40 CFR Part 403 as revised.

b. Categorical Pretreatment Standards mean any regulation containing pollutant discharge limits promulgated by the USEPA in accordance with section 307(b) and (c) of the Clean Water Act(33 USC 1251), as amended, which apply to a specific category of industrial users and which appears in 40 CFR Chapter 1, subchapter N.

c. Pretreatment Standards include all specific prohibitions and prohibitive discharge limits established pursuant to 40 CFR 403.5, including but not limited to, local limits, and the Categorical Pretreatment Standards.

d. Regulated Pollutants shall include those pollutants contained in applicable categorical standards and any other pollutants listed in the Pretreatment Standards which have reasonable potential to be present in an industrial users effluent.

2. Implementation

The authority and procedures of the Industrial Pretreatment Program shall at all times be fully and effectively exercised and implemented, in compliance with the requirements of this permit and in accordance with the legal authorities, policies, procedures and financial provisions described in the permittee's approved Pretreatment Program and Sewer Use Ordinance, the Rhode Island Pretreatment Regulations and the General Pretreatment Regulations 40 CFR 403. The permittee shall maintain adequate resource levels to accomplish the objectives of the Pretreatment Program.

3. Local Limits

Pollutants introduced into POTWs by a non-domestic source (user) shall not: pass through the POTW, interfere with the operation or performance of the works, contaminate sludge as to adversely effect disposal options, or adversely effect worker safety and health.

a. The permittee has submitted a Local Limits Monitoring Plan that was approved on February 24, 2003. The approved Local Limits Monitoring Plan shall be implemented at all times.

b. At the time of renewal of this permit and in accordance with 40 CFR 122.21(j)(4) as revised July 24, 1990, the permittee shall submit to the DEM with its permit renewal application a written technical evaluation of the need to revise local limits. The evaluation shall be based, at a minimum, on information obtained during the implementation of the permittee's approved local limits monitoring plan and procedures and current RIPDES permit discharge limits, sludge disposal criteria, secondary treatment inhibition, and worker health and safety criteria.

4. General

a. The permittee shall carry out inspection, surveillance, and monitoring procedures which will determine, independent of information supplied by the industrial user, whether the industrial user is in compliance with Pretreatment Standards. At a minimum, all significant industrial users shall be inspected and monitored for all regulated pollutants at the frequency established in the approved Industrial Pretreatment Program but in no case less than once per year (one (1) year being determined as the reporting year established in Part I.C.6 of this permit). In addition, these inspections, monitoring and surveillance activities must be conducted in accordance with EPA's Industrial User Inspection and Sampling Manual for POTW's, April 1994. All inspections, monitoring, and surveillance activities shall be performed, and have records maintained, with sufficient care to produce evidence admissible in enforcement proceedings or judicial actions. The permittee shall evaluate whether each SIU requires a slug control plan. If a slug control plan is required, it shall include the contents specified by 40 CFR 403.8(f)(2)(vi).

b. The permittee shall reissue all necessary Industrial User (IU) control mechanisms within thirty (30) days of their expiration date. The permittee shall issue, within sixty (60) days after the determination that an IU is a Significant Industrial User (SIU), all SIU control mechanisms. All SIU control mechanisms must contain, at a minimum, those conditions stated in 40 CFR 403.8(f)(1)(iii)(B). All control mechanisms must be mailed via Certified Mail, Return Receipt Requested. A complete bound copy of the control mechanism with the appropriate receipt must be kept as part of the Industrial User's permanent file. In addition, the permittee must develop a fact sheet describing the basis for the SIU's permit and retain this fact sheet as part of the SIU's permanent file.

c. The permittee must identify each instance of noncompliance with any pretreatment standard and/or requirement and take a formal documented action for each instance of noncompliance. Copies of all such documentation must be maintained in the Industrial User's permanent file.

d. The permittee shall prohibit Industrial Users from the dilution of a discharge as a substitute for adequate treatment in accordance with 40 CFR 403.6(d).

e. The permittee shall comply with the procedures of 40 CFR 403.18 for instituting any modifications of the permittee's approved Pretreatment Program. Significant changes in the operation of a POTW's Approved Pretreatment Program must be submitted and approved following the procedures outlined in 40 CFR 403.18(b) and 403.9(b). However, the endorsement of local officials responsible for supervising and/or funding the pretreatment program required by 403.9(b)(2) will not be required until DEM completes a preliminary review of the submission. The DEM will evaluate and review the permittee's initial proposal for a modification and provide written notification either granting preliminary approval of the proposed modifications or stating the deficiencies contained therein. DEM's written notification will also include a determination whether the submission constitutes a substantial or non-substantial program modification as defined by 40 CFR 403.18. Should DEM determine that a deficiency exists in the proposed modification, the permittee shall submit to DEM, within thirty (30) days of the receipt of said notice, a revised submission consistent with DEM's notice of deficiency.

Pretreatment program modifications which the permittee considers Non-substantial, shall be deemed to be approved within (90) days after submission of the request for modification, unless DEM determines that the modification is in fact a substantial modification or notifies the permittee of deficiencies. Upon receipt of notification that DEM has determined the modification is substantial, the permittee shall initiate the procedures and comply with the deadlines for substantial modifications, which are outlined below.

For substantial modifications, the permittee shall, within sixty (60) days (unless a longer time frame is granted) of the receipt of DEM's preliminary approval of the proposed modification, submit a statement (as required by 403.9(b)(2)) that any local public notification/participation procedures required by local law have been completed and upon approval by RIDEM, the local officials will endorse and/or approve the modification.

Within thirty (30) days of DEM's final approval of the proposed modification(s), the permittee shall implement the modification. Upon final approval by the DEM and adoption by the permittee, this modification(s) shall become part of the approved pretreatment program and shall be incorporated into this permit in accordance with 40CFR 122.63(g).

f. All sampling and analysis required of the permittee, or by the permittee of any Industrial User, must be performed in accordance with the techniques described in 40 CFR 136.

g. For those Industrial Users with discharges that are not subject to Categorical Pretreatment Standards, the permittee shall require appropriate reporting in accordance with 40 CFR 403.12(h).

h. The permittee shall, in accordance with 40 CFR 403.12(f), require all Industrial Users to immediately notify the permittee of all discharges by the Industrial User that could cause problems to the POTW, including slug loadings, as defined by 40 CFR 403.5(b).

i. The permittee shall require all Industrial Users to notify the permittee of substantial changes in discharge as specified in 40 CFR 403.12(j).

j. The permittee shall require New Sources to install and have in operation all pollution control equipment required to meet applicable Pretreatment Standards before beginning to discharge. In addition, the permittee shall require New Sources to meet all applicable Pretreatment Standards within the shortest feasible time which shall not exceed ninety (90) days in accordance with 40 CFR 403.6(b).

k. The permittee shall require all Industrial Users who are required to sample their effluent and report the results of analysis to the POTW to comply with signatory requirements contained in 40 CFR 403.12(l) when submitting such reports.

l. The permittee shall determine, based on the criteria set forth in 40 CFR 403.8(f)(2)(viii), using the EPA method of "rolling quarters", the compliance status of each Industrial User. Any Industrial User determined to meet Significant Non-Compliance (SNC) criteria shall be included in an annual public notification as specified in 40 CFR 403.8(f)(2)(viii).

m. The permittee shall require Industrial Users to comply with the notification and certification requirements of 40 CFR 403.12(p)(1), (3) and (4) pertaining to the discharge of substances to the POTW, which if disposed of otherwise, would be a hazardous waste under 40 CFR Part 261.

n. The permittee shall continue to designate, as SIUs, those Industrial Users (IUs) which meet the definition contained in the permittee's sewer use ordinance.

The permittee shall notify each newly designated SIU of its classification as an SIU within thirty (30) days of identification and shall inform the SIU of the requirements of an SIU contained in 40 CFR 403.12.

5. Categorical Industrial Users (CIUs)

a. The permittee shall require Industrial Users to comply with applicable Categorical Pretreatment Standards in addition to all applicable Pretreatment Standards and Requirements. The permittee shall require of all Categorical Industrial Users (CIUs), all reports on compliance with applicable Categorical Pretreatment Standards and Categorical Pretreatment Standard deadlines as specified in and in accordance with Sections (b), (d), (e) and (g) of 40 CFR 403.12. In addition, the permittee shall require Categorical Industrial Users to comply with the report signatory requirements contained in 40 CFR 403.12(1) when submitting such reports.

b. If the permittee applies the Combined Wastestream Formula (CWF) to develop fixed alternative discharge limits of Categorical Pretreatment Standards, the application of the CWF and the enforcement of the resulting limits must comply with 40 CFR 403.6(e). The permittee must document all calculations within the control mechanism fact sheet and the resulting limits within the CIU's control mechanism. The permittee must ensure that the most stringent limit is applied to the CIU's effluent at end-of-pipe based upon a comparison of the resulting CWF limits and the permittee's local limits.

c. If the permittee has or obtains the authority to apply and enforce equivalent mass-per-day and/or concentration limitations of production-based Categorical Pretreatment Standards, then the permittee shall calculate and enforce the limits in accordance with 40 CFR 403.6(c). The permittee must document all calculations within the control mechanism fact sheet and the resulting limits within the CIU's control mechanism.

6. Annual Report

The annual report for the permittee's program shall contain information pertaining to the reporting year which shall extend from October 1st through September 30th and shall be submitted to the DEM by November 15th. Each item below must be addressed separately and any items which are not applicable must be so indicated. If any item is deemed not applicable a brief explanation must be provided. The annual report shall include the following information pertaining to the reporting year:

a. A listing of Industrial Users which complies with requirements stated in 40 CFR 403.12(i)(1). The list shall identify all Categorical Industrial Users, Significant Industrial Users and any other categories of users established by the permittee;

b. A summary list, including dates, of any notifications received by the permittee of any substantial change in the volume or character of pollutants being introduced into the POTW by new or existing IUs. If applicable, an evaluation of the quality and quantity of influent introduced into the POTW and any anticipated impact due to the changed discharge on the quantity or quality of effluent to be discharged from the POTW shall be included;

c. A summary list of the Compliance status of each Industrial User (IU), as of the end of last quarter covered by the annual report. The list shall identify all IUs in non-compliance, the pretreatment program requirement which the IU failed to meet, and the type, and date of the enforcement action initiated by the permittee in response to the violation. If applicable, the list shall also contain the date which IUs in non-compliance returned to compliance, a description of corrective actions ordered, and the penalties levied.

d. A list of industries which were determined, in accordance with Part I.C.4(l) of this permit, to be in significant non-compliance required to be published in a local newspaper and a copy of an affidavit of publication, from the newspaper, averring that the names of these violators has been published;

e. A summary list of inspection and monitoring activity performed by the permittee, including;
- significant industrial users inspected by the POTW (include inspection dates for each industrial user);
- significant industrial user sampled by the POTW (include sampling dates and dates of analysis, for each industrial user);

f. A summary list of permit issuance/reissuance activities including the name of the industrial user, expiration date of previous permit, issuance date of new permit, and a brief description of any changes to the permit;

g. A list including the report/notification type, due date, and receipt date for each report/notification required by 40 CFR 403.12.

h. A summary of public participation efforts including meetings and workshops held with the public and/or industry and notices/newsletters/bulletins published and/or distributed;

i. A program evaluation in terms of program effectiveness, local limits application and resources which addresses but is not limited to:
- A description of actions being taken to reduce the incidence of SNC by Industrial Users;
- effectiveness of enforcement response program;
- sufficiency of funding and staffing;
- sufficiency of the SUO, Rules and Regulations, and/or statutory authority;

j. An evaluation of recent/proposed program modifications, both substantial and non-substantial, in terms of the modification type, implementation and actual/ expected effect (note proposed modifications must be submitted under separate cover along with the information required by 40 CFR 403.18);

k. A detailed description of all interference and pass-through that occurred during the past year and, if applicable;
- A thorough description of all investigations into interference and pass-through during the past year;
- A description of the monitoring, sewer inspections and evaluations which were done during the past year to detect interference and pass-through, specifying pollutants analyzed and frequencies;

l. A summary of the average, maximum concentration, minimum concentration, and number of data points used for pollutant analytical results for influent, effluent, sludge and any toxicity or bioassay data from the wastewater treatment facility. The summary shall include a comparison of influent sampling results versus the maximum allowable headworks loadings contained in the approved local limits evaluation and effluent sampling results versus water quality standards. Such a comparison shall be based on the analytical results required in Parts I.A and I.C. of this permit and any additional sampling data available to the permittee; and

m. A completed Annual Pretreatment Report Summary Sheet.

7. Enforcement Response Plan (ERP)

The permittee has an approved ERP that meets the requirements of 40 CFR 403.8(f)(5). The approved ERP shall be implemented at all times.

8. Sewer Use Ordinance (SUO)

The permittee has an approved SUO that shall be implemented at all times.

D. **OPERATION AND MAINTENANCE OF THE SEWER SYSTEM**

Operation and maintenance of the sewer system shall be in compliance with the General Requirements of Part II and the following terms and conditions:

1. Maintenance Staff

The permittee shall provide an adequate staff to carry out the operation, maintenance, repair, and testing functions required to ensure compliance with the terms and conditions of this permit.

2. Infiltration/Inflow

The permittee shall minimize infiltration/inflow to the sewer system. A summary report of all actions taken to minimize infiltration/inflow during the previous six (6) months shall be submitted to RIDEM, Office of Water Resources, by the 15th day of January and July of each year. The first report is due July 15, 2010.

E. **SLUDGE**

The permittee shall conform and adhere to all conditions, practices and regulations as contained in the State of Rhode Island Rules and Regulations for the Treatment, Disposal, Utilization and Transportation of Sewage Sludge. The permittee shall comply with its RIDEM Order of Approval for the disposal of sludge.

F. **DETECTION LIMITS**

The permittee shall assure that all wastewater testing required by this permit, is performed in conformance with the method detection limits listed below. All sludge testing required by this permit shall be in conformance with the method detection limits found in 40 CFR 503.8. In accordance with 40 CFR Part 136, EPA approved analysis techniques, quality assurance procedures and quality control procedures shall be followed for all reports required to be submitted under the RIPDES program. These procedures are described in "Methods for the Determination of Metals in Environmental Samples" (EPA/600/4-91/010) and "Methods for Chemical Analysis of Water and Wastes" (EPA/600/4-79/020).

The report entitled "Methods for the Determination of Metals in Environmental Samples" includes a test which must be performed in order to determine if matrix interferences are present, and a series of tests to enable reporting of sample results when interferences are identified. Each step of the series of tests becomes increasingly complex, concluding with the complete Method of Standard Additions analysis. The analysis need not continue once a result which meets the applicable quality control requirements has been obtained. Documentation of all steps conducted to identify and account for matrix interferences shall be submitted along with the monitoring reports.

If, after conducting the complete Method of Standard Additions analysis, the laboratory is unable to determine a valid result, the laboratory shall report "could not be analyzed". Documentation supporting this claim shall be submitted along with the monitoring report. If valid analytical results are repeatedly unobtainable, DEM may require that the permittee determine a method detection limit (MDL) for their effluent or sludge as outlined in 40 CFR Part 136, Appendix B.

Therefore, all sample results shall be reported as: an actual value, "could not be analyzed", less than the reagent water MDL, or less than an effluent or sludge specific MDL. The effluent or sludge specific MDL must be calculated using the methods outlined in 40 CFR Part 136, Appendix B. Samples which have been diluted to ensure that the sample concentration will be within the linear dynamic range shall not be diluted to the extent that the analyte is not detected. If this should occur the analysis shall be repeated using a lower degree of dilution.

When calculating sample averages for reporting on discharge monitoring reports (DMRs):

1. "could not be analyzed" data shall be excluded, and shall not be considered as failure to comply with the permit sampling requirements;

2. results reported as less than the MDL shall be included as values equal to the MDL, and the average shall be reported as "less than" the calculated value.

For compliance purposes, DEM will replace all data reported as less than the MDL with zeroes, provided that DEM determines that all appropriate EPA approved methods were followed. If the re-calculated average exceeds the permit limitation it will be considered a violation.

LIST OF TOXIC POLLUTANTS

The following list of toxic pollutants has been designated pursuant to Section 307(a)(1) of the Clean Water Act. The Method Detection Limits (MDLs) represent the required Rhode Island MDLs.

Volatiles - EPA Method 624		MDL ug/l (ppb)
1V	acrolein	10.0
2V	acrylonitrile	5.0
3V	benzene	1.0
5V	bromoform	1.0
6V	carbon tetrachloride	1.0
7V	chlorobenzene	1.0
8V	chlorodibromomethane	1.0
9V	chloroethane	1.0
10V	2-chloroethylvinyl ether	5.0
11V	chloroform	1.0
12V	dichlorobromomethane	1.0
14V	1,1-dichloroethane	1.0
15V	1,2-dichloroethane	1.0
16V	1,1-dichloroethylene	1.0
17V	1,2-dichloropropane	1.0
18V	1,3-dichloropropylene	1.0
19V	ethylbenzene	1.0
20V	methyl bromide	1.0
21V	methyl chloride	1.0
22V	methylene chloride	1.0
23V	1,1,2,2-tetrachloroethane	1.0
24V	tetrachloroethylene	1.0
25V	toluene	1.0
26V	1,2-trans-dichloroethylene	1.0
27V	1,1,1-trichloroethane	1.0
28V	1,1,2-trichloroethane	1.0
29V	trichloroethylene	1.0
31V	vinyl chloride	1.0

Acid Compounds - EPA Method 625		MDL ug/l (ppb)
1A	2-chlorophenol	1.0
2A	2,4-dichlorophenol	1.0
3A	2,4-dimethylphenol	1.0
4A	4,6-dinitro-o-cresol	1.0
5A	2,4-dinitrophenol	2.0
6A	2-nitrophenol	1.0
7A	4-nitrophenol	1.0
8A	p-chloro-m-cresol	2.0
9A	pentachlorophenol	1.0
10A	phenol	1.0
11A	2,4,6-trichlorophenol	1.0

Pesticides - EPA Method 608		MDL ug/l (ppb)
1P	aldrin	0.059
2P	alpha-BHC	0.058
3P	beta-BHC	0.043
4P	gamma-BHC	0.048
5P	delta-BHC	0.034
6P	chlordane	0.211
7P	4,4'-DDT	0.251
8P	4,4'-DDE	0.049
9P	4,4'-DDD	0.139
10P	dieldrin	0.082
11P	alpha-endosulfan	0.031
12P	beta-endosulfan	0.036
13P	endosulfan sulfate	0.109
14P	endrin	0.050
15P	endrin aldehyde	0.062
16P	heptachlor	0.029
17P	heptachlor epoxide	0.040

Pesticides - EPA Method 608		MDL ug/l (ppb)
18P	PCB-1242	0.289
19P	PCB-1254	0.298
20P	PCB-1221	0.723
21P	PCB-1232	0.387
22P	PCB-1248	0.283
23P	PCB-1260	0.222
24P	PCB-1016	0.494
25P	toxaphene	1.670

Base/Neutral - EPA Method 625		MDL ug/l (ppb)
1B	acenaphthene *	1.0
2B	acenaphthylene *	1.0
3B	anthracene *	1.0
4B	benzidine	4.0
5B	benzo(a)anthracene *	2.0
6B	benzo(a)pyrene *	2.0
7B	3,4-benzofluoranthene *	1.0
8B	benzo(ghi)perylene *	2.0
9B	benzo(k)fluoranthene *	2.0
10B	bis(2-chloroethoxy)methane	2.0
11B	bis(2-chloroethyl)ether	1.0
12B	bis(2-chloroisopropyl)ether	1.0
13B	bis(2-ethylhexyl)phthalate	1.0
14B	4-bromophenyl phenyl ether	1.0
15B	butylbenzyl phthalate	1.0
16B	2-chloronaphthalene	1.0
17B	4-chlorophenyl phenyl ether	1.0
18B	chrysene *	1.0
19B	dibenzo (a,h)anthracene *	2.0
20B	1,2-dichlorobenzene	1.0
21B	1,3-dichlorobenzene	1.0
22B	1,4-dichlorobenzene	1.0
23B	3,3'-dichlorobenzidine	2.0
24B	diethyl phthalate	1.0
25B	dimethyl phthalate	1.0
26B	di-n-butyl phthalate	1.0
27B	2,4-dinitrotoluene	2.0
28B	2,6-dinitrotoluene	2.0
29B	di-n-octyl phthalate	1.0
30B	1,2-diphenylhydrazine (as azobenzene)	1.0
31B	fluoranthene *	1.0
32B	fluorene *	1.0
33B	hexachlorobenzene	1.0
34B	hexachlorobutadiene	1.0
35B	hexachlorocyclopentadiene	2.0
36B	hexachloroethane	1.0
37B	indeno(1,2,3-cd)pyrene *	2.0
38B	isophorone	1.0
39B	naphthalene *	1.0
40B	nitrobenzene	1.0
41B	N-nitrosodimethylamine	1.0
42B	N-nitrosodi-n-propylamine	1.0
43B	N-nitrosodiphenylamine	1.0
44B	phenanthrene *	1.0
45B	pyrene *	1.0
46B	1,2,4-trichlorobenzene	1.0

OTHER TOXIC POLLUTANTS

	MDL ug/l (ppb)
Antimony, Total	5.0
Arsenic, Total	5.0
Beryllium, Total	0.2
Cadmium, Total	1.0
Chromium, Total	5.0
Chromium, Hexavalent***	20.0
Copper, Total	20.0
Lead, Total	3.0
Mercury, Total	0.5
Nickel, Total	10.0
Selenium, Total	5.0
Silver, Total	1.0
Thallium, Total	5.0
Zinc, Total	20.0
Asbestos	**
Cyanide, Total	10.0
Phenols, Total***	50.0
TCDD	**
MTBE (Methyl Tert Butyl Ether)	1.0

* Polynuclear Aromatic Hydrocarbons
** No Rhode Island Department of Environmental Management (RIDEM) MDL
*** Not a priority pollutant as designated in the 1997 Water Quality Regulations (Table 5)

NOTE:

The MDL for a given analyte may vary with the type of sample. MDLs, which are determined in reagent water, may be lower than those determined in wastewater due to fewer matrix interferences. Wastewater is variable in composition and may therefore contain substances (interferents) that could affect MDLs for some analytes of interest. Variability in instrument performance can also lead to inconsistencies in determinations of MDLs.

To help verify the absence of matrix or chemical interference the analyst is required to complete specific quality control procedures. For the metals analyses listed above the analyst must withdraw from the sample two equal aliquots; to one aliquot add a known amount of analyte, and then dilute both to the same volume and analyze. The unspiked aliquot multiplied by the dilution factor should be compared to the original. Agreement of the results within 10% indicates the absence of interference. Comparison of the actual signal from the spiked aliquot to the expected response from the analyte in an aqueous standard should help confirm the finding from the dilution analysis. (Methods for Chemical Analysis of Water and Wastes EPA-600/4-79/020).

For Methods 624 and 625 the laboratory must on an ongoing basis, spike at least 5% of the samples from each sample site being monitored. For laboratories analyzing 1 to 20 samples per month, at least one spiked sample per month is required. The spike should be at the discharge permit limit or 1 to 5 times higher than the background concentration determined in Section 8.3.2, whichever concentration would be larger. (40 CFR Part 136 Appendix B Method 624 and 625 subparts 8.3.1 and 8.3.11).

G. MONITORING AND REPORTING

1. Monitoring

All monitoring required by this permit shall be done in accordance with sampling and analytical testing procedures specified in Federal Regulations (40 CFR Part 136).

2. Reporting

Monitoring results obtained during the previous month(s) shall be summarized and reported on Discharge Monitoring Report (DMR) Forms, postmarked no later than the 15th day of the month following the completed reporting period. A copy of the analytical laboratory report, specifying analytical methods used, shall be included with each report submission. Signed copies of these, and all other reports required herein, shall be submitted to:

Office of Water Resources
RIPDES Program
Rhode Island Department of Environmental Management
235 Promenade Street
Providence, Rhode Island 02908

RHODE ISLAND DEPARTMENT OF ENVIRONMENTAL MANAGEMENT
OFFICE OF WATER RESOURCES
235 PROMENADE STREET
PROVIDENCE, RHODE ISLAND 02908-5767

FACT SHEET

RHODE ISLAND POLLUTANT DISCHARGE ELIMINATION SYSTEM (RIPDES) PERMIT TO DISCHARGE TO WATERS OF THE STATE

RIPDES PERMIT NO. **RI0100056**

NAME AND ADDRESS OF APPLICANT:

Town of Warren
514 Main Street
Warren, RI 02885

NAME AND ADDRESS OF FACILITY WHERE DISCHARGE OCCURS:

Warren Wastewater Treatment Facility
427 Water Street
Warren, RI 02885

RECEIVING WATER: **Warren River**

CLASSIFICATION: **SB1**

I. Proposed Action, Type of Facility, and Discharge Location

The above named applicant has applied to the Rhode Island Department of Environmental Management (DEM) for renewal of a RIPDES Permit to discharge into the designated receiving water. The facility is engaged in the treatment of domestic and industrial sewage. The discharge is from the Warren Wastewater Treatment Facility (WWTF).

II. Description of Discharge

A quantitative description of the discharge in terms of significant effluent parameters based on DMR data from September 2004 through September 2009 is shown on Attachment A-2.

III. Permit and Administrative Compliance Order Limitations and Conditions

The final effluent limitations and monitoring requirements may be found in the draft permit. Since the permittee is unable to comply with its Flow and Total Nitrogen limitations, DEM plans to enter into a Consent Agreement with the permittee that includes schedules for the removal of Infiltration and Inflow (I/I) and the submittal of a formal Facilities Plan for a revised design flow and the upgrade of the WWTF to meet the Total Nitrogen limits.

IV. Permit Basis and Explanation of Effluent Limitation Derivation

The Town of Warren owns and operates the WWTF located at 427 Water Street in Warren, Rhode Island. The discharge to the Warren River consists of treated sanitary and industrial sewage contributed by the Town. Treatment consists of:

Coarse Screening	Aeration
Grit Removal	Secondary Flocculation and Clarification
Comminution	Chlorination
Primary Settling	Dechlorination

The requirements set forth in this permit are from the State's Water Quality Regulations and the State's Regulations for the Rhode Island Pollutant Discharge Elimination System, both filed pursuant to Chapter 46-12, as amended. DEM's primary authority over the permit comes from EPA's delegation of the program in September 1984 under the Federal Clean Water Act (CWA).

The "Average Monthly" and "Average Weekly" BOD_5 and TSS limitations are based upon the secondary treatment requirements of Section 301 (b)(1)(B) of the Clean Water Act (CWA) as defined in 40 CFR 133.102 (a) - (c). The "Maximum Daily" BOD_5, TSS, settleable solids, and fecal coliform limits are based on Rhode Island requirements for Publicly Owned Treatment Works (POTW's) under Section 401 (a)(1) of the CWA and in 40 CFR 124.53 and 124.56. The "Percent Removal" requirements were established in accordance with 40 CFR 133.103. pH limitations are base upon the Rhode Island Water Quality criteria for discharges to salt water. Oil & Grease monitoring has been included in the permit, based on Best Professional Judgment, to ensure that oil and grease levels do not cause impacts to the receiving water (i.e., "grease balls").

In order to evaluate the need for water quality based limits, it is necessary to determine the mixing which occurs in the immediate vicinity of the wastewater discharge (initial dilution). It was previously determined that a mixing zone and corresponding dilution factor is acceptable for the effluent from the WWTF. A chronic dilution factor of 100x with a rectangular mixing zone centered on the outfall having dimensions of 500 ft. (north-south) and 300 ft. (east-west) and an acute dilution factor of 35x with a mixing zone of 50 ft. radius were established based on the findings of the *Dye Dilution Study at Warren, RI* (Aquatec, 1992).

The final water quality-based effluent limits were established based on the acute and chronic saltwater aquatic life criteria using the following: dilution factors of 100 and 35 for chronic and acute, respectively; a zero background concentration; an 80% allocation factor of the criteria; and an analysis of antibacksliding and antidegradation. The saltwater aquatic life criteria comes from the Rhode Island Water Quality Regulations.

In accordance with 40 CFR 122.4(d)(1)(iii), it is only necessary to establish permit limits for those pollutants in the discharge which have reasonable potential to cause or contribute to the exceedance of instream criteria. In order to evaluate the need for permit limits, the most stringent calculated acute and chronic limits are compared to the Discharge Monitoring Report (DMR) and State User Fee data. Based on this analysis, water quality-based permit limits are required for total residual chlorine (TRC), Total Copper, and Total Cyanide. In addition, monitoring for Total Cadmium, Total Chromium, Total Lead, Total Zinc, Total Nickel, and Total Aluminum is being required quarterly as part of the bioassay testing. These pollutants, in addition to Total Copper and Cyanide, are all part of the DEM's list of standard parameters, for discharges to salt waters, that must be measured as part of the bioassay procedures. Therefore, water quality-based limits have been included for these pollutants.

The State of Rhode Island's 2008 *303(d) List of Impaired Waters* identifies the Palmer River as being impaired for nutrients (e.g., Total Nitrogen) and hypoxia (e.g., Dissolved Oxygen). The WWTF and Blount Seafood, have RIPDES permits authorizing them to discharge into the Warren River. However, it has been determined that the effluent from these facilities enter the Palmer

River. Therefore, the discharge from these facilities are pertinent to the Palmer River. In order to address the Palmer River's impairments, DEM sampled the Palmer River as part of an assessment of the Palmer River. During the assessment, it was found that oxygen levels rise after sunrise. This is caused by plant respiration during daylight hours causing elevated oxygen levels and is indicative of eutrophication, which is also evidenced by the excessive growth of green macroalgae and high chlorophyll a levels in the water column. The excessive growth of macroalgae and the high dissolved oxygen concentrations during daylight hours demonstrates that the Palmer River is eutrophic from excessive amounts of nitrogen entering the system. Therefore, to address the Palmer River's impairments, it is necessary that the amount of nitrogen discharged to the River be controlled. To address the Palmer River's impairments, the DEM had to determine the allowable nitrogen load that could be assimilated without causing eutrophic conditions.

The Buzzards Bay Program (BBP) in Massachusetts developed empirical relationships between nitrogen loadings and eutrophication response from observations made in a number of estuaries. The BBP approach uses land use information to estimate nitrogen loads and is considered by DEM to offer a number of advantages for use in Rhode Island based on physical and biological similarities that make the use of the loading - estuarine response relationships for Buzzards Bay appropriate in the Palmer River. The BBP developed an Eutrophication Index (EI) to assist in determining the level of nutrient enrichment a waterbody is experiencing at any given time. The EI uses a scale of 0 to 100 points where 0 equals the most eutrophic and 100 is equivalent to a pristine waterbody. The BBP estimated that an appropriate EI value for Outstanding Natural Resource Waters (ONRW) is 65. Since the Palmer River is designated as a Special Resource Protection Water, whose designated uses are essentially equivalent to those of ONRWs, it should have an EI of 65 or better. Two sampling stations were established in the Palmer River and the results indicate that the Palmer River is eutrophic with an EI score of 32. This supports the need to reduce nitrogen discharges to the Palmer River.

A relationship between the nitrogen loading rate and EI from the BBP was developed that is a function of the loading rate per unit estuary volume. Acceptable loading rates for ONRWs are 50 mg m^{-3} Vr^{-1}. The calculation for allowable annual load is:

$$\text{Annual Load (in kg yr}^{-1}) = \frac{\text{Loading rate x volume at half tide (in m}^3\text{) x } (1+ \tau_w^{1/2})}{\tau_w * 1{,}000{,}000}$$

Where τ_w is the hydraulic turnover time in years and the Vollenweider flushing term is $\tau_w/(1+ \tau_w^{1/2})$.

For the Palmer River, with a flushing time of 17.88 hours, a mean volume of 3.13×10^6 m^3, and an allowable loading rate of 50 mg m^{-3} Vr^{-1}, the corresponding nitrogen assimilative capacity of the Palmer River is 80,011 kg/yr.

Using the annual allowable total nitrogen load for the Palmer River the allowable nitrogen limits were allocated among the three nitrogen sources to the Palmer River. The reductions needed to meet the allowable summer load were calculated first. The chosen scenario sets the Warren WWTF allowable summer total nitrogen concentration at 5 mg/L, an 80% reduction in summer load, while Blount Seafood was allocated an equivalent 80% summer load reduction. At design flow, Blount Seafood's allowable concentration would be 40.4 mg/L. These reductions were sufficient to meet the allowable summer loading to the Palmer River. However, summer point source reductions were not sufficient to meet the allowable annual total nitrogen load. Meeting the allowable annual load also requires an annual watershed reduction and a winter point source load reduction. The point sources were allocated a 20% winter reduction in load, which is equivalent to winter total nitrogen limits of 14.3 mg/l for the Warren WWTF and 93.9 mg/l for Blount Seafood using the design flow for both facilities, while the watershed was allocated an annual 59% reduction. A document that includes a more in-depth discussion of the above analysis is available from the DEM upon request.

The biomonitoring requirements are set forth in 40 CFR 131.11 and in the State's Water Quality

Regulations. The bioassay requirements in the permit shall assure control of toxicity in the effluent. If continued toxicity is demonstrated, then toxicity identification and reduction will be required. Evaluation of the data collected for biotoxicity has revealed that the effluent samples from the treatment plant have demonstrated acceptable toxicity values. The State policy is to require a LC_{50} of >100% effluent. The actual data can be found in Attachment A-2.

The effluent monitoring requirements have been specified in accordance with RIPDES regulations as well as 40 CFR 122.41 (j), 122.44 (i), and 122.48 to yield data representative of the discharge.

The EPA priority pollutants listed in 40 CFR 122, Appendix D, Table II and III shall be scanned for annually.

The permit contains requirements for the permittee to comply with the State's Sludge Regulations.

The permit contains a reporting requirement for a local program to regulate industrial discharges to the sewer system (referred to as pretreatment program). This program is being required under authority of Section 402 (b)(8) of the CWA and 40 CFR 122.44 (j) and 403.8 because the Town receives significant discharges of industrial wastewater.

The remaining general and specific conditions of the permit are based on the RIPDES regulations as well as 40 CFR Parts 122 through 125 and consist primarily of management requirements common to all permits.

V. Comment Period, Hearing Requests, and Procedures for Final Decisions

All persons, including applicants, who believe any condition of the draft permit is inappropriate must raise all issues and submit all available arguments and all supporting material for their arguments in full by the close of the public comment period, to the Rhode Island Department of Environmental Management, Office of Water Resources, 235 Promenade Street, Providence, Rhode Island, 02908-5767. In accordance with Chapter 46-17.4 of Rhode Island General Laws, a public hearing will be held prior to the close of the public comment period. In reaching a final decision on the draft permit the Director will respond to all significant comments and make these responses available to the public at DEM's Providence Office.

Following the close of the comment period, and after a public hearing, the Director will issue a final permit decision and forward a copy of the final decision to the applicant and each person who has submitted written comments, provided oral testimony, or requested notice. Within thirty (30) days following the notice of the final permit decision any interested person may submit a request for a formal hearing to reconsider or contest the final decision. Requests for formal hearings must satisfy the requirements of Rule 49 of the Regulations for the Rhode Island Pollutant Discharge Elimination System.

VI. DEM Contact

Additional information concerning the permit may be obtained between the hours of 8:30 a.m. and 4:00 p.m., Monday through Friday, excluding holidays from:

Joseph Haberek, P.E.
RIPDES Program
Office of Water Resources
Department of Environmental Management
235 Promenade Street
Providence, Rhode Island 02908
Telephone: (401) 222-4700, ext. 7715
E-mail: joseph.haberek@dem.ri.gov

Permit No. RI0100056

DRAFT

Date

Eric A. Beck, P.E.
Supervising Sanitary Engineer
Office of Water Resources
Department of Environmental Management

ATTACHMENT A-1

Annual Pretreatment Report Summary Sheet

POTW Name: [ ]

NPDES Permit #: [ ]

Pretreatment Report Period Start Date: [ ]

Pretreatment Report Period End Date: [ ]

# of Significant Industrial Users (SIUs): [ ]

# of SIUs Without Control Mechanisms: [ ]

# of SIUs not Inspected: [ ]

# of SIUs not Sampled: [ ]

# of SIUs in Significant Noncompliance (SNC) with Pretreatment Standards: [ ]

# of SIUs in SNC with Reporting Requirements: [ ]

# of SIUs in SNC with Pretreatment Compliance Schedule: [ ]

# of SIUs in SNC Published in Newspaper: [ ]

# of SIUs with Compliance Schedules: [ ]

# of Violation Notices Issued to SIUs: [ ]

# of Administrative Orders Issued to SIUs: [ ]

# of Civil Suits Filed Against SIUs: [ ]

# of Criminal Suits Filed Against SIUs: [ ]

# of Categorical Industrial Users (CIUs): [ ]

# of CIUs in SNC: [ ]

Annual Pretreatment Report Summary Sheet

Penalties

Total Dollar Amount of Penalties Collected $

# of IUs from which Penalties have been collected:

Local Limits

Date of Most Recent Technical Evaluation of Local Limits:

Date of Most Recent Adoption of Technically Based Local Limits:

Pollutant	Limit (mg/l)	MAHL (lb/day)

ATTACHMENT A-2

DESCRIPTION OF DISCHARGE: Secondary treated domestic and industrial wastewater.
DISCHARGE: 001A - Secondary Treatment Discharge

AVERAGE EFFLUENT CHARACTERISTICS AT POINT OF DISCHARGE:

PARAMETER	AVERAGE[1]	MAXIMUM[2]
FLOW (MGD) MGD	1.97 MGD	3.15 MGD
BOD_5 (PPM)	2.46 mg/l	5.59 mg/l
TSS	5.03 mg/l	13.25 mg/l
Fecal Coliform	3.29 MPN/100 ml	59.00 MPN/100 ml
pH	6.63 S.U.(minimum)	7.00 S.U.(maximum)
Chlorine Residual	0.03 ug/l	0.17 ug/l
Copper	8.85 ug/l	8.85 ug/l
Cyanide	6.25 ug/l	6.25 ug/l
Total Nitrogen (May – Oct)		15.38 mg/l
(Nov – April)		12.01mg/l
Oil and Grease		4.04 mg/l

[1]Data represents statistical mean of the monthly average data from September 2004 – September 2009

[2]Data represents statistical mean of the daily maximum data from September 2004 – September 2009

Biotoxicity Data LC_{50} Values (in percent effluent)

	2007 3rd qtr.	4th qtr.	2008 1st qtr.	2nd qtr.	3rd qtr.	4th qtr.	2009 1st qtr.	2nd qtr.	3rd qtr.
Mysid Minnow	>100 %	>100 %	>100 %	>100 %	>100 %	>100 %	>100 %	>100 %	>100 %

Warren Wastewater Treatment Facility

Warren, Rhode Island

Permit Development Document
RIPDES Permit No. RI0100056

Rhode Island Department of Environmental Management
Office of Water Resources
November 2009

Warren Wastewater Treatment Facility
Permit Development Document

Introduction

The Town of Warren owns and operates a Wastewater Treatment Facility (WWTF) located on Water Street, Warren, Rhode Island. The discharge to the Warren River consists of secondary treated domestic and industrial wastewater effluent. Treatment consists of the following: Coarse Screening, Grit Removal, Comminution, Primary Settling, Aeration, Secondary Flocculation and Clarification, Chlorination, and Dechlorination.

Development of Rhode Island Pollutant Discharge Elimination System (RIPDES) permit limitations is a multi-step process consisting of the following steps: Calculating allowable water quality-based discharge levels based on water quality criteria, background data, and available dilution; Assigning applicable technology-based limits based on federal Effluent Limitation Guidelines (ELGs); Assigning necessary limits based on Best Professional Judgment (BPJ); Setting the most stringent of these three (3) limits as the new permit limits; Comparing existing permit limits to the new limits and performing an antibacksliding/antidegradation analysis to determine the final permit limits; and evaluating the ability of the facility to meet the final permit limits.

Water quality criteria are comprised of numeric and narrative criteria. Numeric criteria are scientifically derived ambient concentrations developed by EPA or States for various pollutants of concern to protect human health and aquatic life. Narrative criteria are statements that describe the desired water quality goal. A technology-based limit is a numeric limit, which is determined by examining the capability of a treatment process to reduce or eliminate pollutants.

Technology-Based Permit Limitations

The "Average Monthly" and "Average Weekly" biochemical oxygen demand (BOD_5) limitations, the total suspended solids (TSS) limitations, and the pH limitations are based upon the secondary treatment requirements in Section 301(b)(1)(B) of the Clean Water Act (CWA), as defined in 40 CFR 133.102 (a)-(c). Fecal coliform and "Maximum Daily" BOD_5 and TSS limits are based on Rhode Island requirements for Publicly Owned Treatment Works (POTWs) under Rule 17.04(b) of the RIPDES Regulations and as provided in 40 CFR 123.25.

The "Percent Removal" requirements for BOD_5 and TSS for outfall 001 are in accordance with 40 CFR 133.102(a) and (b) respectively.

Water Quality-Based Permit Limitations

The allowable water quality-based effluent limitations were established on the basis of acute and chronic aquatic life criteria and human health criteria using the following: available instream dilution; an allocation factor; and background concentrations when available and/or appropriate. The aquatic life and human health criteria are specified in the Rhode Island Water Quality Regulations, as amended. Aquatic life criteria have been established to ensure the protection and propagation of aquatic life while human health criteria represent the pollutant levels that would not result in a significant risk to public health from ingestion of aquatic organisms. The more stringent of the two criteria was then used in establishing allowable effluent limitations. Details concerning the calculation of potential permit limitations, selection of factors, which influence their calculation, and the selection of final permit limitations are included below or in the attached documents. The City's first permit to contain water quality based limits was issued in September 1991. The pH limitations are based upon the water quality criteria for discharges to salt water from the RI Water Quality Regulations.

Mixing Zones and Dilution Factors

On November 26, 1996, the Rhode Island Department of Environmental Management (DEM) reissued a RIPDES permit to the Warren WWTF that contained water quality-based permit limits using a chronic dilution factor of 100x and an acute dilution factor of 35x, determined from the *Dye Dilution Study at Warren, RI WPCP* (Aquatec, 1992). The Town of Warren had this effluent dye study conducted, in an effort to comply with water quality based limits and to determine the actual dilution factor. Similar studies have been conducted by other major RIPDES permittees that discharge to marine waters.

Based on the results of this dye study, it was determined that mixing zones and corresponding dilution factors are acceptable for the effluent from the Warren WWTF. The chronic mixing zone is of rectangular shape, centered on the outfall and having dimensions of 500 ft (north-south) by 300 ft (east-west), while the acute mixing zone has a 50 ft radius. As previously indicated, the chronic and acute dilution factors are 100x and 35x, respectively. Additional information may be found in the development document for the 1996 permit, which is on file at DEM. Provided in Figure #1 is a map detailing the location of the outfall and the acute and chronic mixing zones.

By using the previously mentioned chronic and acute dilution factors, the allowable discharge limits were calculated as follows:

a) Background concentration unknown or available data is impacted by sources that have not yet achieved water quality based limits.

$$Limit_l = (DF) * (Criteria) * (80\%)$$

Where: DF = acute or chronic dilution factor, as appropriate

b) Using available background concentration data.

$$Limit_l = (DF) * (Criteria) * 90\% - (Background) * (DF - 1)$$

Where: DF = acute or chronic dilution factor, as appropriate

Reference Attachment A for calculations of allowable water quality-based limits using Aquatic Life and Human Health Criteria.

The formulas and data noted above were applied with the following exceptions

A) Pollutants that based on the acute and chronic dilution factors have a higher allowable chronic limit than allowable acute limit. For this situation, both the "Monthly Average" and "Daily Maximum" limits were set at the allowable acute limit.

B) Total residual chlorine. The limits for TRC were established in accordance with the DEM Effluent Disinfection Policy. The "Monthly Average" and "Daily Maximum" limits were based on a 100% allocation, a zero background concentration, and the appropriate dilution factors. The 100% allocation factor for TRC was used due to the non-conservative nature of chlorine and the improbability of the receiving water having a detectable background TRC concentration.

C) Pollutants with water quality based monthly average limits in the previous RIPDES permit. The relaxation of monthly average limits from the previous permit was restricted in accordance with the antibacksliding provisions of the Clean Water Act and the DEM's Policy on the Implementation of the Antidegradation Provisions of the Rhode Island Water Quality Regulations (Appendix C of the Rhode Island Water Quality Regulations).

Since the analysis outlined above may allow a relaxation of the monthly average limit for copper, provided below is a brief introduction to Antibacksliding and Antidegradation; as well as a discussion on how the two policies were used to calculate water quality based limits for copper.

Antibacksliding

Antibacksliding restricts the level of relaxation of water quality based limits from the previous permit. Section 303(d)(4) of the Clean Water Act addresses antibacksliding as the following:

Section 303(d)(4)

A) Standards not attained - For receiving waters that have not attained the applicable water quality standards, limits based on a TMDL or WLA can only be revised if the water quality standards will be met. This may be done by (i) determining that the cumulative effect of all such revised limits would assure the attainment of such water quality standards; or (ii) removing the designated use which is not being attained in accordance with regulations under Section 303.

B) Standards attained - For receiving waters achieving or exceeding applicable water quality standards, limits can be relaxed if the revision is consistent with the State's Antidegradation Policy.

Therefore, in order to determine whether backsliding is permissible, the first question that must be answered is whether or not the receiving water is attaining the water quality standard. The Office has determined the most appropriate evaluation of existing water quality is by calculating the pollutant levels, which would result after consideration of all currently valid RIPDES permit limits or historic discharge data (whichever is greater), background data (when available), and any new information (i.e.: dilution factors).

Antidegradation

The DEM's "Policy on the Implementation of the Antidegradation Provisions of the Rhode Island Water Quality Regulations" (the Policy) establishes four tiers of water quality protection:

Tier 1. In all surface waters, existing uses and the level of water quality necessary to protect the existing uses shall be maintained and protected.

Tier 2. In waters where the existing water quality exceeds the levels necessary to support the propagation of fish and wildlife, and recreation in and on the water, that quality shall be maintained and protected, except for insignificant changes in water quality as determined by the Director and in accordance with the Policy. In addition, the Director may allow significant degradation which is determined to be necessary to achieve important economic or social benefits to the State in accordance with the Policy.

Tier 2½. Where high quality waters constitute Special Resource Protection Waters (SRPWs), there shall be no measurable degradation of the existing water quality necessary to protect the characteristics which cause the waterbody to be designated a SRPW. Notwithstanding that all public drinking water supplies are SRPWs, public drinking water suppliers may undertake temporary and short-term activities within the boundary perimeter of a public drinking water supply impoundment for essential maintenance or to address emergency conditions in order to prevent adverse effects on public health or safety. These activities must comply with the requirements set fourth in Tier 1 and Tier 2.

Tier 3. Where high quality waters constitute an Outstanding Natural Resource (ONRW), that water quality shall be maintained and protected. The State may allow some limited activities that result in temporary and short-term changes in the water quality of an ONRW. Such activities must not permanently degrade water quality or result in water quality lower than necessary to protect the existing uses in the ONRW.

The formulas previously presented ensure that permit limitations are based upon water quality criteria and methodologies established to ensure that all designated uses will be met.

In terms of the applicability of Tier 2 of the Policy, a water body is assessed as being high quality on a parameter-by-parameter basis. In accordance with Part II of the Policy, "Antidegradation applies to all new or increased projects or activities which may lower water quality or affect existing water uses, including but not limited to all 401 Water Quality Certification reviews and any new, reissued, or modified RIPDES permits." Part VI.A of the Policy indicates that it is not applicable to activities which result in insignificant changes in water quality and that significant changes in water quality will only be allowed if it is necessary to accommodate important economic and social development in the area in which the receiving waters are located (important benefits demonstration). Part VI.B.4 of the Policy states that: "Theoretically, any new or increased discharge or activity could lower existing water quality and thus require the important benefits demonstration. However, RIDEM will: 1) evaluate applications on a case-by-case basis, using BPJ and all pertinent and available facts, including scientific and technical data and calculations as provided by the applicant; and 2) determine whether the incremental loss is significant enough to require the important benefits demonstration described below. [If not then as a general rule RIDEM will allocate no more than 20%.] Some of the considerations which will be made to determine if an impact is significant in each site specific decision are: 1) percent change in water quality parameter value and their temporal distribution; 2) quality and value of the resource; 3) cumulative impact of discharges and activities on water quality to-date; 4) measurability of the change; 5) visibility of the change; 6) impact on fish and wildlife habitat; and 7) impact on potential and existing uses. As a general guide, any discharge or activity which consumes greater than 20% of the remaining assimilative capacity will be considered a significant impact and will be required to demonstrate important economic or social benefits to justify the activity. However, on a case-by-case basis, <u>any</u> proposed percent consumption of the remaining assimilative capacity may be deemed significant and invoke full requirements to demonstrate important economic or social benefits."

An increased discharge is defined as an increase in any limitation, which would result in an increased mass loading to a receiving water. The baseline for this comparison is the monthly average mass loading established by the previous permit. It would be inappropriate to use the daily maximum mass loading since the Policy is not applicable to short-term changes in water quality.

For the purposes of ensuring that the revised limit is consistent with the requirements of antidegradation, existing water quality must be defined. As explained earlier, DEM evaluates existing water quality by determining the pollutant levels which would result under the design conditions appropriate for the particular criteria (i.e., background water quality, when available and/or appropriate; non-point source inputs; and existing RIPDES permit limitations or recent historical discharge data, whichever is higher). In general, available data would be used to make this determination.

Based on this approach, the present instream water quality C_p is defined as:

$$C_p = \frac{(DF - 1) * C_b + C_d}{DF}$$

where: C_b = background concentration (if available)
C_d = the greater of either historic discharge data or the previous permit's limits
DF = dilution factor

If the waterbody is a high quality water for the pollutant in question ($C_p < C_{criteria}$), then the discharge requires an evaluation under Tier 2 protection. If the waterbody is not determined to be high quality for that parameter, then antibacksliding will allow an increased permit limit only if it can be assured that water quality standards would be attained. Therefore, the permit limit would be calculated to comply with Tier 1 protection, using the procedures noted previously (i.e., $Limit_1$).

Assuming the receiving water has been designated as a high quality waterbody for the parameter under investigation, the next step is to determine whether the new or increased discharge is permissible and if so whether an important benefits demonstration is required. As explained above, for existing discharges DEM shall follow the general rule of allocating no more than 20% of the remaining assimilative capacity without the need to complete this demonstration (assuming the receiving water is not an SRPW or ONRW). On a case-by-case basis, the DEM may limit the allocation or determine that any incremental loss or impact to the receiving water is significant enough to require a detailed important benefits demonstration.

Water Quality Based Limits - Considering Antibacksliding and Antidegradation

Below are the four (4) steps DEM used to establish permit limitations for copper to be consistent with Tier 2 protection of antidegradation.

1) Determine the remaining assimilative capacity of the receiving water C_{rac}. The remaining assimilative capacity (or buffer) is equivalent to the difference between the criteria and the calculated present instream water quality concentrations:

$$C_{rac} = C_{criteria} - C_p$$

where:
$C_{criteria}$=applicable standard for the most sensitive use; and
C_p = the calculated present water quality concentration.

2) Establish the percentage of the remaining assimilative capacity that will be allocated to the permittee.

RIDEM allocated 0% of the remaining assimilative capacity for Copper. The decision to allocate 0% of the remaining assimilative capacity was made since the treatment plant's historic discharge levels for copper were well below the previous permit's limit. Therefore, there was no need to allocate any additional assimilative capacity of the receiving water.

3) Calculate an increased permit limit that would meet the Antidegradation Implementation Policy.

The next step is to calculate a permit limit based on the available concentration. The available concentration is a percentage of the remaining assimilative capacity of the receiving water, which can be allocated to the permittee, plus the present water quality. This concentration is then used to calculate a permit limit. The limit is calculated by subtracting background data (if available or appropriate) from the criteria and using the appropriate dilution factors and allocation factors in a mass balanced relationship.

The limit is determined by:

$$Limit_2 = (C_p + \% * C_{rac}) * DF - (DF - 1) * C_b$$

4) Finally, compare $Limit_1$ to $Limit_2$.

The final limit is the smaller of either $Limit_1$ or $Limit_2$.

Provided in Attachments B and C are calculations determining the historic discharge level and illustrating the antibacksliding/antidegradation process, respectively.

Reasonable Potential

In accordance with 40 CFR 122.4(d)(1)(iii), it is only necessary to establish permit limits for those pollutants in the discharge which have the reasonable potential to cause or contribute to the exceedance of instream criteria. In order to evaluate the need for permit limits, the most stringent calculated acute (daily maximum) and chronic (monthly average) limits are compared to the Discharge Monitoring Report (DMR) and the State User Fee Program data. Complete listings of State User Fee Program data and DMR data for the past five (5) years are provided in Attachments D and E, respectively. Based on this analysis, permit limits are required for Total Residual Chlorine (TRC), Cyanide, and Total Copper.

DEM's User Fee Program detected the presence of the pesticides Aldrin and Heptachlor in the facility's effluent. However, DEM has not established permit limitations for these pollutants because of the sporadic nature of the detection of these parameters (one detect for Aldrin and two detects for Heptachlor), which DEM attributed to laboratory interference. Instead, the permit requires continued monitoring for these pollutants as part of the annual priority pollutant scans.

Although reasonable potential was not established for the following pollutants (i.e., effluent data was not available or effluent monitoring has consistently demonstrated discharge levels far below the permissible levels), monitoring is being required quarterly as part of the bioassay testing: Total Cadmium, Total Chromium, Total Lead, Total Zinc, Total Nickel, and Total Aluminum. Therefore, water quality-based limits have been included for these pollutants. These pollutants, in addition to Total Copper and Cyanide, are all part of the DEM's list of standard parameters, for discharges to salt waters, that must be measured as part of the bioassay procedures. Total Copper and Cyanide are already being measured because, as discussed above, these pollutants had reasonable potential to cause or contribute to an exceedance of instream criteria.

Attachment F is a summary comparison of the allowable limits vs. the DMR and State User Fee Program data.

Nutrient Limitations

The State of Rhode Island's 2008 *303(d) List of Impaired Waters* identifies the Palmer River as being impaired for nutrients (e.g., Total Nitrogen) and hypoxia (e.g., Dissolved Oxygen). Two facilities, the Warren WWTF and Blount Seafood, have RIPDES permits authorizing them to discharge into the Warren River. However, based on dye studies conducted by ASA for Blount Seafood in 1989 and by the DEM and FDA in 1995, it was determined that the travel time for the effluent from these facilities in the Warren River to the Palmer and Barrington Rivers on the flood tide is less than one hour and that most of the dye released on the flood tide entered the Palmer River rather than the Barrington River. Therefore, the discharge from these facilities are pertinent to the Palmer River because their effluent is carried into the Palmer River.

In order to address the Palmer River's impairments, DEM sampled the Palmer River as part of an assessment of the Palmer River. The DEM's sampling consisted of six cruises during 1996 and 1997. Each cruise was comprised of high and low slack tide surveys with water samples collected for fecal coliform and nutrient analyses and water column profiling for salinity, temperature, and dissolved oxygen. The study also included collecting macro-algae for identification and to estimate density.

During the survey, it was found that oxygen levels rise in the morning hours after sunrise with dissolved oxygen in Belcher Cove typically between 130 and 160 percent of saturation on most dates during daylight hours. These findings reinforced the conclusions of a 1994 Blount Seafood water quality study of the Palmer River that included two-days of water quality sampling during slack high and low tide for a suite of nutrients and measurements of salinity, temperature, and dissolved oxygen profiles. The Blount Seafood study found that daytime dissolved oxygen levels throughout the area were near or above saturation values and that these values are higher than those found during the sunrise surveys. The Blount results confirm the DEM's findings that oxygen levels rise in the morning hours after sunrise. This is caused by plant respiration during daylight hours causing elevated oxygen levels and is indicative of eutrophication. Eutrophication in the Palmer River is also evidenced by the excessive growth of green macroalgae and high chlorophyll a levels that are an indication of a phytoplankton bloom in the water column. The excessive growth of macroalgae and phytoplankton and the high dissolved oxygen concentrations during daylight hours demonstrates that the Palmer River is eutrophic from excessive amounts of nitrogen entering the system. Therefore, to address the Palmer River's impairments, it is necessary that the amount of nitrogen discharged to the River be controlled.

Nitrogen loads to the Palmer River were calculated for the three major nitrogen sources, the Palmer River Watershed, the Warren WWTF, and Blount Seafood. Loads were calculated on both an annual and a summer (May through October) basis. For the Warren WWTF, the nitrogen loads were calculated using nitrogen concentration data that was collected by the plant and the actual flow on the day that the effluent was sampled. For Blount Seafood, the nitrogen loads were calculated using nitrogen concentration data that was collected by the plant and the average monthly flow. Nitrogen loads to Palmer River were calculated by summing the Palmer

River watershed nitrogen load with the loads from the Warren WWTF and Blount Seafood. The total nitrogen loads to the Palmer River were calculated to be 138,889 kg/year on an annual basis and 50,888 kg/year on a summer basis. To address the Palmer River's impairments, the DEM had to determine the allowable nitrogen load that could be assimilated without causing eutrophic conditions.

The Buzzards Bay Program (BBP) in Massachusetts developed empirical relationships between nitrogen loadings and eutrophication response from observations made in a number of estuaries. The BBP approach uses land use information to estimate nitrogen loads and is considered by DEM to offer a number of advantages for use in Rhode Island based on physical and biological similarities outlined below that make the use of the loading - estuarine response relationships for Buzzards Bay appropriate in the Palmer River:

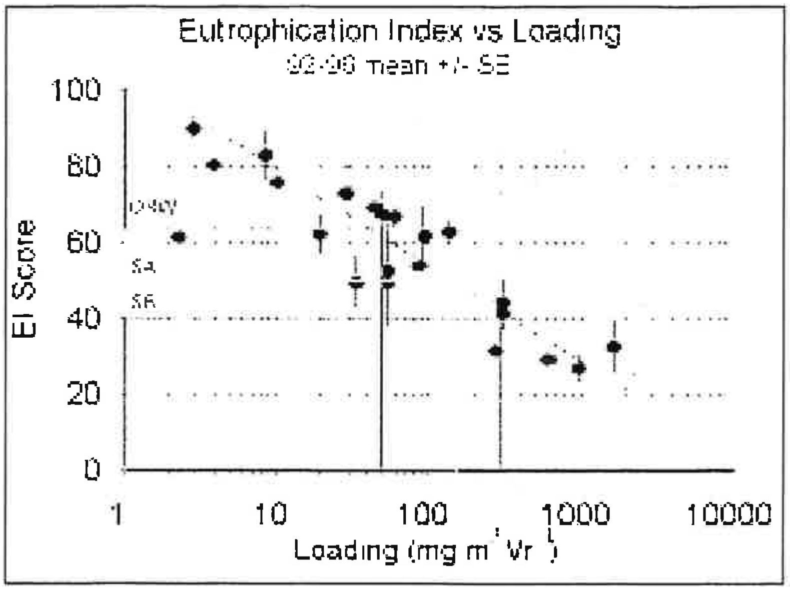
1. The BBP approach has been developed for estuaries that are physically similar to RI estuaries such as the Palmer River. The similarities include:
   - Geometry (depth and size),
   - Tidal regime,
   - Drainage area characteristics (land use and size),
   - Climatic conditions such as rainfall and seasonal temperature variations,
   - Ambient seaward water chemical and thermal conditions.

2. Plant and animal communities affecting water quality in and around Buzzards Bay, including the plankton and macroalgal species are similar to those in Rhode Island.

3. The nature of nitrogen sources to the Palmer River is similar to Buzzards Bay, with point sources responsible for roughly 50% of the estimated load. The remaining sources are predominately septic systems and agricultural sources.

A Eutrophication Index (EI) was developed by the BBP to assist in determining the level of nutrient enrichment a waterbody is experiencing at any given time. The EI uses water quality data including oxygen saturation levels, secchi depth, dissolved organic nitrogen, chlorophyll and total organic nitrogen, assigns them a score which is then translated into the Eutrophication Index. The EI uses a scale of 0 to 100 points where 0 equals the most eutrophic and 100 is equivalent to a pristine waterbody. EI Scores of 65 to 100 are considered "good to excellent" water quality, 35 to 65 are considered "fair to good" water quality, and less than 35 are considered typical of eutrophic conditions. The Buzzards Bay Project estimated that an appropriate EI value for Outstanding Natural Resource Waters (ONRW) is 65, for SA waters is 50, and for SB waters is 40. Since the Palmer River is designated as a Special Resource Protection Water, whose designated uses are essentially equivalent to those of ONRWs, it should have an EI of 65 or better. Two sampling stations, located in the central Palmer River and in Belcher Cove, were established in the Palmer River. All parameters, listed above were measured at these stations and the EI was calculated. The results indicate that the Palmer River is eutrophic with an EI score of 32. This supports the need to reduce nitrogen discharges to the Palmer River.

A relationship between the nitrogen loading rate and EI from the BBP is presented below. As the figure shows, the environmental response is a function of the loading rate per unit estuary volume. Acceptable loading rates for ONRWs are 50 mg m^{-3} Vr^{-1}.



The calculation for allowable annual load is:

$$\text{Annual Load (in kg yr}^{-1}\text{)} = \frac{\text{Loading rate x volume at half tide (in m}^3\text{) x } (1+\tau_w^{1/2})}{\tau_w * 1{,}000{,}000}$$

Where τ_w is the hydraulic turnover time in years and the Vollenweider flushing term is $\tau_w/(1+\tau_w^{1/2})$.

For the Palmer River, with a flushing time of 17.88 hours, a mean volume of 3.13 x 10^6 m^3, and an allowable loading rate of 50 mg m^{-3} Vr^{-1}, the corresponding nitrogen assimilative capacity of the Palmer River is 80,011 kg/yr.

Using the annual allowable total nitrogen load for the Palmer River of 80,011 kg/year, the allowable nitrogen limits were allocated among the three nitrogen sources to the Palmer River, the two RIPDES point sources and the Palmer River watershed. The existing summer, winter, and annual nitrogen loads from the two RIPDES point sources were recalculated using a dataset that was extended to January 2007. The reductions needed to meet the allowable summer load were calculated first. Summer discharge for the Warren WWTF was set to 90% of design flow while Blount Seafood was set at design flow. The 90% value was chosen based on DEM work in the Providence and Seekonk Rivers that determined that the average summer flows form municipal wastewater treatment facilities were 90% of the annual flows. The chosen scenario sets the Warren WWTF allowable summer total nitrogen concentration at 5 mg/L, an 80% reduction in summer load, while Blount Seafood was allocated an equivalent 80% summer load reduction. At design flow, Blount Seafood's allowable concentration would be 40.4 mg/L. These reductions were sufficient to meet the allowable summer loading to the Palmer River. However, summer point source reductions were not sufficient to meet the allowable annual total nitrogen load of 80,011 kg/year. Meeting the allowable annual load also requires an annual watershed reduction and a winter point source load reduction. The point sources were allocated a 20% winter reduction in load, which is equivalent to winter total nitrogen limits of 14.3 mg/l for the Warren WWTF and 93.9 mg/l for Blount Seafood using the design flow for both facilities, while the watershed was allocated an annual 59% reduction. When the winter point source reductions were combined with the summer point source reductions, the Warren WWTF and Blount were assigned a 56% and 59% reduction, respectively. Table 18 details this reduction scenario.

	Existing Winter Load (kg/yr)	Required Winter Load (kg/yr)	Percent Winter Reduction	Existing Summer Load (kg/yr)	Required Summer Load (kg/yr)[1]	Percent Summer Reduction	Existing Annual Load (kg/yr)	Required Annual Load (kg/yr)	Percent Annual Reduction
Warren WWTF[2]	24,580	19,664	20.0%	32,255	6,309	80.4%	59,203	25,973	56.1%
Blount[2]	16,109	12,887	20.0%	28,851	5,636	80.4%	45,479	18,523	59.3%
Total NPDES	**40,689**	**32,551**	**20.0%**	**61,106**	**11,945**	**80.4%**	**104,682**	**44,496**	**57.5%**
Watershed	**65,411**	**26,819**	**59.0%**	**21,209**	**8,695**	**59.0%**	**86,620**	**35,514**	**59.0%**
TOTAL		**59,370**			**20,640**			**80,010**	

[1] Summer Loads are based on 184 days between May and October
[2] Point source loads are based on 95 percentile values of actual DMR data for the following months: winter (November – April), summer (May – October), and annual (January – December).

Based on the above analysis, the Warren WWTF is being assigned a summer monthly average total nitrogen limit of 5.0 mg/l during the months of May – October and a winter monthly average total nitrogen limit of 14.3 mg/l during the months of November – April. Similarly, Blount Seafood is being assigned an equivalent percent reduction in its total nitrogen discharges, which equates to a summer monthly average total nitrogen limit of 40.4 mg/l during the months of May – October and a winter monthly average total nitrogen limit of 93.9 mg/l during the months of November – April. A document, titled *Evaluation of Nitrogen Targets and Load Reductions for the Palmer River*, that includes a more in-depth discussion of the above analysis is available from the DEM upon request.

Bioassay Testing

DEM's toxicity permitting policy is based on past toxicity data and the level of available dilution. Evaluation of the data collected for toxicity revealed that the prechlorinated effluent samples consistently demonstrated acceptable acute toxicity values for Mysids (shrimp). Based upon past toxicity results and available dilution, the draft permit requires an $LC_{50} \geq 100\%$ effluent limit for quarterly acute tests conducted on Mysids only. At this time, chronic toxicity testing is not required based on the chronic dilution factor of 100:1, exceeding DEM's 20:1 dilution threshold used for assigning chronic toxicity limits.

BPJ-Based Limits

Oil & Grease monitoring has been included to ensure that the collection system will not experience blockages due to excessive levels of grease and to ensure that the WWTF will not experience inhibition.

RIDEM and EPA agree that TSS is an appropriate measure of the solids content being discharged to the receiving waters and that Settleable Solids are a "process-control parameter" that can aid in the assessment of the operation of the plant but need not be an effluent limit. Therefore, the permit requirements for Settleable Solids are monitor only.

The monthly average flow limit assigned in the permit was set equal to the currently approved wastewater flow from the Warren WWTF's Facilities Plan. The approved flow from the Facilities Plan is based on the ability of the WWTF's equipment to process both pollutant loads and hydraulic flows and ensures that the capacity of the WWTF is not exceeded.

Final Permit Limitations

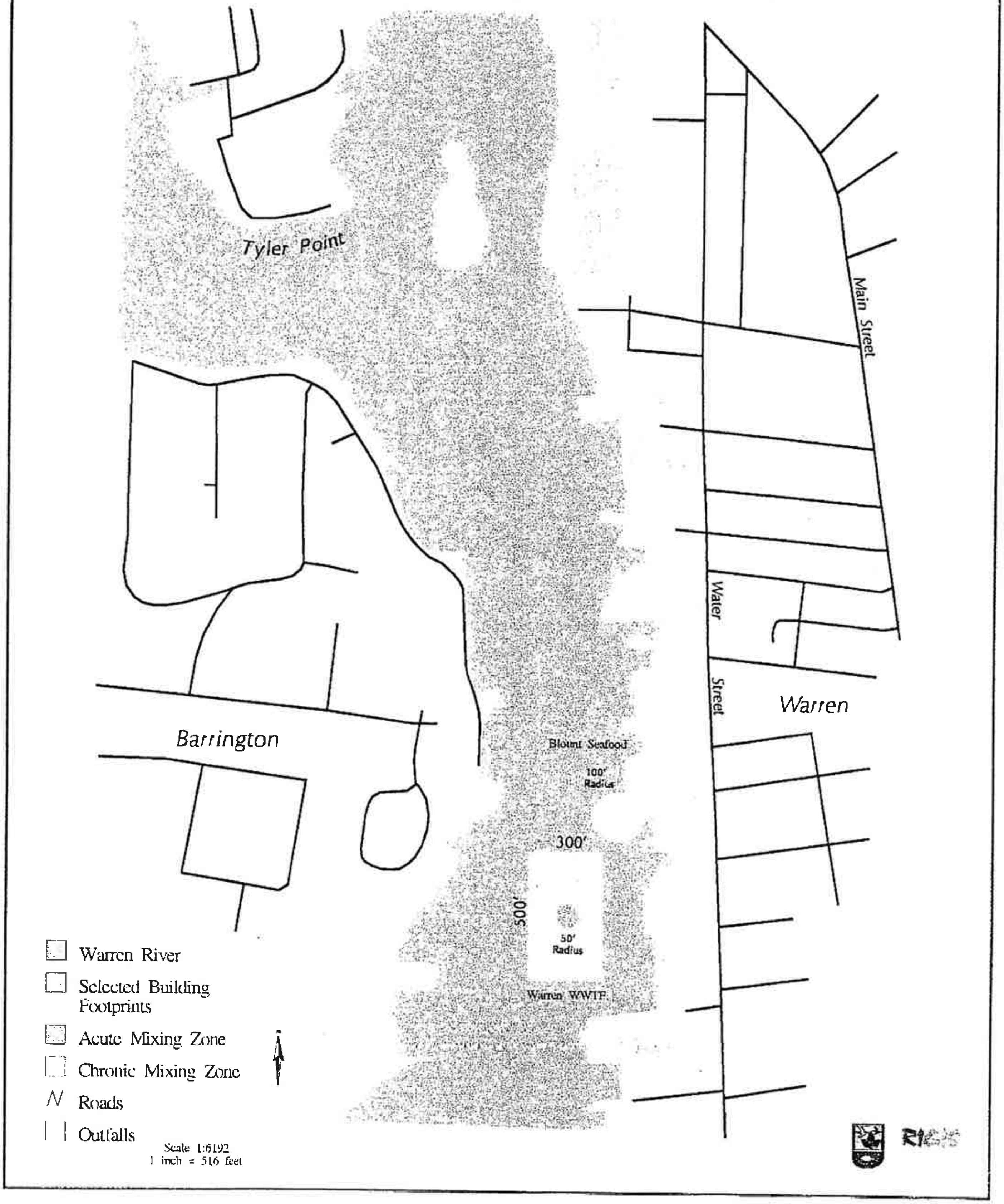
	Quantity		Concentration		
Parameter	Monthly Average	Daily Maximum	Monthly Average	Weekly Average	Daily Maximum
Flow	2.01 MGD	--- MGD			
BOD_5	502 lb/day	838 lb/day	30 mg/l	45 mg/l	50 mg/l
BOD_5 % Removal			85 %		
TSS	502 lb/day	838 lb/day	30 mg/l	45 mg/l	50 mg/l
TSS % Removal			85 %		
Settleable Solids				--- ml/l	--- ml/l
Total Residual Chlorine			455.0 μg/l		455.0 μg/l
Fecal Coliform			200 MPN / 100 ml	400 MPN / 100 ml	400 MPN / 100 ml
pH			6.5 SU (min.)		8.5 SU (max.)
Oil & Grease					--- mg/l
TKN (as N)			--- mg/l		--- mg/l
Total Nitrate (as N)			--- mg/l		--- mg/l
Total Nitrite (as N)			--- mg/l		--- mg/l
Total Nitrogen (May–Oct)	83.8 lb/day		5.0 mg/l		--- mg/l
(Nov-April)	239.7 lb/day		14.3 mg/l		--- mg/l
Total Copper			50.0 μg/l		162.0 μg/l
Cyanide			28.0 μg/l		28.0 μg/l
Total Cadmium			708 μg/l		1127 μg/l
Total Chromium			4028 μg/l		31017 μg/l
Total Lead			681 μg/l		6183 μg/l
Total Zinc			2664 μg/l		2664 μg/l
Total Nickel			663 μg/l		2093 μg/l
Total Aluminum			--- μg/l		--- μg/l
LC_{50} - Mysidopsis bahia					≥ 100%

Note: --- signifies a parameter that must be monitored and data reported; no limit has been established at this time.

FIGURE #1

Warren Wastewater Treatment Facility
Mixing Zone

Figure #1
Warren River Outfalls
RI Department of Environmental Management, Division of Water Resources



ATTACHMENT A

Calculation of Allowable Acute and Chronic Discharge Limitations Based on Saltwater Aquatic Life Criteria and Human Health Criteria

CALCULATION OF WATER QUALITY BASED SALTWATER DISCHARGE LIMITS

FACILITY SPECIFIC DATA INPUT SHEET

NOTE: LIMITS BASED ON RI WATER QUALITY CRITERIA DATED JULY 2006

FACILITY NAME: **Warren Wastewater Treatment Facility**

RIPDES PERMIT #: **RI0100056**

	DISSOLVED BACKGROUND DATA (ug/L)	ACUTE METAL TRANSLATOR	CHRONIC METAL TRANSLATOR
ALUMINUM	**NA**	**NA**	**NA**
ARSENIC	**NA**	**1**	**1**
CADMIUM	**NA**	**0.994**	**0.994**
CHROMIUM III	**NA**	**NA**	**NA**
CHROMIUM VI	**NA**	**0.993**	**0.993**
COPPER	**NA**	**0.83**	**0.83**
LEAD	**NA**	**0.951**	**0.951**
MERCURY	**NA**	**0.85**	**NA**
NICKEL	**NA**	**0.99**	**0.99**
SELENIUM	**NA**	**0.998**	**0.998**
SILVER	**NA**	**0.85**	**0.85**
ZINC	**NA**	**0.946**	**0.946**

USE NA WHEN NO DATA IS AVAILABLE

NOTE 1: METAL TRANSLATORS FROM RI WATER QUALITY REGS.

DILUTION FACTORS	
ACUTE =	**35** x
CHRONIC =	**100** x
HUMAN HEALTH =	**100** x

NOTE: TEST WWTF'S DILUTION FACTORS OBTAINED FROM A DYE STUDY.

TOTAL AMMONIA CRITERIA (ug/L)		
WINTER	ACUTE =	**5600**
	CHRONIC =	**840**
SUMMER	ACUTE =	**4400**
	CHRONIC =	**660**

NOTE 1: LIMITS ARE FROM TABLE 3 IN THE RI WATER QUALITY REGS.
USING:
SALINITY = 20 g/Kg
WINTER (NOV-APRIL) pH=8.4 s.u.;
SUMMER (MAY-OCT) pH=8.2 s.u.
WINTER (NOV-APRIL) TEMP=10.0 C;
SUMMER (MAY-OCT) TEMP=20.0 C.

CALCULATION OF WATER QUALITY BASED SALTWATER DISCHARGE LIMITS

FACILITY NAME: Warren Wastewater Treatment Facility RIPDES PERMIT #: RI0100056

NOTE: METALS CRITERIA ARE DISSOLVED, METALS LIMITS ARE TOTAL; AMMONIA CRITERIA AND LIMITS HAVE BEEN CONVERTED TO ug/l N.

CHEMICAL NAME	CAS #	BACKGROUND CONCENTRATION (ug/L)	SALTWATER CRITERIA ACUTE (ug/L)	DAILY MAX LIMIT (ug/L)	SALTWATER CRITERIA CHRONIC (ug/L)	HUMAN HEALTH NON-CLASS A CRITERIA (ug/L)	MONTHLY AVE LIMIT (ug/L)
PRIORITY POLLUTANTS:							
TOXIC METALS AND CYANIDE							
ANTIMONY	7440360			No Criteria		640	51200
ARSENIC (limits are total recoverable)	7440382	NA	69	1932	36	1.4	112
ASBESTOS	1332214			No Criteria			No Criteria
BERYLLIUM	7440417			No Criteria			No Criteria
CADMIUM (limits are total recoverable)	7440439	NA	40	1126.760563	8.8		708.249497
CHROMIUM III (limits are total recoverable)	16065831	NA		No Criteria			No Criteria
CHROMIUM VI (limits are total recoverable)	18540299	NA	1100	31017.11984	50		4028.197382
COPPER (limits are total recoverable)	7440508	NA	4.8	161.9277108	3.1		298.7951807
CYANIDE	57125		1	28.00	1	140	80
LEAD (limits are total recoverable)	7439921	NA	210	6182.9653	8.1		681.3880126
MERCURY (limits are total recoverable)	7439976	NA	1.8	59.29411765	0.94	0.15	12
NICKEL (limits are total recoverable)	7440020	NA	74	2092.929293	8.2	4600	662.6262626
SELENIUM (limits are total recoverable)	7782492	NA	290	8136.272545	71	4200	5691.382766
SILVER (limits are total recoverable)	7440224	NA	1.9	62.58823529			No Criteria
THALLIUM	7440280			No Criteria		0.47	37.6
ZINC (limits are total recoverable)	7440666	NA	90	2663.84778	81	26000	6849.894292
VOLATILE ORGANIC COMPOUNDS							
ACROLEIN	107028			No Criteria		290	23200
ACRYLONITRILE	107131			No Criteria		2.5	200
BENZENE	71432			No Criteria		510	40800
BROMOFORM	75252			No Criteria		1400	112000
CARBON TETRACHLORIDE	56235			No Criteria		16	1280
CHLOROBENZENE	108907			No Criteria		1600	128000
CHLORODIBROMOMETHANE	124481			No Criteria		130	10400
CHLOROFORM	67663			No Criteria		4700	376000
DICHLOROBROMOMETHANE	75274			No Criteria		170	13600
1,2DICHLOROETHANE	107062			No Criteria		370	29600
1,1DICHLOROETHYLENE	75354			No Criteria		7100	568000
1,2DICHLOROPROPANE	78875			No Criteria		150	12000
1,3DICHLOROPROPYLENE	542756			No Criteria		21	1680
ETHYLBENZENE	100414			No Criteria		2100	168000
BROMOMETHANE (methyl bromide)	74839			No Criteria		1500	120000
CHLOROMETHANE (methyl chloride)	74873			No Criteria			No Criteria
METHYLENE CHLORIDE	75092			No Criteria		5900	472000

CALCULATION OF WATER QUALITY BASED SALTWATER DISCHARGE LIMITS

FACILITY NAME: Warren Wastewater Treatment Facility RIPDES PERMIT #: RI0100056

NOTE: METALS CRITERIA ARE DISSOLVED, METALS LIMITS ARE TOTAL; AMMONIA CRITERIA AND LIMITS HAVE BEEN CONVERTED TO ug/l N.

CHEMICAL NAME	CAS #	BACKGROUND CONCENTRATION (ug/L)	SALTWATER CRITERIA ACUTE (ug/L)	DAILY MAX LIMIT (ug/L)	SALTWATER CRITERIA CHRONIC (ug/L)	HUMAN HEALTH NON-CLASS A CRITERIA (ug/L)	MONTHLY AVE LIMIT (ug/L)
1,1,2,2TETRACHLOROETHANE	79345			No Criteria		40	3200
TETRACHLOROETHYLENE	127184			No Criteria		33	2640
TOLUENE	108883			No Criteria		15000	1200000
1,2TRANSDICHLOROETHYLENE	156605			No Criteria		10000	800000
1,1,1TRICHLOROETHANE	71556			No Criteria			No Criteria
1,1,2TRICHLOROETHANE	79005			No Criteria		160	12800
TRICHLOROETHYLENE	79016			No Criteria		300	24000
VINYL CHLORIDE	75014			No Criteria		2.4	192
ACID ORGANIC COMPOUNDS							
2CHLOROPHENOL	95578			No Criteria		150	12000
2,4DICHLOROPHENOL	120832			No Criteria		290	23200
2,4DIMETHYLPHENOL	105679			No Criteria		850	68000
4,6DINITRO2METHYL PHENOL	534521			No Criteria		280	22400
2,4DINITROPHENOL	51285			No Criteria		5300	424000
4NITROPHENOL	88755			No Criteria			No Criteria
PENTACHLOROPHENOL	87865		13	364	7.9	30	632
PHENOL	108952			No Criteria		1700000	136000000
2,4,6TRICHLOROPHENOL	88062			No Criteria		24	1920
BASE NEUTRAL COMPUNDS							
ACENAPHTHENE	83329			No Criteria		990	79200
ANTHRACENE	120127			No Criteria		40000	3200000
BENZIDINE	92875			No Criteria		0.002	0.16
POLYCYCLIC AROMATIC HYDROCARBONS				No Criteria		0.18	14.4
BIS(2CHLOROETHYL)ETHER	111444			No Criteria		5.3	424
BIS(2CHLOROISOPROPYL)ETHER	108601			No Criteria		65000	5200000
BIS(2ETHYLHEXYL)PHTHALATE	117817			No Criteria		22	1760
BUTYL BENZYL PHTHALATE	85687			No Criteria		1900	152000
2CHLORONAPHTHALENE	91587			No Criteria		1600	128000
1,2DICHLOROBENZENE	95501			No Criteria		1300	104000
1,3DICHLOROBENZENE	541731			No Criteria		960	76800
1,4DICHLOROBENZENE	106467			No Criteria		190	15200
3,3DICHLOROBENZIDENE	91941			No Criteria		0.28	22.4
DIETHYL PHTHALATE	84662			No Criteria		44000	3520000
DIMETHYL PHTHALATE	131113			No Criteria		1100000	88000000
DInBUTYL PHTHALATE	84742			No Criteria		4500	360000
2,4DINITROTOLUENE	121142			No Criteria		34	2720

Water Quality Based Effluent Limits - Saltwater

CALCULATION OF WATER QUALITY BASED SALTWATER DISCHARGE LIMITS

FACILITY NAME: Warren Wastewater Treatment Facility RIPDES PERMIT #: RI0100056

NOTE: METALS CRITERIA ARE DISSOLVED, METALS LIMITS ARE TOTAL; AMMONIA CRITERIA AND LIMITS HAVE BEEN CONVERTED TO ug/l N.

CHEMICAL NAME	CAS #	BACKGROUND CONCENTRATION (ug/L)	SALTWATER CRITERIA ACUTE (ug/L)	DAILY MAX LIMIT (ug/L)	SALTWATER CRITERIA CHRONIC (ug/L)	HUMAN HEALTH NON-CLASS A CRITERIA (ug/L)	MONTHLY AVE LIMIT (ug/L)
1,2DIPHENYLHYDRAZINE	122667			No Criteria		2	160
FLUORANTHENE	206440			No Criteria		140	11200
FLUORENE	86737			No Criteria		5300	424000
HEXACHLOROBENZENE	118741			No Criteria		0.0029	0.232
HEXACHLOROBUTADIENE	87683			No Criteria		180	14400
HEXACHLOROCYCLOPENTADIENE	77474			No Criteria		1100	88000
HEXACHLOROETHANE	67721			No Criteria		33	2640
ISOPHORONE	78591			No Criteria		9600	768000
NAPHTHALENE	91203			No Criteria			No Criteria
NITROBENZENE	98953			No Criteria		690	55200
NNITROSODIMETHYLAMINE	62759			No Criteria		30	2400
NNITROSODINPROPYLAMINE	621647			No Criteria		5.1	408
NNITROSODIPHENYLAMINE	86306			No Criteria		60	4800
PYRENE	129000			No Criteria		4000	320000
1,2,4trichlorobenzene	120821			No Criteria		70	5600
PESTICIDES/PCBs							
ALDRIN	309002		1.3	36.4		0.0005	0.04
Alpha BHC	319846			No Criteria		0.049	3.92
Beta BHC	319857			No Criteria		0.17	13.6
Gamma BHC (Lindane)	58899		0.16	4.48		1.8	144
CHLORDANE	57749		0.09	2.52	0.004	0.0081	0.32
4,4DDT	50293		0.13	3.64	0.001	0.0022	0.08
4,4DDE	72559			No Criteria		0.0022	0.176
4,4DDD	72548			No Criteria		0.0031	0.248
DIELDRIN	60571		0.71	19.88	0.0019	0.00054	0.0432
ENDOSULFAN (alpha)	959988		0.034	0.952	0.0087	89	0.696
ENDOSULFAN (beta)	33213659		0.034	0.952	0.0087	89	0.696
ENDOSULFAN (sulfate)	1031078			No Criteria		89	7120
ENDRIN	72208		0.037	1.036	0.0023	0.06	0.184
ENDRIN ALDEHYDE	7421934			No Criteria		0.3	24
HEPTACHLOR	76448		0.053	1.484	0.0036	0.00079	0.0632
HEPTACHLOR EPOXIDE	1024573		0.053	1.484	0.0036	0.00039	0.0312
POLYCHLORINATED BIPHENYLS3	1336363			No Criteria	0.03	0.00064	0.0512
2,3,7,8TCDD (Dioxin)	1746016			No Criteria		0.000000051	0.00000408
TOXAPHENE	8001352		0.21	5.88	0.0002	0.0028	0.016
TRIBUTYLTIN			0.42	11.76	0.0074		0.592

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CALCULATION OF WATER QUALITY BASED SALTWATER DISCHARGE LIMITS

FACILITY NAME: Warren Wastewater Treatment Facility RIPDES PERMIT #: RI0100056

NOTE: METALS CRITERIA ARE DISSOLVED, METALS LIMITS ARE TOTAL; AMMONIA CRITERIA AND LIMITS HAVE BEEN CONVERTED TO ug/l N.

CHEMICAL NAME	CAS #	BACKGROUND CONCENTRATION (ug/L)	SALTWATER CRITERIA ACUTE (ug/L)	DAILY MAX LIMIT (ug/L)	SALTWATER CRITERIA CHRONIC (ug/L)	HUMAN HEALTH NON-CLASS A CRITERIA (ug/L)	MONTHLY AVE LIMIT (ug/L)
NON PRIORITY POLLUTANTS: OTHER SUBSTANCES							
ALUMINUM (limits are total recoverable)	7429905	NA		No Criteria			No Criteria
AMMONIA as N (winter/summer)	7664417		4603 | 3616.8	128890 101270	690.5 | 542.5		55238.4 | 43401.6
4BROMOPHENYL PHENYL ETHER				No Criteria			No Criteria
CHLORIDE	16887006			No Criteria			No Criteria
CHLORINE	7782505		13	455	7.5		750
4CHLORO2METHYLPHENOL				No Criteria			No Criteria
1CHLORONAPHTHALENE				No Criteria			No Criteria
4CHLOROPHENOL	106489			No Criteria			No Criteria
2,4DICHLORO6METHYLPHENOL				No Criteria			No Criteria
1,1DICHLOROPROPANE				No Criteria			No Criteria
1,3DICHLOROPROPANE	142289			No Criteria			No Criteria
2,3DINITROTOLUENE				No Criteria			No Criteria
2,4DINITRO6METHYL PHENOL				No Criteria			No Criteria
IRON	7439896			No Criteria			No Criteria
pentachlorobenzene	608935			No Criteria			No Criteria
PENTACHLOROETHANE				No Criteria			No Criteria
1,2,3,5tetrachlorobenzene				No Criteria			No Criteria
1,1,1,2TETRACHLOROETHANE	630206			No Criteria			No Criteria
2,3,4,6TETRACHLOROPHENOL	58902			No Criteria			No Criteria
2,3,5,6TETRACHLOROPHENOL				No Criteria			No Criteria
2,4,5TRICHLOROPHENOL	95954			No Criteria			No Criteria
2,4,6TRINITROPHENOL	88062			No Criteria			No Criteria
XYLENE	1330207			No Criteria			No Criteria

CALCULATION OF WATER QUALITY BASED SALTWATER DISCHARGE LIMITS

FACILITY NAME: Warren Wastewater Treatment Facility RIPDES PERMIT #: RI0100056

CHEMICAL NAME	CAS#	DAILY MAX LIMIT (ug/L)	MONTHLY AVE LIMIT (ug/L)
PRIORITY POLLUTANTS:			
TOXIC METALS AND CYANIDE			
ANTIMONY	7440360	No Criteria	51200.00
ARSENIC, TOTAL	7440382	1932.00	112.00
ASBESTOS	1332214	No Criteria	No Criteria
BERYLLIUM	7440417	No Criteria	No Criteria
CADMIUM, TOTAL	7440439	1126.76	708.25
CHROMIUM III, TOTAL	16065831	No Criteria	No Criteria
CHROMIUM VI, TOTAL	18540299	31017.12	4028.20
COPPER, TOTAL	7440508	161.93	161.93
CYANIDE	57125	28.00	28.00
LEAD, TOTAL	7439921	6182.97	681.39
MERCURY, TOTAL	7439976	59.29	12.00
NICKEL, TOTAL	7440020	2092.93	662.63
SELENIUM, TOTAL	7782492	8136.27	5691.38
SILVER, TOTAL	7440224	62.59	62.59
THALLIUM	7440280	No Criteria	37.60
ZINC, TOTAL	7440666	2663.85	2663.85
VOLATILE ORGANIC COMPOUNDS			
ACROLEIN	107028	No Criteria	23200.00
ACRYLONITRILE	107131	No Criteria	200.00
BENZENE	71432	No Criteria	40800.00
BROMOFORM	75252	No Criteria	112000.00
CARBON TETRACHLORIDE	56235	No Criteria	1280.00
CHLOROBENZENE	108907	No Criteria	128000.00
CHLORODIBROMOMETHANE	124481	No Criteria	10400.00
CHLOROFORM	67663	No Criteria	376000.00
DICHLOROBROMOMETHANE	75274	No Criteria	13600.00
1,2DICHLOROETHANE	107062	No Criteria	29600.00
1,1DICHLOROETHYLENE	75354	No Criteria	568000.00
1,2DICHLOROPROPANE	78875	No Criteria	12000.00
1,3DICHLOROPROPYLENE	542756	No Criteria	1680.00
ETHYLBENZENE	100414	No Criteria	168000.00
BROMOMETHANE (methyl bromide)	74839	No Criteria	120000.00
CHLOROMETHANE (methyl chloride)	74873	No Criteria	No Criteria
METHYLENE CHLORIDE	75092	No Criteria	472000.00
1,1,2,2TETRACHLOROETHANE	79345	No Criteria	3200.00

CHEMICAL NAME	CAS#	DAILY MAX LIMIT (ug/L)	MONTHLY AVE LIMIT (ug/L)
TETRACHLOROETHYLENE	127184	No Criteria	2640.00
TOLUENE	108883	No Criteria	1200000.00
1,2TRANSDICHLOROETHYLENE	156605	No Criteria	800000.00
1,1,1TRICHLOROETHANE	71556	No Criteria	No Criteria
1,1,2TRICHLOROETHANE	79005	No Criteria	12800.00
TRICHLOROETHYLENE	79016	No Criteria	24000.00
VINYL CHLORIDE	75014	No Criteria	192.00
ACID ORGANIC COMPOUNDS			
2CHLOROPHENOL	95578	No Criteria	12000.00
2,4DICHLOROPHENOL	120832	No Criteria	23200.00
2,4DIMETHYLPHENOL	105679	No Criteria	68000.00
4,6DINITRO2METHYL PHENOL	534521	No Criteria	22400.00
2,4DINITROPHENOL	51285	No Criteria	424000.00
4NITROPHENOL	88755	No Criteria	No Criteria
PENTACHLOROPHENOL	87865	364.00	364.00
PHENOL	108952	No Criteria	136000000.00
2,4,6TRICHLOROPHENOL	88062	No Criteria	1920.00
BASE NEUTRAL COMPUNDS			
ACENAPHTHENE	83329	No Criteria	79200.00
ANTHRACENE	120127	No Criteria	3200000.00
BENZIDINE	92875	No Criteria	0.16
PAHs		No Criteria	14.40
BIS(2CHLOROETHYL)ETHER	111444	No Criteria	424.00
BIS(2CHLOROISOPROPYL)ETHER	108601	No Criteria	5200000.00
BIS(2ETHYLHEXYL)PHTHALATE	117817	No Criteria	1760.00
BUTYL BENZYL PHTHALATE	85687	No Criteria	152000.00
2CHLORONAPHTHALENE	91587	No Criteria	128000.00
1,2DICHLOROBENZENE	95501	No Criteria	104000.00
1,3DICHLOROBENZENE	541731	No Criteria	76800.00
1,4DICHLOROBENZENE	106467	No Criteria	15200.00
3,3DICHLOROBENZIDENE	91941	No Criteria	22.40
DIETHYL PHTHALATE	84662	No Criteria	3520000.00
DIMETHYL PHTHALATE	131113	No Criteria	88000000.00
DI-n-BUTYL PHTHALATE	84742	No Criteria	360000.00
2,4DINITROTOLUENE	121142	No Criteria	2720.00
1,2DIPHENYLHYDRAZINE	122667	No Criteria	160.00
FLUORANTHENE	206440	No Criteria	11200.00

CALCULATION OF WATER QUALITY BASED SALTWATER DISCHARGE LIMITS

FACILITY NAME: Warren Wastewater Treatment Facility RIPDES PERMIT #: RI0100056

CHEMICAL NAME	CAS#	DAILY MAX LIMIT (ug/L)	MONTHLY AVE LIMIT (ug/L)
FLUORENE	86737	No Criteria	424000.00
HEXACHLOROBENZENE	118741	No Criteria	0.23
HEXACHLOROBUTADIENE	87683	No Criteria	14400.00
HEXACHLOROCYCLOPENTADIENE	77474	No Criteria	88000.00
HEXACHLOROETHANE	67721	No Criteria	2640.00
ISOPHORONE	78591	No Criteria	768000.00
NAPHTHALENE	91203	No Criteria	No Criteria
NITROBENZENE	98953	No Criteria	55200.00
N-NITROSODIMETHYLAMINE	62759	No Criteria	2400.00
N-NITROSODI-N-PROPYLAMINE	621647	No Criteria	408.00
N-NITROSODIPHENYLAMINE	86306	No Criteria	4800.00
PYRENE	129000	No Criteria	320000.00
1,2,4trichlorobenzene	120821	No Criteria	5600.00
PESTICIDES/PCBs			
ALDRIN	309002	36.40	0.04
Alpha BHC	319846	No Criteria	3.92
Beta BHC	319857	No Criteria	13.60
Gamma BHC (Lindane)	58899	4.48	4.48
CHLORDANE	57749	2.52	0.32
4,4DDT	50293	3.64	0.08
4,4DDE	72559	No Criteria	0.18
4,4DDD	72548	No Criteria	0.25
DIELDRIN	60571	19.88	0.04
ENDOSULFAN (alpha)	959988	0.95	0.70
ENDOSULFAN (beta)	33213659	0.95	0.70
ENDOSULFAN (sulfate)	1031078	No Criteria	7120.00
ENDRIN	72208	1.04	0.18
ENDRIN ALDEHYDE	7421934	No Criteria	24.00
HEPTACHLOR	76448	1.48	0.06
HEPTACHLOR EPOXIDE	1024573	1.48	0.03
POLYCHLORINATED BIPHENYLS3	1336363	No Criteria	0.05
2,3,7,8TCDD (Dioxin)	1746016	No Criteria	0.00
TOXAPHENE	8001352	5.88	0.02
TRIBUTYLTIN		11.76	0.59

CHEMICAL NAME	CAS#	DAILY MAX LIMIT (ug/L)	MONTHLY AVE LIMIT (ug/L)
NON PRIORITY POLLUTANTS: OTHER SUBSTANCES			
ALUMINUM, TOTAL	7429905	No Criteria	No Criteria
AMMONIA (as N), WINTER (NOV-APR	7664417	128889.60	55238.40
AMMONIA (as N), SUMMER (MAY-OC	7664417	101270.40	43401.60
4BROMOPHENYL PHENYL ETHER		No Criteria	No Criteria
CHLORIDE	16887006	No Criteria	No Criteria
CHLORINE	7782505	455.00	455.00
4CHLORO2METHYLPHENOL		No Criteria	No Criteria
1CHLORONAPHTHALENE		No Criteria	No Criteria
4CHLOROPHENOL	106489	No Criteria	No Criteria
2,4DICHLORO6METHYLPHENOL		No Criteria	No Criteria
1,1DICHLOROPROPANE		No Criteria	No Criteria
1,3DICHLOROPROPANE	142289	No Criteria	No Criteria
2,3DINITROTOLUENE		No Criteria	No Criteria
2,4DINITRO6METHYL PHENOL		No Criteria	No Criteria
IRON	7439896	No Criteria	No Criteria
pentachlorobenzene	608935	No Criteria	No Criteria
PENTACHLOROETHANE		No Criteria	No Criteria
1,2,3,5tetrachlorobenzene		No Criteria	No Criteria
1,1,1,2TETRACHLOROETHANE	630206	No Criteria	No Criteria
2,3,4,6TETRACHLOROPHENOL	58902	No Criteria	No Criteria
2,3,5,6TETRACHLOROPHENOL		No Criteria	No Criteria
2,4,5TRICHLOROPHENOL	95954	No Criteria	No Criteria
2,4,6TRINITROPHENOL	88062	No Criteria	No Criteria
XYLENE	1330207	No Criteria	No Criteria

ATTACHMENT B

Calculation of Historic Discharge Levels for Copper

Warren WWTF - Historic Copper Effluent Concentratio

Calculate the 95th percentile Cu Concentration:

DMR Date	Cu (ug/l) [Xi]	ln(Xi) [Yi]	(Yi-uy)^2	95th Percentile
9/30/2004	13.0	2.565	0.301	18.6
10/31/2004	20.0	2.996	0.959	18.6
11/30/2004	17.0	2.833	0.667	18.6
12/31/2004	8.6	2.152	0.018	18.6
1/31/2005	5.0	1.609	0.166	18.6
2/28/2005	5.1	1.629	0.150	18.6
3/31/2005	4.2	1.435	0.338	18.6
4/30/2005	4.5	1.504	0.262	18.6
5/31/2005	7.6	2.028	0.000	18.6
6/30/2005	6.7	1.902	0.013	18.6
7/31/2005	11.0	2.398	0.146	18.6
8/31/2005	6.4	1.856	0.026	18.6
9/30/2005	12.0	2.485	0.220	18.6
10/31/2005	7.0	1.946	0.005	18.6
11/30/2005	9.7	2.272	0.065	18.6
12/31/2005	7.0	1.946	0.005	18.6
1/31/2006	5.8	1.758	0.067	18.6
2/28/2006	5.2	1.649	0.135	18.6
3/31/2006	10.0	2.303	0.082	18.6
4/30/2006	8.8	2.175	0.025	18.6
5/31/2006	9.3	2.230	0.046	18.6
6/30/2006	3.4	1.224	0.628	18.6
7/31/2006	2.0	0.693	1.751	18.6
8/31/2006	5.8	1.758	0.067	18.6
9/30/2006	13.0	2.565	0.301	18.6
10/31/2006	5.6	1.723	0.086	18.6
11/30/2006	5.5	1.705	0.097	18.6
12/31/2006	8.6	2.152	0.018	18.6
1/31/2007	5.4	1.686	0.109	18.6
2/28/2007	6.7	1.902	0.013	18.6
3/31/2007	4.7	1.548	0.220	18.6
4/30/2007	3.9	1.361	0.429	18.6
5/31/2007	5.2	2.708	0.064	18.6
6/30/2007	7.5	2.015	0.000	18.6
7/31/2007	7.7	2.041	0.001	18.6
8/31/2007	6.4	1.856	0.026	18.6
9/30/2007	7.6	2.028	0.000	18.6
10/31/2007	7.8	2.054	0.001	18.6
11/30/2007	9.1	2.208	0.037	18.6
12/31/2007	5.2	1.649	0.135	18.6
1/31/2008	4.0	1.386	0.397	18.6
2/29/2008	5.3	1.668	0.122	18.6
3/31/2008	6.6	1.887	0.017	18.6
4/30/2008	58.8	4.074	4.235	18.6
5/31/2008	4.3	1.459	0.311	18.6
6/30/2008	5.9	1.775	0.058	18.6
7/31/2008	20.6	3.025	1.018	18.6

Warren WWTF - Historic Copper Effluent Concentratio

Calculate the 95th percentile Cu Concentration:

8/31/2008	14.7	2.688	0.451	18.6
9/30/2008	10.4	2.342	0.106	18.6
10/31/2008	2.0	0.693	1.751	18.6
11/30/2008	20.0	2.996	0.959	18.6
12/31/2008	5.0	1.609	0.166	18.6
1/31/2009	7.0	1.946	0.005	18.6
2/28/2009	15.0	2.708	0.479	18.6
3/31/2009	9.0	2.197	0.033	18.6
4/30/2009	5.0	1.609	0.166	18.6
5/31/2009	6.0	1.792	0.050	18.6
6/30/2009	10.0	2.303	0.082	18.6
7/31/2009	6.0	1.792	0.050	18.6
8/31/2009	9.0	2.197	0.033	18.6
9/30/2009	10.0	2.303	0.082	18.6

k= 61

uy= 2.016
oy= 0.551

z95 = 1.645
Upper 95th = 18.606

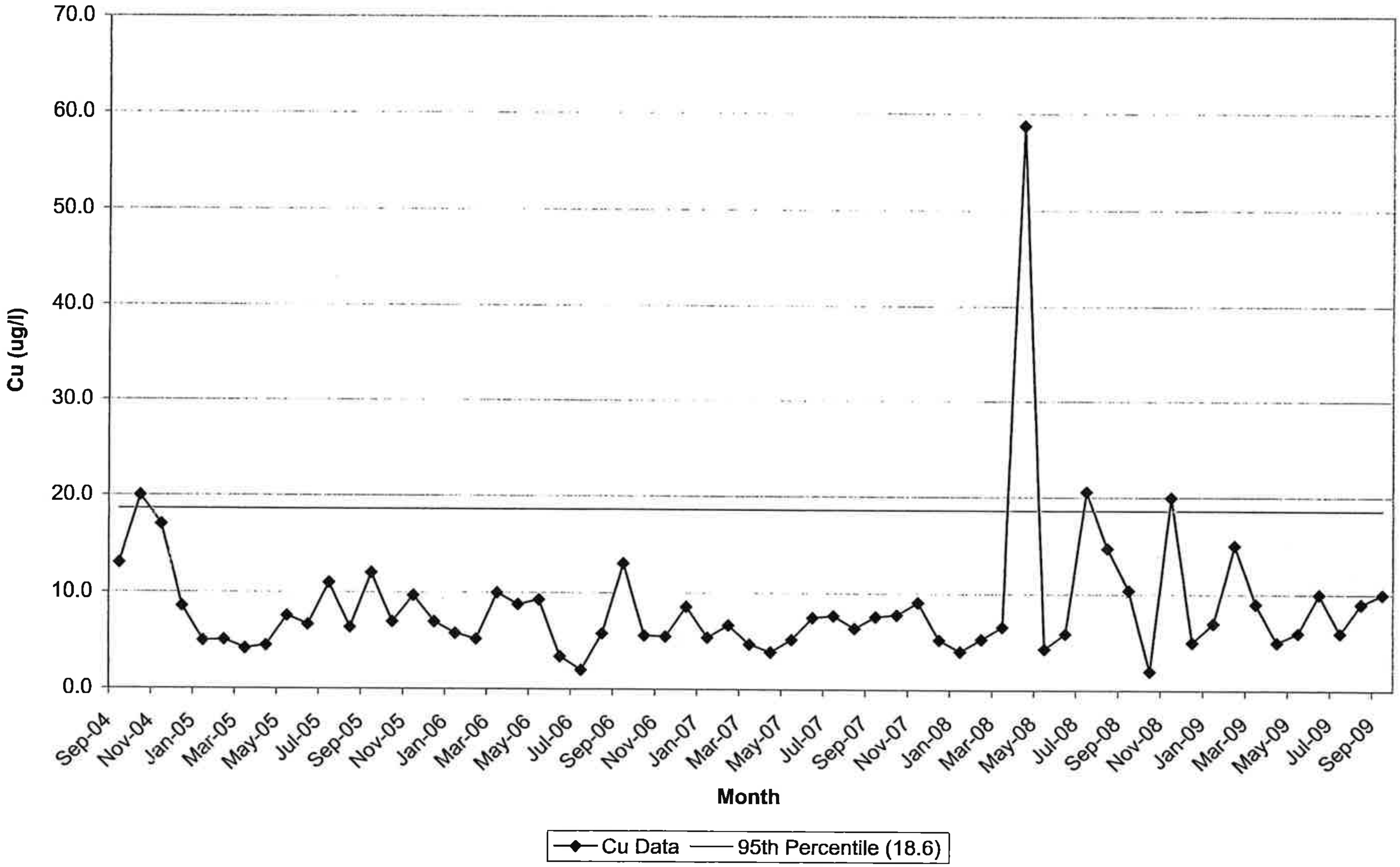
$y_i = \ln(x_i)$

$\mu y = \sum(y_i)/k$

$\sigma_y = \sqrt{\left(\sum\left[(y_i - \mu y)^2\right]/[k-1]\right)}$

$x_{99} = \exp.\left[\mu_y + (z_{99})(\sigma_y)\right]$

Warren WWTF Historic Effluent Data



ATTACHMENT C

Calculation of Allowable Chronic Discharge Limitations for Copper Based on an Analysis Considering Antidegradation and Antibacksliding

Facility : Warren WWTF
Parameter : Copper

nput required data (use N/A when data is not available):

Chronic Metals Translator	:		0.83
Previous monthly average limit (Total)	:		50 ug/L
Historical discharge concentration (Total)	:		18.6 ug/L
Waterbody background concentration (Dissolved)	:	NA	ug/L
Facility chronic dilution factor	:		100 x
Chronic criteria (Dissolved)	:		3.1 ug/L
Remaining Assimilative Capacity to be Allocated	:		0 %

Determine existing water quality:

$$Cp = \frac{(DF - 1)*Cb + 1*(Cd*MT)}{DF} = \quad 0.415 \text{ ug/L}$$

DF = Chronic Dilution Factor   Cb = Background Data (Dissolved)
Cd = Maximum of Historical Data or Previous Monthly Limit
MT = Metals Translator (Use RI Conversion Factor if Site-Specific is Unavailable)

Since the resulting instream concentration is less than the chronic criteria, the water body is attaining and pursuant to 303(d)(4)(b) backsliding is only possible if the requirements of antidegradation can be met.

Calculation of the new chronic permit limit:

Crac = Ccriteria - Cp = 2.685 ug/L

Proposed Limit = (Cp + %*Crac)*DF - (DF-1)*Cb = 41.5 ug/L Dissolved
Proposed Limit = (Proposed Dissolved Limit/MT) = 50 ug/L Total

Traditional Limit = 161.93 ug/L

The antidegradation permit limit is less than the limit which would result from using traditional procedures. Therefore, use the antidegradation permit limit.

Chronic limit = 50 ug/L

Calculation of the new acute permit limit:

Acute Limit = 161.93 ug/L

Final Limits:

MONTHLY AVERAGE PERMIT LIMIT : 50.0 ug/L
DAILY MAXIMUM PERMIT LIMIT : 161.9 ug/L

ATTACHMENT D

Summary of State User Fee Data
September 2004 to September 2009

WARREN 2004-2008

Facility Warren

ParameterName *ABHC*

Cycle	Date	Concentration
19	9/14/2006	0.07

Summary for 'ParameterName' = ABHC (1 detail record)

Sum		*0.07*
Avg		*0.07*
Min	*0.07*	
Max	*0.07*	

ParameterName *Aldrin*

Cycle	Date	Concentration
17	8/19/2004	0.05

Summary for 'ParameterName' = Aldrin (1 detail record)

Sum		*0.05*
Avg		*0.05*
Min	*0.05*	
Max	*0.05*	

ParameterName *Arsenic*

Cycle	Date	Concentration
20	9/27/2007	2
21	10/7/2008	1.1

Summary for 'ParameterName' = Arsenic (2 detail records)

Sum		*3.1*
Avg		*1.55*
Min	*1.1*	
Max	*2*	

ParameterName *Bis(2-ethylhexyl) phthalate*

Cycle	Date	Concentration
17	8/19/2004	11.2
19	9/14/2006	23.8

Summary for 'ParameterName' = Bis(2-ethylhexyl) phthalate (2 detail records)

Sum		*35*
Avg		*17.5*
Min	*11.2*	
Max	*23.8*	

ParameterName *BOD*

Cycle	Date	Concentration
17	8/19/2004	4000
18	8/16/2005	2000
19	9/14/2006	1000
20	9/27/2007	2000
21	10/7/2008	3000

Summary for 'ParameterName' = BOD (5 detail records)

Sum		*12000*
Avg		*2400*
Min	*1000*	
Max	*4000*	

ParameterName *Bromodichloromethane*

Cycle	Date	Concentration
19	9/14/2006	8
20	9/27/2007	1
21	10/7/2008	3.7

Summary for 'ParameterName' = Bromodichloromethane (3 detail records)

Sum		*12.7*
Avg		*4.23333333333333*
Min	*1*	
Max	*8*	

ParameterName *Bromoform*

Cycle	Date	Concentration
19	9/14/2006	1

Summary for 'ParameterName' = Bromoform (1 detail record)

Sum		*1*
Avg		*1*
Min	*1*	
Max	*1*	

ParameterName *Chloroform*

Cycle	Date	Concentration
17	8/19/2004	1.3
18	8/16/2005	1.6
19	9/14/2006	4.3
20	9/27/2007	1.7
21	10/7/2008	4.4

Summary for 'ParameterName' = Chloroform (5 detail records)

Sum		*13.3*
Avg		*2.66*
Min	*1.3*	
Max	*4.4*	

ParameterName *Chromium, Total*

Cycle	Date	Concentration
20	9/27/2007	1
21	10/7/2008	1.3

Summary for 'ParameterName' = Chromium, Total (2 detail records)

Sum		*2.3*
Avg		*1.15*
Min	*1*	
Max	*1.3*	

ParameterName *Copper, Total*

Cycle	Date	Concentration
19	9/14/2006	52
20	9/27/2007	17
21	10/7/2008	9.2

Summary for 'ParameterName' = Copper, Total (3 detail records)

Sum		*78.2*
Avg		*26.0666666666667*
Min	*9.2*	
Max	*52*	

ParameterName *Cyanide*

Cycle	Date	Concentration
17	8/19/2004	20

Summary for 'ParameterName' = Cyanide (1 detail record)

Sum		*20*
Avg		*20*
Min	*20*	
Max	*20*	

ParameterName *DBHC*

Cycle	Date	Concentration
19	9/14/2006	0.06

Summary for 'ParameterName' = DBHC (1 detail record)

Sum		*0.06*
Avg		*0.06*
Min	*0.06*	
Max	*0.06*	

ParameterName *Dibromochloromethane*

Cycle	Date	Concentration
19	9/14/2006	3.8
21	10/7/2008	1.2

Summary for 'ParameterName' = Dibromochloromethane (2 detail records)

Sum		*5*
Avg		*2.5*
Min	*1.2*	
Max	*3.8*	

ParameterName *Endosulfan I*

Cycle	Date	Concentration
18	8/16/2005	0.07

Summary for 'ParameterName' = Endosulfan I (1 detail record)

Sum		*0.07*
Avg		*0.07*
Min	*0.07*	
Max	*0.07*	

ParameterName *GBHC*

Cycle	Date	Concentration
17	8/19/2004	0.07

Summary for 'ParameterName' = GBHC (1 detail record)

Sum		*0.07*
Avg		*0.07*
Min	*0.07*	
Max	*0.07*	

ParameterName *Heptachlor*

Cycle	Date	Concentration
17	8/19/2004	0.2
20	9/27/2007	0.07

Summary for 'ParameterName' = Heptachlor (2 detail records)

Sum		*0.27*
Avg		*0.135*
Min	*0.07*	
Max	*0.2*	

ParameterName *Lead, Total*

Cycle	Date	Concentration
17	8/19/2004	6
18	8/16/2005	6
20	9/27/2007	3
21	10/7/2008	2.1

Summary for 'ParameterName' = Lead, Total (4 detail records)

Sum		*17.1*
Avg		*4.275*
Min	*2.1*	
Max	*6*	

ParameterName *Tetrachloroethene*

Cycle	Date	Concentration
17	8/19/2004	1.6

Summary for 'ParameterName' = Tetrachloroethene (1 detail record)

Sum		*1.6*
Avg		*1.6*
Min	*1.6*	
Max	*1.6*	

ParameterName *TSS*

Cycle	Date	Concentration
17	8/19/2004	2000

19	9/14/2006	2000
20	9/27/2007	2000
21	10/7/2008	2000

Summary for 'ParameterName' = TSS (4 detail records)

Sum		*8000*
Avg		*2000*
Min	*2000*	
Max	*2000*	

ParameterName *Zinc, Total*

Cycle	Date	Concentration
18	8/16/2005	32
19	9/14/2006	45
20	9/27/2007	56
21	10/7/2008	24.6

Summary for 'ParameterName' = Zinc, Total (4 detail records)

Sum		*157.6*
Avg		*39.4*
Min	*24.6*	
Max	*56*	

Summary for 'Facility' = Warren (46 detail records)

Sum		*20347.49*
Avg		*442.3367391304 35*
Min	*0.05*	
Max	*4000*	
Grand		*20347.49*

ATTACHMENT E

Summary of Discharge Monitoring Report Data
September 2004 to September 2009

WARREN WWTF RI0100056

001A

BOD, 5-day, 20 deg. C Monitoring Location = Effluent

	mg/L C1 MO AVG	mg/L C2 WKLY AVG	mg/L C3 DAILY MX	lb/d Q1 MO AVG	lb/d Q2 DAILY MX
9/30/2004	2.7	3.6	4.6	# 24.	96.
10/31/2004	5.1	8.3	16.7	# 65.	229.
11/30/2004	11.	14.	17.9	# 135.	209.
12/31/2004	5.6	8.	13.1	# 184.	295.
1/31/2005	2.	3.	4.2	# 49.	81.
2/28/2005	3.6	5.	6.4	# 82.	165.
3/31/2005	1.8	3.8	2.9	# 48.	130.
4/30/2005	1.4	1.7	2.2	# 45.	68.
5/31/2005	1.1	1.3	2.2	# 31.	68.
6/30/2005	1.7	2.5	3.5	# 21.	44.
7/31/2005	1.4	1.8	3.8	# 10.	25.
8/31/2005	1.	1.3	2.3	# 4.	8.
9/30/2005	1.9	2.8	4.	# 12.	26.
10/31/2005	1.4	1.6	3.5	# 31.	35.
11/30/2005	1.4	2.1	2.5	# 29.	63.
12/31/2005	1.7	2.	2.6	# 38.	69.
1/31/2006	1.2	2.2	2.5	# 33.	69.
2/28/2006	1.3	1.5	2.5	# 27.	54.
3/31/2006	1.4	1.7	2.1	# 16.	24.
4/30/2006	1.8	3.	6.8	# 18.	74.
5/31/2006	1.4	2.	2.4	# 25.	66.
6/30/2006	1.4	1.7	2.	# 33.	51.
7/31/2006	1.	1.6	1.9	# 17.	36.
8/31/2006	1.	1.	1.6	# 7.	12.
9/30/2006	1.2	1.7	3.6	# 13.	42.
10/31/2006	1.5	2.3	3.8	# 21.	54.
11/30/2006	1.9	3.	3.9	# 40.	67.
12/31/2006	1.7	2.3	2.9	# 27.	43.
1/31/2007	2.5	2.6	4.2	# 56.	104.
2/28/2007	1.8	2.2	2.5	# 25.	44.
3/31/2007	3.1	5.6	14.7	# 80.	490.
4/30/2007	1.1	1.3	1.9	# 33.	53.
5/31/2007	1.	1.3	1.8	# 17.	27.
6/30/2007	3.7	9.1	17.4	# 49.	232.
7/31/2007	1.7	2.2	3.6	# 17.	39.
8/31/2007	2.2	3.93	4.2	# 18.	38.
9/30/2007	2.4	3.	4.4	# 17.	28.
10/31/2007	1.6	2.1	2.4	# 11.	18.
11/30/2007	2.9	5.	7.2	# 33.	96.
12/31/2007	4.3	5.3	8.1	# 62.	142.
1/31/2008	3.8	4.7	6.	# 68.	104.
2/29/2008	3.4	3.9	6.5	# 73.	131.
3/31/2008	3.7	7.1	10.	# 97.	350.
4/30/2008	2.8	3.6	6.1	# 47.	97.
5/31/2008	3.	4.8	5.7	# 46.	87.
6/30/2008	2.3	4.5	8.	# 29.	107.
7/31/2008	1.8	3.7	4.9	# 19.	48.
8/31/2008	1.7	3.5	5.8	# 18.	55.
9/30/2008	2.2	4.3	6.2	# 34.	72.
10/31/2008	2.3	3.9	6.9	# 32.	100.
11/30/2008	2.4	2.5	4.1	# 35.	69.
12/31/2008	7.1	11.	15.	# 196.	574.
1/31/2009	5.	5.8	15.	# 104.	313.
2/28/2009	5.3	6.9	12.4	# 83.	148.
3/31/2009	2.	2.7	2.9	# 39.	80.
4/30/2009	2.7	2.9	4.5	# 61.	149.
5/31/2009	2.2	3.6	3.9	# 17.	80.
6/30/2009	1.9	2.8	3.4	# 29.	49.
7/31/2009	1.9	4.2	7.	# 40.	183.
8/31/2009	1.5	2.	3.4	# 21.	45.
9/30/2009	1.4	1.6	2.4	# 16.	29.
Count	61	61	61	# 61	61
Max	11.00	14.00	17.90	# 196.00	574.00
Ave	2.46	3.61	5.59	# 42.74	104.66
Min	1.00	1.00	1.60	# 4.00	8.00

Chlorine, total residual Monitoring Location = Effluent

	ug/L C1 MO AVG	ug/L C3 DAILY MX
9/30/2004	.	.2
10/31/2004	.1	.44
11/30/2004	.	.1
12/31/2004	.	.2
1/31/2005	.	.1
2/28/2005	.1	.3
3/31/2005	.1	.2
4/30/2005	.	.1
5/31/2005	.	.2
6/30/2005	.	.2
7/31/2005	.	.2
8/31/2005	.	.1
9/30/2005	.	.2
10/31/2005	.01	.05
11/30/2005	.	.2
12/31/2005	.	.2
1/31/2006	.1	.3
2/28/2006	.1	.2
3/31/2006	.	.1
4/30/2006	.	.2
5/31/2006	.	.2
6/30/2006	.	.2
7/31/2006	.1	.2
8/31/2006	.	.1
9/30/2006	.	.1
10/31/2006	.	.1
11/30/2006	.	.2
12/31/2006	.	.2
1/31/2007	.1	.2
2/28/2007	.	.3
3/31/2007	.	.4
4/30/2007	.01	.1
5/31/2007	.02	.07
6/30/2007	.01	.1
7/31/2007	.	.1
8/31/2007	.	.1
9/30/2007	.01	.1
10/31/2007	.	.1
11/30/2007	.01	.1
12/31/2007	.	.1
1/31/2008	.01	.3
2/29/2008	.1	.4
3/31/2008	.01	.2
4/30/2008	.01	.2
5/31/2008	.01	.1
6/30/2008	.	.2
7/31/2008	.04	.29
8/31/2008	.05	.17
9/30/2008	.08	.08
10/31/2008	.1	.16
11/30/2008	.04	.16
12/31/2008	.02	.08
1/31/2009	.03	.16
2/28/2009	.1	.28
3/31/2009	.06	.34
4/30/2009	.03	.09
5/31/2009	.05	.15
6/30/2009	.035	.065
7/31/2009	.03	.06
8/31/2009	.04	.17
9/30/2009	.05	.15
Count	61	61
Max	0.10	0.44
Ave	0.03	0.17
Min	0.00	0.05

Coliform, fecal general Monitoring Location = Effluent

	MPN/100mL C1 MO AVG	MPN/100mL C2 WKLY AVG	MPN/100mL C3 DAILY MX	
9/30/2004	2.7	3.	3.	
10/31/2004	3.	3.3	4.	
11/30/2004	4.	7.	23.	
12/31/2004	1.1	32.	230.	
1/31/2005	5.6	10.6	43.	
2/28/2005	4.	11.	150.	
3/31/2005	3.8	7.2	43.	
4/30/2005	3.2	3.3	4.	
5/31/2005	4.4	6.9	9.	
6/30/2005	3.1	3.3	4.	
7/31/2005	4.5	8.	43.	
8/31/2005	3.3	3.3	4.	
9/30/2005	3.	3.	3.	
10/31/2005	3.	3.	3.	
11/30/2005	4.	4.	43.	
12/31/2005	1.1	30.	43.	
1/31/2006	1.	18.	43.	
2/28/2006	3.	3.3	4.	
3/31/2006	3.	3.3	4.	
4/30/2006	4.4	5.9	23.	
5/31/2006	10.	32.	93.	
6/30/2006	3.1	3.3	4.	
7/31/2006	3.6	4.	9.	
8/31/2006	3.	3.	3.	
9/30/2006	3.1	3.3	4.	
10/31/2006	3.	3.	3.	
11/30/2006	3.2	3.6	4.	
12/31/2006	3.2	3.3	4.	
1/31/2007	3.3	4.3	9.	
2/28/2007	3.	3.	3.	
3/31/2007	1.2	27.	23.	
4/30/2007	3.6	4.3	9.	
5/31/2007	3.	3.	3.	
6/30/2007	4.	9.4	93.	
7/31/2007	3.1	3.3	4.	
8/31/2007	3.	3.	3.	
9/30/2007	4.4	22.	930.	
10/31/2007	3.	3.3	4.	
11/30/2007	3.	3.	3.	
12/31/2007	3.	3.3	4.	
1/31/2008	1.1	33.	930.	
2/29/2008	3.1	3.3	4.	
3/31/2008	3.	3.	3.	
4/30/2008	3.5	5.1	15.	
5/31/2008	4.8	11.	150.	
6/30/2008	1.	12.	230.	
7/31/2008	3.2	4.3	9.	
8/31/2008	3.	3.	3.	
9/30/2008	3.	3.3	4.	
10/31/2008	3.2	4.3	9.	
11/30/2008	3.	3.3	4.	
12/31/2008	1.	22.	93.	
1/31/2009	3.7	4.3	9.	
2/28/2009	3.5	4.3	9.	
3/31/2009	3.3	5.1	15.	
4/30/2009	4.6	7.2	43.	
5/31/2009	3.9	8.7	75.	
6/30/2009	3.4	5.1	15.	
7/31/2009	3.5	5.9	23.	
8/31/2009	3.4	4.3	9.	
9/30/2009	3.3	4.3	9.	
Count	61	61	61	0
Max	10.00	33.00	930.00	#
Ave	3.29	7.71	59.00	#
Min	1.00	3.00	3.00	#

Copper, total (as Cu) Monitoring Location = Effluent

	ug/L C1 MO AVG	ug/L C3 DAILY MX
9/30/2004	13.	13.
10/31/2004	20.	20.
11/30/2004	17.	17.
12/31/2004	8.6	8.6
1/31/2005	5.	5.
2/28/2005	5.1	5.1
3/31/2005	4.2	4.2
4/30/2005	4.5	4.5
5/31/2005	7.6	7.6
6/30/2005	6.7	6.7
7/31/2005	11.	11.
8/31/2005	6.4	6.4
9/30/2005	12.	12.
10/31/2005	7.	7.
11/30/2005	9.7	9.7
12/31/2005	7.	7.
1/31/2006	5.8	5.8
2/28/2006	5.2	5.2
3/31/2006	10.	10.
4/30/2006	8.8	8.8
5/31/2006	9.3	9.3
6/30/2006	3.4	3.4
7/31/2006	2.	2.
8/31/2006	5.8	5.8
9/30/2006	13.	13.
10/31/2006	5.6	5.6
11/30/2006	5.5	5.5
12/31/2006	8.6	8.6
1/31/2007	5.4	5.4
2/28/2007	6.7	6.7
3/31/2007	4.7	4.7
4/30/2007	3.9	3.9
5/31/2007	5.2	5.2
6/30/2007	7.5	7.5
7/31/2007	7.7	7.7
8/31/2007	6.4	6.4
9/30/2007	7.6	7.6
10/31/2007	7.8	7.8
11/30/2007	9.1	9.1
12/31/2007	5.2	5.2
1/31/2008	4.	4.
2/29/2008	5.3	5.3
3/31/2008	6.6	6.6
4/30/2008	58.8	58.8
5/31/2008	4.3	4.3
6/30/2008	5.9	5.9
7/31/2008	20.6	20.6
8/31/2008	14.7	14.7
9/30/2008	10.4	10.4
10/31/2008	2.	2.
11/30/2008	20.	20.
12/31/2008	5.	5.
1/31/2009	7.	7.
2/28/2009	15.	15.
3/31/2009	9.	9.
4/30/2009	5.	5.
5/31/2009	6.	6.
6/30/2009	10.	10.
7/31/2009	6.	6.
8/31/2009	9.	9.
9/30/2009	10.	10.
Count	61	61
Max	58.80	58.80
Ave	8.85	8.85
Min	2.00	2.00

Cyanide, total (as CN) Monitoring Location = Effluent

	ug/L C1 MO AVG	ug/L C3 DAILY MX
9/30/2004		
10/31/2004		
11/30/2004		
12/31/2004		
1/31/2005	10.	10.
2/28/2005		
3/31/2005		
4/30/2005		
5/31/2005		
6/30/2005		
7/31/2005	10.	10.
8/31/2005		
9/30/2005		
10/31/2005		
11/30/2005		
12/31/2005		
1/31/2006		
2/28/2006		
3/31/2006		
4/30/2006		
5/31/2006		
6/30/2006		
7/31/2006		
8/31/2006		
9/30/2006		
10/31/2006		
11/30/2006		
12/31/2006		
1/31/2007	10.	10.
2/28/2007		
3/31/2007		
4/30/2007		
5/31/2007		
6/30/2007		
7/31/2007	10.	10.
8/31/2007		
9/30/2007		
10/31/2007		
11/30/2007		
12/31/2007		
1/31/2008		
2/29/2008		
3/31/2008		
4/30/2008		
5/31/2008		
6/30/2008		
7/31/2008	10.	10.
8/31/2008		
9/30/2008		
10/31/2008		
11/30/2008		
12/31/2008		
1/31/2009	.01	.01
2/28/2009		
3/31/2009		
4/30/2009		
5/31/2009		
6/30/2009		
7/31/2009	.01	.01
8/31/2009		
9/30/2009		
Count	8	8
Max	10.00	10.00
Ave	6.25	6.25
Min	0.00	0.00

Flow, in conduit or thru treatment plant_Monitoring Location = Effluent

	Mgal/d Q1 30DA AVG	Mgal/d Q2 DAILY MX
9/30/2004	1.11	3.1
10/31/2004	1.56	2.1
11/30/2004	1.55	2.1
12/31/2004	2.4	3.6
1/31/2005	2.82	3.7
2/28/2005	2.64	3.6
3/31/2005	3.06	5.6
4/30/2005	3.65	8.1
5/31/2005	2.84	4.6
6/30/2005	1.4	2.1
7/31/2005	1.4	2.1
8/31/2005	.55	1.5
9/30/2005	.79	1.2
10/31/2005	2.56	7.1
11/30/2005	2.46	5.
12/31/2005	2.77	4.5
1/31/2006	3.03	3.9
2/28/2006	2.56	3.9
3/31/2006	1.4	1.8
4/30/2006	1.15	1.4
5/31/2006	2.23	3.8
6/30/2006	2.92	5.8
7/31/2006	1.76	2.8
8/31/2006	1.01	1.8
9/30/2006	1.26	1.7
10/31/2006	1.68	3.8
11/30/2006	2.68	4.7
12/31/2006	2.05	2.9
1/31/2007	2.29	3.2
2/28/2007	1.57	1.8
3/31/2007	2.77	4.91
4/30/2007	3.33	6.3
5/31/2007	2.25	2.9
6/30/2007	1.49	2.
7/31/2007	1.17	1.5
8/31/2007	.96	1.5
9/30/2007	.88	1.2
10/31/2007	.85	1.4
11/30/2007	1.22	1.6
12/31/2007	1.72	2.5
1/31/2008	1.99	2.4
2/29/2008	2.6	3.2
3/31/2008	3.17	4.7
4/30/2008	2.01	2.9
5/31/2008	1.79	2.
6/30/2008	1.55	1.7
7/31/2008	1.31	3.21
8/31/2008	1.22	1.42
9/30/2008	1.64	3.46
10/31/2008	1.72	2.01
11/30/2008	1.79	2.73
12/31/2008	3.12	5.74
1/31/2009	2.32	3.96
2/28/2009	1.96	2.85
3/31/2009	2.185	3.58
4/30/2009	2.746	3.99
5/31/2009	1.9	2.99
6/30/2009	1.79	1.93
7/31/2009	2.28	3.72
8/31/2009	1.82	2.48
9/30/2009	1.27	1.81
Count	61	61
Max	3.65	8.10
Ave	1.97	3.15
Min	0.55	1.20

Nitrogen, ammonia total (as N) Monitoring Location = Effluent

	mg/L C3 DAILY MX	mg/L C3 DAILY MX
9/30/2004	12.	
10/31/2004	2.9	
11/30/2004		2.
12/31/2004		.61
1/31/2005		1.2
2/28/2005		3.9
3/31/2005		2.5
4/30/2005		.34
5/31/2005	1.1	
6/30/2005	.23	
7/31/2005	.37	
8/31/2005	.56	
9/30/2005	1.6	
10/31/2005	.58	
11/30/2005		.23
12/31/2005		.43
1/31/2006		.32
2/28/2006		1.5
3/31/2006		.1
4/30/2006		.5
5/31/2006	.33	
6/30/2006	.37	
7/31/2006	.66	
8/31/2006	.43	
9/30/2006	2.1	
10/31/2006	1.4	
11/30/2006		.32
12/31/2006		.54
1/31/2007		.45
2/28/2007		3.
3/31/2007		2.7
4/30/2007		.94
5/31/2007	.47	
6/30/2007	.59	
7/31/2007	.41	
8/31/2007	4.	
9/30/2007	1.	
10/31/2007	.46	
11/30/2007		2.2
12/31/2007		1.8
1/31/2008		.74
2/29/2008		4.2
3/31/2008		4.1
4/30/2008		2.3
5/31/2008	5.2	
6/30/2008	.42	
7/31/2008	20.	
8/31/2008	1.5	
9/30/2008	.26	
10/31/2008	12.	
11/30/2008		1.1
12/31/2008		.7
1/31/2009		2.5
2/28/2009		2.4
3/31/2009		2.5
4/30/2009		2.6
5/31/2009	.1	
6/30/2009	.1	
7/31/2009	.1	
8/31/2009	.6	
9/30/2009	.1	
Count	31	30
Max	20.00	4.20
Ave	2.32	1.62
Min	0.10	0.10

Nitrogen, Kjeldahl, total (as N) Monitoring Location = Effluent

	mg/L C3 DAILY MX
9/30/2004	18.
10/31/2004	3.2
11/30/2004	6.2
12/31/2004	2.8
1/31/2005	3.8
2/28/2005	6.8
3/31/2005	4.8
4/30/2005	1.7
5/31/2005	2.
6/30/2005	2.3
7/31/2005	2.2
8/31/2005	1.3
9/30/2005	3.8
10/31/2005	1.6
11/30/2005	3.2
12/31/2005	1.
1/31/2006	1.3
2/28/2006	2.
3/31/2006	.5
4/30/2006	.79
5/31/2006	1.6
6/30/2006	2.4
7/31/2006	1.9
8/31/2006	1.6
9/30/2006	2.
10/31/2006	2.6
11/30/2006	2.1
12/31/2006	1.9
1/31/2007	1.5
2/28/2007	4.5
3/31/2007	3.1
4/30/2007	1.6
5/31/2007	1.5
6/30/2007	1.8
7/31/2007	4.3
8/31/2007	7.2
9/30/2007	3.3
10/31/2007	1.7
11/30/2007	4.9
12/31/2007	3.6
1/31/2008	2.6
2/29/2008	5.3
3/31/2008	4.6
4/30/2008	4.6
5/31/2008	6.3
6/30/2008	2.1
7/31/2008	25.
8/31/2008	2.3
9/30/2008	1.1
10/31/2008	11.1
11/30/2008	3.3
12/31/2008	2.2
1/31/2009	5.7
2/28/2009	5.7
3/31/2009	3.5
4/30/2009	4.2
5/31/2009	2.1
6/30/2009	1.3
7/31/2009	1.6
8/31/2009	1.9
9/30/2009	1.4
Count	61
Max	25.00
Ave	3.64
Min	0.50

Nitrogen, nitrate total (as N) Monitoring Location = Effluent

	mg/L C3 DAILY MX
9/30/2004	5.6
10/31/2004	4.8
11/30/2004	7.2
12/31/2004	6.3
1/31/2005	4.9
2/28/2005	2.5
3/31/2005	3.8
4/30/2005	5.5
5/31/2005	11.
6/30/2005	11.
7/31/2005	11.
8/31/2005	8.
9/30/2005	5.6
10/31/2005	13.
11/30/2005	13.
12/31/2005	10.
1/31/2006	7.1
2/28/2006	8.3
3/31/2006	12.
4/30/2006	12.
5/31/2006	5.6
6/30/2006	11.
7/31/2006	.01
8/31/2006	14.
9/30/2006	18.
10/31/2006	27.
11/30/2006	9.3
12/31/2006	12.
1/31/2007	7.2
2/28/2007	4.6
3/31/2007	3.7
4/30/2007	4.3
5/31/2007	10.
6/30/2007	15.
7/31/2007	16.
8/31/2007	15.
9/30/2007	17.
10/31/2007	17.
11/30/2007	15.
12/31/2007	14.
1/31/2008	2.8
2/29/2008	2.
3/31/2008	2.2
4/30/2008	1.5
5/31/2008	3.5
6/30/2008	11.
7/31/2008	20.
8/31/2008	17.
9/30/2008	16.
10/31/2008	14.5
11/30/2008	13.4
12/31/2008	16.
1/31/2009	3.3
2/28/2009	4.4
3/31/2009	10.8
4/30/2009	3.37
5/31/2009	9.38
6/30/2009	6.91
7/31/2009	4.24
8/31/2009	15.9
9/30/2009	17.3
Count	61
Max	27.00
Ave	9.73
Min	0.01

Nitrogen, nitrite total (as N) Monitoring Location = Effluent

	mg/L C3 DAILY MX
9/30/2004	.81
10/31/2004	1.4
11/30/2004	1.8
12/31/2004	.69
1/31/2005	.01
2/28/2005	.01
3/31/2005	.1
4/30/2005	1.
5/31/2005	1.
6/30/2005	.01
7/31/2005	.01
8/31/2005	.01
9/30/2005	.01
10/31/2005	.01
11/30/2005	.01
12/31/2005	.01
1/31/2006	.01
2/28/2006	.01
3/31/2006	.01
4/30/2006	.01
5/31/2006	.01
6/30/2006	.01
7/31/2006	11.
8/31/2006	.01
9/30/2006	.01
10/31/2006	.16
11/30/2006	.01
12/31/2006	.01
1/31/2007	.01
2/28/2007	.01
3/31/2007	.02
4/30/2007	.01
5/31/2007	.01
6/30/2007	.01
7/31/2007	.01
8/31/2007	.01
9/30/2007	.01
10/31/2007	.01
11/30/2007	.01
12/31/2007	.94
1/31/2008	2.2
2/29/2008	3.8
3/31/2008	.17
4/30/2008	1.8
5/31/2008	4.3
6/30/2008	4.4
7/31/2008	.01
8/31/2008	.01
9/30/2008	.01
10/31/2008	.007
11/30/2008	.01
12/31/2008	.804
1/31/2009	5.59
2/28/2009	7.2
3/31/2009	5.68
4/30/2009	4.19
5/31/2009	.007
6/30/2009	.011
7/31/2009	.007
8/31/2009	.007
9/30/2009	.007
Count	61
Max	11.00
Ave	0.97
Min	0.01

Nitrogen, total (as N) Monitoring Location = Effluent

	mg/L C3 DAILY MX	mg/L C3 DAILY MX
9/30/2004	10.51	
10/31/2004	9.4	
11/30/2004		15.2
12/31/2004		9.79
1/31/2005		8.7
2/28/2005		9.3
3/31/2005		8.7
4/30/2005		8.2
5/31/2005	13.	
6/30/2005	12.21	
7/31/2005	12.61	
8/31/2005	9.31	
9/30/2005	9.41	
10/31/2005	14.61	
11/30/2005		16.21
12/31/2005		11.01
1/31/2006		8.41
2/28/2006		10.4
3/31/2006		12.51
4/30/2006		12.8
5/31/2006	7.21	
6/30/2006	13.41	
7/31/2006	12.91	
8/31/2006	14.61	
9/30/2006	20.	
10/31/2006	29.76	
11/30/2006		11.41
12/31/2006		13.91
1/31/2007		8.71
2/28/2007		9.11
3/31/2007		6.82
4/30/2007		7.81
5/31/2007	11.21	
6/30/2007	16.81	
7/31/2007	20.31	
8/31/2007	22.21	
9/30/2007	20.31	
10/31/2007	18.71	
11/30/2007		19.91
12/31/2007		18.54
1/31/2008		7.6
2/29/2008		11.1
3/31/2008		6.97
4/30/2008		7.9
5/31/2008	10.2	
6/30/2008	12.31	
7/31/2008	26.2	
8/31/2008	19.31	
9/30/2008	17.11	
10/31/2008	25.6	
11/30/2008		16.71
12/31/2008		19.
1/31/2009		14.59
2/28/2009		17.3
3/31/2009		19.98
4/30/2009		11.76
5/31/2009	16.9	
6/30/2009	8.22	
7/31/2009	5.847	
8/31/2009	17.807	
9/30/2009	18.707	
Count	31	30
Max	29.76	19.98
Ave	15.38	12.01
Min	5.85	6.82

Oil & grease Monitoring Location = Effluent

	mg/L C3 DAILY MX
9/30/2004	3.
10/31/2004	6.7
11/30/2004	6.
12/31/2004	18.
1/31/2005	4.
2/28/2005	5.
3/31/2005	2.
4/30/2005	14.
5/31/2005	6.2
6/30/2005	
7/31/2005	.9
8/31/2005	2.3
9/30/2005	1.2
10/31/2005	1.2
11/30/2005	5.9
12/31/2005	3.8
1/31/2006	21.
2/28/2006	2.8
3/31/2006	4.5
4/30/2006	2.3
5/31/2006	5.7
6/30/2006	3.4
7/31/2006	1.5
8/31/2006	17.
9/30/2006	.5
10/31/2006	4.1
11/30/2006	3.4
12/31/2006	9.7
1/31/2007	5.
2/28/2007	1.5
3/31/2007	3.5
4/30/2007	1.1
5/31/2007	4.2
6/30/2007	1.3
7/31/2007	1.
8/31/2007	.8
9/30/2007	1.5
10/31/2007	1.2
11/30/2007	8.3
12/31/2007	1.8
1/31/2008	1.4
2/29/2008	7.
3/31/2008	1.9
4/30/2008	6.4
5/31/2008	3.3
6/30/2008	1.7
7/31/2008	2.1
8/31/2008	.8
9/30/2008	6.5
10/31/2008	2.
11/30/2008	2.
12/31/2008	2.
1/31/2009	2.
2/28/2009	2.
3/31/2009	2.
4/30/2009	2.
5/31/2009	2.
6/30/2009	2.
7/31/2009	2.
8/31/2009	2.
9/30/2009	2.
Count	60
Max	21.00
Ave	4.04
Min	0.50

pH Monitoring Location = Effluent

	SU C1 MINIMUM	SU C3 MAXIMUM
9/30/2004	6.6	7.3
10/31/2004	6.5	7.
11/30/2004	6.6	7.
12/31/2004	6.5	6.8
1/31/2005	6.5	7.1
2/28/2005	6.9	7.1
3/31/2005	6.9	7.3
4/30/2005	6.8	7.4
5/31/2005	6.7	7.
6/30/2005	6.7	6.9
7/31/2005	6.6	6.9
8/31/2005	6.6	7.
9/30/2005	6.6	6.9
10/31/2005	6.7	6.9
11/30/2005	6.7	6.9
12/31/2005	6.7	6.9
1/31/2006	6.7	6.9
2/28/2006	6.5	7.
3/31/2006	6.4	7.
4/30/2006	6.4	7.1
5/31/2006	6.1	6.9
6/30/2006	6.8	7.
7/31/2006	6.5	7.
8/31/2006	6.4	7.1
9/30/2006	6.6	7.1
10/31/2006	6.6	7.1
11/30/2006	6.7	6.9
12/31/2006	6.6	7.
1/31/2007	6.5	6.8
2/28/2007	6.7	6.9
3/31/2007	6.7	6.9
4/30/2007	6.6	6.9
5/31/2007	6.7	7.1
6/30/2007	6.2	7.1
7/31/2007	6.6	6.9
8/31/2007	6.7	7.
9/30/2007	6.5	7.
10/31/2007	6.5	6.9
11/30/2007	6.6	6.9
12/31/2007	6.7	6.9
1/31/2008	6.6	6.9
2/29/2008	6.7	7.
3/31/2008	6.7	7.
4/30/2008	6.7	6.9
5/31/2008	6.6	6.9
6/30/2008	6.5	6.9
7/31/2008	6.7	6.9
8/31/2008	6.7	7.
9/30/2008	6.7	7.
10/31/2008	6.9	7.
11/30/2008	6.8	6.9
12/31/2008	6.8	7.3
1/31/2009	6.7	7.2
2/28/2009	6.8	7.2
3/31/2009	6.7	7.
4/30/2009	6.8	7.2
5/31/2009	6.7	7.1
6/30/2009	6.7	7.
7/31/2009	6.5	7.
8/31/2009	6.7	7.
9/30/2009	6.7	6.9
Count	61	61
Max	6.90	7.40
Ave	6.63	7.00
Min	6.10	6.80

Solids, settleable Monitoring Location = Effluent

	mL/L C2 WKLY AVG	mL/L C3 DAILY MX
9/30/2004	.	.
10/31/2004	.	.
11/30/2004	.	.
12/31/2004	.	.
1/31/2005	.	.
2/28/2005	.	.
3/31/2005	.	.
4/30/2005	.	.
5/31/2005	.	.
6/30/2005	.	.
7/31/2005	.	.
8/31/2005	.	.
9/30/2005	.	.
10/31/2005	.	.
11/30/2005	.	.
12/31/2005	.	.
1/31/2006	.	.
2/28/2006	.	.
3/31/2006	.	.
4/30/2006	.	.
5/31/2006	.	.
6/30/2006	.	.
7/31/2006	.	.
8/31/2006	.	.
9/30/2006	.	.
10/31/2006	.	.
11/30/2006	.	.
12/31/2006	.	.
1/31/2007	.	.
2/28/2007	.	.
3/31/2007	.	.
4/30/2007	.	.
5/31/2007	.	.
6/30/2007	.	.
7/31/2007	.	.
8/31/2007	.	.
9/30/2007	.	.
10/31/2007	.	.
11/30/2007	.	.
12/31/2007	.	.
1/31/2008	.	.
2/29/2008	.	.
3/31/2008	.	.
4/30/2008	.	.
5/31/2008	.	.
6/30/2008	.	.
7/31/2008	.	.
8/31/2008	.	.
9/30/2008	.	.
10/31/2008	.	.
11/30/2008	.	.
12/31/2008	.	.
1/31/2009	.	.
2/28/2009	.	.
3/31/2009	.	.
4/30/2009	.	.
5/31/2009	.	.
6/30/2009	.	.
7/31/2009	.	.
8/31/2009	.	.
9/30/2009	.	.
Count	61	61
Max	0.00	0.00
Ave	0.00	0.00
Min	0.00	0.00

Solids, total suspended Monitoring Location = Effluent

	mg/L C1 MO AVG	mg/L C2 WKLY AVG	mg/L C3 DAILY MX	lb/d Q1 MO AVG	lb/d Q2 DAILY MX
9/30/2004	4.2	5.	10.	# 45.	259.
10/31/2004	8.2	13.	21.	# 105.	298.
11/30/2004	16.7	21.	31.	# 203.	392.
12/31/2004	10.6	15.	26.	# 209.	293.
1/31/2005	4.4	6.	9.	# 102.	270.
2/28/2005	8.5	9.6	14.	# 186.	315.
3/31/2005	2.3	4.3	9.	# 69.	260.
4/30/2005	2.8	3.7	5.	# 87.	153.
5/31/2005	3.	3.7	9.	# 74.	308.
6/30/2005	2.7	4.3	6.	# 32.	70.
7/31/2005	2.3	4.	4.	# 21.	61.
8/31/2005	2.9	4.3	6.	# 13.	38.
9/30/2005	4.4	6.	9.	# 28.	64.
10/31/2005	3.3	4.6	6.	# 68.	230.
11/30/2005	3.8	6.	7.	# 91.	250.
12/31/2005	2.8	4.	6.	# 62.	125.
1/31/2006	3.1	6.	10.	# 79.	147.
2/28/2006	3.1	4.6	10.	# 66.	183.
3/31/2006	4.7	5.3	28.	# 53.	304.
4/30/2006	3.6	8.6	12.	# 35.	130.
5/31/2006	2.5	2.	2.4	# 49.	175.
6/30/2006	5.2	6.6	9.	# 119.	240.
7/31/2006	5.8	7.6	11.	# 85.	135.
8/31/2006	2.4	2.6	6.	# 20.	55.
9/30/2006	3.7	6.	12.	# 41.	130.
10/31/2006	5.	6.3	9.	# 68.	117.
11/30/2006	4.1	6.6	12.	# 87.	260.
12/31/2006	4.1	5.3	9.	# 70.	150.
1/31/2007	5.6	8.3	11.	# 106.	174.
2/28/2007	2.8	4.	6.	# 38.	80.
3/31/2007	4.5	9.6	19.	# 124.	634.
4/30/2007	3.1	6.6	16.	# 114.	840.
5/31/2007	3.4	4.3	7.	# 66.	169.
6/30/2007	6.9	11.	23.	# 91.	307.
7/31/2007	6.8	16.	25.	# 68.	250.
8/31/2007	4.8	10.3	12.	# 39.	101.
9/30/2007	5.3	10.	15.	# 37.	100.
10/31/2007	3.3	4.	8.	# 23.	53.
11/30/2007	7.5	13.	18.	# 81.	173.
12/31/2007	7.9	9.6	16.	# 113.	294.
1/31/2008	7.1	9.6	16.	# 118.	280.
2/29/2008	5.1	6.6	12.	# 111.	280.
3/31/2008	7.4	17.	23.	# 209.	806.
4/30/2008	6.	8.	14.	# 105.	325.
5/31/2008	3.3	7.6	10.	# 50.	133.
6/30/2008	3.	5.	8.	# 39.	107.
7/31/2008	9.8	17.6	39.	# 106.	400.
8/31/2008	6.85	19.	27.	# 66.	263.
9/30/2008	4.2	9.6	15.	# 54.	150.
10/31/2008	7.3	16.	24.	# 104.	316.
11/30/2008	4.	6.6	8.	# 58.	126.
12/31/2008	7.9	17.	29.	# 230.	967.
1/31/2009	8.1	9.3	14.	# 165.	292.
2/28/2009	9.8	18.	25.	# 153.	383.
3/31/2009	2.6	4.	7.	# 45.	127.
4/30/2009	3.2	4.6	9.	# 82.	267.
5/31/2009	3.3	4.3	8.	# 53.	123.
6/30/2009	4.6	9.	10.	# 68.	126.
7/31/2009	3.2	6.3	8.	# 58.	131.
8/31/2009	4.9	7.	11.	# 73.	156.
9/30/2009	2.8	3.6	7.	# 30.	93.
Count	61	61	61	# 61	61
Max	16.70	21.00	39.00	# 230.00	967.00
Ave	5.03	8.10	13.25	# 82.69	236.69
Min	2.30	2.00	2.40	# 13.00	38.00

BOD, 5-day, 20 deg. C Monitoring Location = Influent

	mg/L C1 MO AVG	mg/L C2 WKLY AVG	mg/L C3 DAILY MX		lb/d Q1 MO AVG	lb/d Q2 DAILY MX
9/30/2004	190.	216.	263.	#	1687.	5636.
10/31/2004	190.	211.	248.	#	2669.	3243.
11/30/2004	187.	198.	315.	#	2443.	4203.
12/31/2004	168.	208.	251.	#	3213.	4187.
1/31/2005	144.	183.	236.	#	3324.	6725.
2/28/2005	112.	159.	219.	#	2320.	4263.
3/31/2005	109.	165.	213.	#	2552.	4854.
4/30/2005	117.	177.	180.	#	3493.	4804.
5/31/2005	146.	221.	267.	#	3200.	5122.
6/30/2005	223.	273.	326.	#	2629.	4549.
7/31/2005	265.	301.	350.	#	1882.	2402.
8/31/2005	286.	320.	360.	#	1347.	2072.
9/30/2005	234.	261.	342.	#	1447.	2202.
10/31/2005	132.	214.	221.	#	2297.	5184.
11/30/2005	176.	205.	264.	#	3907.	9383.
12/31/2005	205.	242.	272.	#	4569.	5898.
1/31/2006	224.	264.	293.	#	6274.	8550.
2/28/2006	247.	257.	294.	#	5447.	8076.
3/31/2006	273.	279.	336.	#	3228.	4594.
4/30/2006	306.	331.	362.	#	2914.	3533.
5/31/2006	242.	285.	305.	#	4161.	6770.
6/30/2006	206.	288.	330.	#	4999.	7796.
7/31/2006	224.	273.	311.	#	3232.	5524.
8/31/2006	255.	293.	344.	#	2261.	5164.
9/30/2006	240.	245.	329.	#	2583.	3596.
10/31/2006	222.	262.	342.	#	3009.	4849.
11/30/2006	174.	196.	276.	#	3817.	5645.
12/31/2006	192.	217.	285.	#	3392.	7739.
1/31/2007	157.	216.	348.	#	3240.	9287.
2/28/2007	219.	258.	344.	#	2915.	4744.
3/31/2007	209.	265.	314.	#	4734.	7333.
4/30/2007	194.	201.	374.	#	5283.	10246.
5/31/2007	244.	274.	306.	#	4640.	7304.
6/30/2007	243.	269.	338.	#	3146.	4837.
7/31/2007	257.	276.	309.	#	2587.	3608.
8/31/2007	246.	271.	342.	#	2042.	3816.
9/30/2007	289.	313.	338.	#	2147.	3273.
10/31/2007	275.	293.	354.	#	1944.	3243.
11/30/2007	300.	342.	350.	#	3119.	4630.
12/31/2007	289.	316.	360.	#	3954.	5097.
1/31/2008	245.	311.	363.	#	4127.	6358.
2/29/2008	190.	217.	239.	#	4067.	4931.
3/31/2008	132.	148.	249.	#	3394.	4899.
4/30/2008	215.	228.	278.	#	3610.	5705.
5/31/2008	192.	226.	282.	#	3489.	3998.
6/30/2008	193.	235.	279.	#	2447.	3389.
7/31/2008	193.	245.	257.	#	2117.	2851.
8/31/2008	201.	232.	254.	#	2101.	2754.
9/30/2008	230.	284.	293.	#	4934.	7969.
10/31/2008	227.	273.	303.	#	3249.	4258.
11/30/2008	215.	262.	314.	#	3186.	4582.
12/31/2008	111.	195.	233.	#	2663.	6132.
1/31/2009	123.	162.	212.	#	2381.	3355.
2/28/2009	165.	178.	245.	#	2594.	4407.
3/31/2009	131.	142.	206.	#	2314.	3281.
4/30/2009	126.	127.	182.	#	2900.	6056.
5/31/2009	214.	273.	368.	#	3576.	5588.
6/30/2009	234.	287.	296.	#	3499.	4443.
7/31/2009	200.	241.	261.	#	4015.	6221.
8/31/2009	233.	258.	341.	#	3546.	5090.
9/30/2009	186.	182.	222.	#	2036.	2627.
Count	61	61	61	#	61	61
Max	306.00	342.00	374.00	#	6274.00	10246.00
Ave	206.02	241.70	293.25	#	3185.11	5129.10
Min	109.00	127.00	180.00	#	1347.00	2072.00

Copper, total (as Cu) Monitoring Location = Influent

	ug/L C1 MO AVG	ug/L C3 DAILY MX
9/30/2004	30.	30.
10/31/2004	70.	70.
11/30/2004	57.	57.
12/31/2004	34.	34.
1/31/2005	61.	61.
2/28/2005	11.	11.
3/31/2005	16.	16.
4/30/2005	29.	29.
5/31/2005	86.	86.
6/30/2005	33.	33.
7/31/2005	150.	150.
8/31/2005	33.	33.
9/30/2005	50.	50.
10/31/2005	60.	60.
11/30/2005	50.	50.
12/31/2005	26.	26.
1/31/2006	46.	46.
2/28/2006	35.	35.
3/31/2006	34.	34.
4/30/2006	82.	82.
5/31/2006	81.	81.
6/30/2006	48.	48.
7/31/2006	6.9	6.9
8/31/2006	28.	28.
9/30/2006	44.	44.
10/31/2006	68.	68.
11/30/2006	68.	68.
12/31/2006	48.	48.
1/31/2007	77.	77.
2/28/2007	64.	64.
3/31/2007	41.	41.
4/30/2007	16.1	16.1
5/31/2007	40.2	40.2
6/30/2007	86.9	86.9
7/31/2007	69.4	69.4
8/31/2007	77.5	77.5
9/30/2007	124.	124.
10/31/2007	55.8	55.8
11/30/2007	39.1	39.1
12/31/2007	71.8	71.8
1/31/2008	47.6	47.6
2/29/2008	42.9	42.9
3/31/2008	19.8	19.8
4/30/2008	6.3	6.3
5/31/2008	48.3	48.3
6/30/2008	77.2	77.2
7/31/2008	63.4	63.4
8/31/2008	55.	55.
9/30/2008	47.9	47.9
10/31/2008	50.	50.
11/30/2008	40.	40.
12/31/2008	9.	9.
1/31/2009	39.	39.
2/28/2009	46.	46.
3/31/2009	27.	27.
4/30/2009	21.	21.
5/31/2009	25.	25.
6/30/2009	39.	39.
7/31/2009	23.	23.
8/31/2009	43.	43.
9/30/2009	51.	51.
Count	61	61
Max	150.00	150.00
Ave	48.67	48.67
Min	6.30	6.30

Cyanide, total (as CN) Monitoring Location = Influent

	ug/L C1 MO AVG	ug/L C3 DAILY MX
9/30/2004		
10/31/2004		
11/30/2004		
12/31/2004		
1/31/2005	10.	10.
2/28/2005		
3/31/2005		
4/30/2005		
5/31/2005		
6/30/2005		
7/31/2005	10.	10.
8/31/2005		
9/30/2005		
10/31/2005		
11/30/2005		
12/31/2005		
1/31/2006		
2/28/2006		
3/31/2006		
4/30/2006		
5/31/2006		
6/30/2006		
7/31/2006		
8/31/2006		
9/30/2006		
10/31/2006		
11/30/2006		
12/31/2006		
1/31/2007	10.	10.
2/28/2007		
3/31/2007		
4/30/2007	.	.
5/31/2007		
6/30/2007		
7/31/2007	10.	10.
8/31/2007		
9/30/2007		
10/31/2007		
11/30/2007		
12/31/2007		
1/31/2008		
2/29/2008		
3/31/2008		
4/30/2008		
5/31/2008		
6/30/2008		
7/31/2008	10.	10.
8/31/2008		
9/30/2008		
10/31/2008		
11/30/2008		
12/31/2008		
1/31/2009	.01	.01
2/28/2009		
3/31/2009		
4/30/2009		
5/31/2009		
6/30/2009		
7/31/2009	.01	.01
8/31/2009		
9/30/2009		
Count	8	8
Max	10.00	10.00
Ave	6.25	6.25
Min	0.00	0.00

Solids, total suspended Monitoring Location = Influent

	mg/L C1 MO AVG	mg/L C2 WKLY AVG	mg/L C3 DAILY MX	lb/d Q1 MO AVG	lb/d Q2 DAILY MX
9/30/2004	179.	188.	356.	# 1816.	9204.
10/31/2004	217.	353.	576.	# 2871.	8167.
11/30/2004	134.	188.	388.	# 1969.	5177.
12/31/2004	145.	160.	260.	# 2827.	5855.
1/31/2005	86.	95.	208.	# 2247.	6245.
2/28/2005	118.	137.	244.	# 2436.	4774.
3/31/2005	85.	123.	196.	# 1989.	4103.
4/30/2005	97.	127.	152.	# 2912.	4297.
5/31/2005	163.	295.	356.	# 3452.	5938.
6/30/2005	228.	359.	644.	# 2812.	9668.
7/31/2005	195.	229.	284.	# 1306.	2168.
8/31/2005	262.	296.	376.	# 1335.	2912.
9/30/2005	206.	238.	376.	# 1234.	1882.
10/31/2005	158.	225.	416.	# 3017.	9367.
11/30/2005	115.	132.	188.	# 2444.	5671.
12/31/2005	186.	193.	332.	# 4173.	8307.
1/31/2006	165.	207.	320.	# 4551.	7473.
2/28/2006	213.	251.	356.	# 4640.	7566.
3/31/2006	330.	419.	984.	# 3877.	13130.
4/30/2006	794.	1267.	2592.	# 2334.	25941.
5/31/2006	301.	487.	780.	# 5183.	16263.
6/30/2006	234.	423.	684.	# 4750.	13691.
7/31/2006	222.	236.	424.	# 3187.	7903.
8/31/2006	318.	416.	516.	# 2772.	7746.
9/30/2006	423.	683.	1060.	# 4474.	11496.
10/31/2006	336.	379.	540.	# 4490.	7429.
11/30/2006	198.	195.	312.	# 4310.	8327.
12/31/2006	184.	206.	280.	# 4896.	10642.
1/31/2007	168.	324.	612.	# 3228.	10719.
2/28/2007	260.	296.	484.	# 3546.	6055.
3/31/2007	262.	306.	468.	# 5976.	10929.
4/30/2007	290.	469.	836.	# 7766.	23008.
5/31/2007	280.	348.	544.	# 5344.	9674.
6/30/2007	252.	312.	364.	# 3266.	5044.
7/31/2007	494.	640.	896.	# 4949.	8967.
8/31/2007	403.	545.	1148.	# 3602.	7009.
9/30/2007	694.	837.	1264.	# 5041.	8433.
10/31/2007	724.	1099.	1364.	# 5088.	9774.
11/30/2007	632.	969.	1704.	# 6551.	21317.
12/31/2007	580.	674.	1112.	# 7866.	13771.
1/31/2008	694.	2070.	3608.	# 11621.	31525.
2/29/2008	391.	401.	1048.	# 8115.	19229.
3/31/2008	311.	398.	816.	# 7175.	16333.
4/30/2008	489.	549.	1080.	# 8253.	18915.
5/31/2008	388.	416.	800.	# 6574.	12009.
6/30/2008	288.	493.	956.	# 3624.	11162.
7/31/2008	279.	400.	696.	# 2997.	7488.
8/31/2008	257.	349.	448.	# 2659.	4371.
9/30/2008	468.	745.	1048.	# 6546.	16346.
10/31/2008	539.	697.	1428.	# 7629.	20246.
11/30/2008	510.	693.	1408.	# 7552.	20902.
12/31/2008	250.	560.	788.	# 5738.	26287.
1/31/2009	125.	169.	256.	# 2350.	4063.
2/28/2009	397.	804.	1860.	# 11267.	27612.
3/31/2009	171.	197.	256.	# 2946.	4123.
4/30/2009	235.	417.	948.	# 5083.	16128.
5/31/2009	289.	418.	588.	# 4637.	9355.
6/30/2009	448.	516.	896.	# 6768.	13450.
7/31/2009	365.	444.	968.	# 6477.	15581.
8/31/2009	270.	320.	444.	# 4172.	8850.
9/30/2009	235.	329.	460.	# 2576.	4795.
Count	61	61	61	# 61	61
Max	794.00	2070.00	3608.00	# 11621.00	31525.00
Ave	307.05	437.89	750.75	# 4512.89	11062.49
Min	85.00	95.00	152.00	# 1234.00	1882.00

BOD, 5-day, percent removal Monitoring Location = Percent Removal

	% C1 MO AV MN
9/30/2004	99.
10/31/2004	97.
11/30/2004	94.
12/31/2004	97.
1/31/2005	99.
2/28/2005	97.
3/31/2005	98.
4/30/2005	99.
5/31/2005	99.
6/30/2005	99.
7/31/2005	99.
8/31/2005	99.7
9/30/2005	99.
10/31/2005	99.
11/30/2005	99.
12/31/2005	99.
1/31/2006	99.
2/28/2006	99.
3/31/2006	99.
4/30/2006	99.
5/31/2006	99.
6/30/2006	99.
7/31/2006	99.
8/31/2006	99.
9/30/2006	99.
10/31/2006	99.
11/30/2006	99.
12/31/2006	99.
1/31/2007	98.
2/28/2007	99.
3/31/2007	99.
4/30/2007	99.
5/31/2007	99.
6/30/2007	98.
7/31/2007	99.
8/31/2007	99.
9/30/2007	99.
10/31/2007	99.
11/30/2007	99.
12/31/2007	99.
1/31/2008	98.
2/29/2008	98.
3/31/2008	97.
4/30/2008	99.
5/31/2008	98.
6/30/2008	99.
7/31/2008	99.
8/31/2008	99.
9/30/2008	99.
10/31/2008	99.
11/30/2008	99.
12/31/2008	94.
1/31/2009	96.
2/28/2009	97.
3/31/2009	98.
4/30/2009	98.
5/31/2009	99.
6/30/2009	99.
7/31/2009	99.
8/31/2009	99.
9/30/2009	99.
Count	61
Max	99.70
Ave	98.50
Min	94.00

Solids, suspended percent removal Monitoring Location = Percent Removal

	% C1 MO AV MN
9/30/2004	98.
10/31/2004	96.
11/30/2004	89.
12/31/2004	93.
1/31/2005	95.
2/28/2005	93.
3/31/2005	97.
4/30/2005	97.
5/31/2005	98.
6/30/2005	99.
7/31/2005	99.
8/31/2005	99.
9/30/2005	98.
10/31/2005	98.
11/30/2005	97.
12/31/2005	98.
1/31/2006	98.
2/28/2006	99.
3/31/2006	99.
4/30/2006	99.
5/31/2006	99.
6/30/2006	98.
7/31/2006	97.
8/31/2006	99.
9/30/2006	99.
10/31/2006	99.
11/30/2006	98.
12/31/2006	98.
1/31/2007	97.
2/28/2007	99.
3/31/2007	98.
4/30/2007	99.
5/31/2007	99.
6/30/2007	97.
7/31/2007	99.
8/31/2007	99.
9/30/2007	99.
10/31/2007	99.
11/30/2007	99.
12/31/2007	99.
1/31/2008	99.
2/29/2008	99.
3/31/2008	98.
4/30/2008	99.
5/31/2008	99.
6/30/2008	99.
7/31/2008	96.
8/31/2008	97.
9/30/2008	99.
10/31/2008	99.
11/30/2008	99.
12/31/2008	97.
1/31/2009	94.
2/28/2009	97.
3/31/2009	96.
4/30/2009	99.
5/31/2009	99.
6/30/2009	99.
7/31/2009	99.
8/31/2009	98.
9/30/2009	99.
Count	61
Max	99.00
Ave	97.85
Min	89.00

001T

LC50 Statre 48Hr Acute Mysid. Bahia Monitoring Location = Effluent

	% C1 MO AV MN
9/30/2004	
12/31/2004	
3/31/2005	
6/30/2005	
9/30/2005	100.
12/31/2005	100.
3/31/2006	100.
6/30/2006	100.
9/30/2006	100.
12/31/2006	100.
3/31/2007	100.
6/30/2007	100.
9/30/2007	100.
12/31/2007	100.
3/31/2008	100.
6/30/2008	100.
9/30/2008	100.
12/31/2008	100.
3/31/2009	100.
6/30/2009	100.
9/30/2009	100.
Count	49
Max	100.00
Ave	97.92
Min	61.00

ATTACHMENT F

Comparison of Allowable Limits with Discharge Monitoring Report Data and State User Fee Data

Facility Name: *Warren WWTF*
RIPDES Permit #: *RI0100056*
Outfall #: *001A*

NOTE: METALS LIMITS ARE TOTAL METALS

Parameter	CAS #	Concentration Limits (ug/L) Based on WQ Criteria		Antideg. Limits (ug/L)	Ave UFP Data (ug/L) 9/04 - 9/09		Ave. DMR Data (ug/L) 9/04 - 9/09		Potential Permit Limits (ug/L)	
		Daily Max	Monthly Ave	Monthly Ave	Max	Ave	Daily Max	Monthly Ave	Daily Max	Monthly Ave
PRIORITY POLLUTANTS										
TOXIC METALS AND CYANIDE										
ANTIMONY	7440360	No Criteria	51200.00	---	---	---	---	---	---	51200
ARSENIC (limits are total recoverable)	7440382	1932.00	112.00	---	2	1.55	---	---	1932	112
ASBESTOS	1332214	No Criteria	No Criteria	---	---	---	---	---	---	---
BERYLLIUM	7440417	No Criteria	No Criteria	---	---	---	---	---	---	---
CADMIUM (limits are total recoverable)	7440439	1126.76	708.25	---	---	---	---	---	1126.8	708.2
CHROMIUM III (limits are total recoverable)	16065831	No Criteria	No Criteria	---	---	---	---	---	---	---
CHROMIUM VI (limits are total recoverable)	18540299	31017.12	4028.20	---	1.3	1.15	---	---	31017.1	4028.2
COPPER (limits are total recoverable)	7440508	161.93	161.93	50	52	26.07	8.85	8.85	161.9	50
CYANIDE	57125	28.00	28.00	---	20	20	6.25	6.25	28	28
LEAD (limits are total recoverable)	7439921	6182.97	681.39	---	6	4.275	---	---	6183.0	681.4
MERCURY (limits are total recoverable)	7439976	59.29	12.00	---	---	---	---	---	59.3	12
NICKEL (limits are total recoverable)	7440020	2092.93	662.63	---	---	---	---	---	2092.9	662.6
SELENIUM (limits are total recoverable)	7782492	8136.27	5691.38	---	---	---	---	---	8136.3	5691.4
SILVER (limits are total recoverable)	7440224	62.59	62.59	---	---	---	---	---	62.6	62.6
THALLIUM	7440280	No Criteria	37.60	---	---	---	---	---	---	37.6
ZINC (limits are total recoverable)	7440666	2663.85	2663.85	---	56	39.4	---	---	2663.8	2663.8
VOLATILE ORGANIC COMPOUNDS										
ACROLEIN	107028	No Criteria	23200.00	---	---	---	---	---	---	23200
ACRYLONITRILE	107131	No Criteria	200.00	---	---	---	---	---	---	200
BENZENE	71432	No Criteria	40800.00	---	---	---	---	---	---	40800
BROMOFORM	75252	No Criteria	112000.00	---	1	1	---	---	---	112000
CARBON TETRACHLORIDE	56235	No Criteria	1280.00	---	---	---	---	---	---	1280
CHLOROBENZENE	108907	No Criteria	128000.00	---	---	---	---	---	---	128000
CHLORODIBROMOMETHANE	124481	No Criteria	10400.00	---	3.8	2.5	---	---	---	10400
CHLOROFORM	67663	No Criteria	376000.00	---	4.4	2.66	---	---	---	376000
DICHLOROBROMOMETHANE	75274	No Criteria	13600.00	---	8	4.23	---	---	---	13600
1,2DICHLOROETHANE	107062	No Criteria	29600.00	---	---	---	---	---	---	29600
1,1DICHLOROETHYLENE	75354	No Criteria	568000.00	---	---	---	---	---	---	568000
1,2DICHLOROPROPANE	78875	No Criteria	12000.00	---	---	---	---	---	---	12000
1,3DICHLOROPROPYLENE	542756	No Criteria	1680.00	---	---	---	---	---	---	1680
ETHYLBENZENE	100414	No Criteria	168000.00	---	---	---	---	---	---	168000
BROMOMETHANE (methyl bromide)	74839	No Criteria	120000.00	---	---	---	---	---	---	120000

Facility Name: *Warren WWTF*
RIPDES Permit #: *RI0100056*
Outfall #: *001A*

NOTE: METALS LIMITS ARE TOTAL METALS

Parameter	CAS #	Concentration Limits (ug/L) Based on WQ Criteria		Antideg. Limits (ug/L)	Ave UFP Data (ug/L) 9/04 - 9/09		Ave. DMR Data (ug/L) 9/04 - 9/09		Potential Permit Limits (ug/L)	
		Daily Max	Monthly Ave	Monthly Ave	Max	Ave	Daily Max	Monthly Ave	Daily Max	Monthly Ave
CHLOROMETHANE (methyl chloride)	74873	No Criteria	No Criteria	---	---	---	---	---	---	---
METHYLENE CHLORIDE	75092	No Criteria	472000.00	---	---	---	---	---	---	472000
1,1,2,2TETRACHLOROETHANE	79345	No Criteria	3200.00	---	---	---	---	---	---	3200
TETRACHLOROETHYLENE	127184	No Criteria	2640.00	---	1.6	1.6	---	---	---	2640
TOLUENE	108883	No Criteria	1200000.00	---	---	---	---	---	---	1200000
1,2TRANSDICHLOROETHYLENE	156605	No Criteria	800000.00	---	---	---	---	---	---	800000
1,1,1TRICHLOROETHANE	71556	No Criteria	No Criteria	---	---	---	---	---	---	---
1,1,2TRICHLOROETHANE	79005	No Criteria	12800.00	---	---	---	---	---	---	12800
TRICHLOROETHYLENE	79016	No Criteria	24000.00	---	---	---	---	---	---	24000
VINYL CHLORIDE	75014	No Criteria	192.00	---	---	---	---	---	---	192
ACID ORGANIC COMPOUNDS										
2CHLOROPHENOL	95578	No Criteria	12000.00	---	---	---	---	---	---	12000
2,4DICHLOROPHENOL	120832	No Criteria	23200.00	---	---	---	---	---	---	23200
2,4DIMETHYLPHENOL	105679	No Criteria	68000.00	---	---	---	---	---	---	68000
4,6DINITRO2METHYL PHENOL	534521	No Criteria	22400.00	---	---	---	---	---	---	22400
2,4DINITROPHENOL	51285	No Criteria	424000.00	---	---	---	---	---	---	424000
4NITROPHENOL	88755	No Criteria	No Criteria	---	---	---	---	---	---	---
PENTACHLOROPHENOL	87865	364.00	364.00	---	---	---	---	---	364	364
PHENOL	108952	No Criteria	136000000.00	---	---	---	---	---	---	136000000
2,4,6TRICHLOROPHENOL	88062	No Criteria	1920.00	---	---	---	---	---	---	1920
BASE NEUTRAL COMPOUNDS										
ACENAPHTHENE	83329	No Criteria	79200.00	---	---	---	---	---	---	79200
ANTHRACENE	120127	No Criteria	3200000.00	---	---	---	---	---	---	3200000
BENZIDINE	92875	No Criteria	0.16	---	---	---	---	---	---	0.16
POLYCYCLIC AROMATIC HYDROCARBONS		No Criteria	14.40	---	---	---	---	---	---	14.4
BIS(2CHLOROETHYL)ETHER	111444	No Criteria	424.00	---	---	---	---	---	---	424
BIS(2CHLOROISOPROPYL)ETHER	108601	No Criteria	5200000.00	---	---	---	---	---	---	5200000
BIS(2ETHYLHEXYL)PHTHALATE	117817	No Criteria	1760.00	---	23.8	17.5	---	---	---	1760
BUTYL BENZYL PHTHALATE	85687	No Criteria	152000.00	---	---	---	---	---	---	152000
2CHLORONAPHTHALENE	91587	No Criteria	128000.00	---	---	---	---	---	---	128000
1,2DICHLOROBENZENE	95501	No Criteria	104000.00	---	---	---	---	---	---	104000
1,3DICHLOROBENZENE	541731	No Criteria	76800.00	---	---	---	---	---	---	76800
1,4DICHLOROBENZENE	106467	No Criteria	15200.00	---	---	---	---	---	---	15200
3,3DICHLOROBENZIDENE	91941	No Criteria	22.40	---	---	---	---	---	---	22.4

Facility Name: ***Warren WWTF***

RIPDES Permit #: ***RI0100056***

Outfall #: ***001A***

NOTE: METALS LIMITS ARE TOTAL METALS

Parameter	CAS #	Concentration Limits (ug/L) Based on WQ Criteria		Antideg. Limits (ug/L)	Ave UFP Data (ug/L) 9/04 - 9/09		Ave. DMR Data (ug/L) 9/04 - 9/09		Potential Permit Limits (ug/L)	
		Daily Max	Monthly Ave	Monthly Ave	Max	Ave	Daily Max	Monthly Ave	Daily Max	Monthly Ave
DIETHYL PHTHALATE	84662	No Criteria	3520000.00	---	---	---	---	---	---	3520000
DIMETHYL PHTHALATE	131113	No Criteria	88000000.00	---	---	---	---	---	---	88000000
DInBUTYL PHTHALATE	84742	No Criteria	360000.00	---	---	---	---	---	---	360000
2,4DINITROTOLUENE	121142	No Criteria	2720.00	---	---	---	---	---	---	2720
1,2DIPHENYLHYDRAZINE	122667	No Criteria	160.00	---	---	---	---	---	---	160
FLUORANTHENE	206440	No Criteria	11200.00	---	---	---	---	---	---	11200
FLUORENE	86737	No Criteria	424000.00	---	---	---	---	---	---	424000
HEXACHLOROBENZENE	118741	No Criteria	0.23	---	---	---	---	---	---	0.232
HEXACHLOROBUTADIENE	87683	No Criteria	14400.00	---	---	---	---	---	---	14400
HEXACHLOROCYCLOPENTADIENE	77474	No Criteria	88000.00	---	---	---	---	---	---	88000
HEXACHLOROETHANE	67721	No Criteria	2640.00	---	---	---	---	---	---	2640
ISOPHORONE	78591	No Criteria	768000.00	---	---	---	---	---	---	768000
NAPHTHALENE	91203	No Criteria	No Criteria	---	---	---	---	---	---	---
NITROBENZENE	98953	No Criteria	55200.00	---	---	---	---	---	---	55200
NNITROSODIMETHYLAMINE	62759	No Criteria	2400.00	---	---	---	---	---	---	2400
NNITROSODINPROPYLAMINE	621647	No Criteria	408.00	---	---	---	---	---	---	403
NNITROSODIPHENYLAMINE	86306	No Criteria	4800.00	---	---	---	---	---	---	4800
PYRENE	129000	No Criteria	320000.00	---	---	---	---	---	---	320000
1,2,4trichlorobenzene	120821	No Criteria	5600.00	---	---	---	---	---	---	5600
PESTICIDES/PCBs										
ALDRIN	309002	36.40	0.04	---	0.05	0.05	---	---	36.4	0.04
Alpha BHC	319846	No Criteria	3.92	---	0.07	0.07	---	---	---	3.92
Beta BHC	319857	No Criteria	13.60	---	0.06	0.06	---	---	---	13.6
Gamma BHC (Lindane)	58899	4.48	4.48	---	0.07	0.07	---	---	4.48	4.48
CHLORDANE	57749	2.52	0.32	---	---	---	---	---	2.52	0.32
4,4DDT	50293	3.64	0.08	---	---	---	---	---	3.64	0.08
4,4DDE	72559	No Criteria	0.18	---	---	---	---	---	---	0.176
4,4DDD	72548	No Criteria	0.25	---	---	---	---	---	---	0.248
DIELDRIN	60571	19.88	0.04	---	---	---	---	---	19.88	0.0432
ENDOSULFAN (alpha)	959988	0.95	0.70	---	0.07	0.07	---	---	0.952	0.696
ENDOSULFAN (beta)	33213659	0.95	0.70	---	---	---	---	---	0.952	0.696
ENDOSULFAN (sulfate)	1031078	No Criteria	7120.00	---	---	---	---	---	---	7120
ENDRIN	72208	1.04	0.18	---	---	---	---	---	1.036	0.184
ENDRIN ALDEHYDE	7421934	No Criteria	24.00	---	---	---	---	---	---	24

Facility Name: *Warren WWTF*
RIPDES Permit #: *RI0100056*
Outfall #: *001A*

NOTE: METALS LIMITS ARE TOTAL METALS

Parameter	CAS #	Concentration Limits (ug/L) Based on WQ Criteria		Antideg. Limits (ug/L)	Ave UFP Data (ug/L) 9/04 - 9/09		Ave. DMR Data (ug/L) 9/04 - 9/09		Potential Permit Limits (ug/L)	
		Daily Max	Monthly Ave	Monthly Ave	Max	Ave	Daily Max	Monthly Ave	Daily Max	Monthly Ave
HEPTACHLOR	76448	1.48	0.06	---	0.2	0.135	---	---	1.484	0.0632
HEPTACHLOR EPOXIDE	1024573	1.48	0.03	---	---	---	---	---	1.484	0.0312
POLYCHLORINATED BIPHENYLS3	1336363	No Criteria	0.05	---	---	---	---	---	---	0.0512
2,3,7,8TCDD (Dioxin)	1746016	No Criteria	0.00	---	---	---	---	---	---	0.00000408
TOXAPHENE	8001352	5.88	0.02	---	---	---	---	---	5.88	0.016
TRIBUTYLTIN		11.76	0.59	---	---	---	---	---	11.76	0.592
NON PRIORITY POLLUTANTS:										
OTHER SUBSTANCES										
ALUMINUM (limits are total recoverable)	7429905	No Criteria	No Criteria	---	---	---	---	---	---	---
AMMONIA (winter)	7664417	128889.60	55238.40	---	---	---	1620	1620	128889.6	55238.4
AMMONIA (summer)		101270.40	43401.60	---	---	---	2320	2320	101270.4	43401.6
4BROMOPHENYL PHENYL ETHER	16887006	No Criteria	No Criteria	---	---	---	---	---	---	---
CHLORIDE	7782505	No Criteria	No Criteria	---	---	---	---	---	---	---
CHLORINE		455.00	455.00	---	---	---	170	30	455	455
4CHLORO2METHYLPHENOL		No Criteria	No Criteria	---	---	---	---	---	---	---
1CHLORONAPHTHALENE	106489	No Criteria	No Criteria	---	---	---	---	---	---	---
4CHLOROPHENOL		No Criteria	No Criteria	---	---	---	---	---	---	---
2,4DICHLORO6METHYLPHENOL		No Criteria	No Criteria	---	---	---	---	---	---	---
1,1DICHLOROPROPANE	142289	No Criteria	No Criteria	---	---	---	---	---	---	---
1,3DICHLOROPROPANE		No Criteria	No Criteria	---	---	---	---	---	---	---
2,3DINITROTOLUENE		No Criteria	No Criteria	---	---	---	---	---	---	---
2,4DINITRO6METHYL PHENOL	7439896	No Criteria	No Criteria	---	---	---	---	---	---	---
IRON	608935	No Criteria	No Criteria	---	---	---	---	---	---	---
pentachlorobenzene		No Criteria	No Criteria	---	---	---	---	---	---	---
PENTACHLOROETHANE		No Criteria	No Criteria	---	---	---	---	---	---	---
1,2,3,5tetrachlorobenzene	630206	No Criteria	No Criteria	---	---	---	---	---	---	---
1,1,1,2TETRACHLOROETHANE	58902	No Criteria	No Criteria	---	---	---	---	---	---	---
2,3,4,6TETRACHLOROPHENOL		No Criteria	No Criteria	---	---	---	---	---	---	---
2,3,5,6TETRACHLOROPHENOL	95954	No Criteria	No Criteria	---	---	---	---	---	---	---
2,4,5TRICHLOROPHENOL	88062	No Criteria	No Criteria	---	---	---	---	---	---	---
2,4,6TRINITROPHENOL	1330207	No Criteria	No Criteria	---	---	---	---	---	---	---
XYLENE		No Criteria	No Criteria	---	---	---	---	---	---	---

EVALUATION OF NITROGEN TARGETS AND LOAD REDUCTIONS FOR THE PALMER RIVER

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1.0 Introduction

The State of Rhode Island's 2008 *303(d) List of Impaired Waters* identified the Palmer River as being impaired by nutrients (e.g., total nitrogen) and hypoxia (2008). The purpose of this report is to evaluate instream nitrogen, oxygen and chlorophyll conditions, to estimate nitrogen loads entering the Palmer River, and to evaluate approaches for determining the nitrogen loading that will result in compliance with water quality standards and to establish limits for point source discharges.

The presence and quantity of eelgrass in a waterbody helps to describe the health of a waterbody. Dense eelgrass beds indicate a healthy ecosystem. The oxygen rich waters and protection offered by the eelgrass provide a nursery habitat for juvenile fish and other organisms. If eelgrass is in decline or totally absent from an area where eelgrass previously flourished this is most likely due to excessive nutrients and possibly other pollutants. Historically the Palmer River was entirely filled with eelgrass (Kopp, 1995; Doherty, 1995). Today the eelgrass has been replaced by *Ulva lactuca* (sea lettuce), which grows in dense beds.

In a book called "Our week afloat; or How we explored the Pequonset River" Henry Cady using his pseudonym Wallace P. Stanley described the river he grew up on in Warren, Rhode Island in 1891 from the viewpoint of two young boys out for adventure. They pass under two bridges, one for horse and carriage and the other a railroad trestle. As they enter the wider part of the Palmer the author describes an abundant growth of eelgrass in the lower Palmer River:

> "Where're you steering to? You've run us into the eel-grass!"
>
> ". … presently we were in a sort of lane of clear water, on either side of which the eelgrass dotted the surface as far as we could see. Near by, the long, slimy, yellowish-green ribbons were in sight, lying in a closely packed mass and all pointing straight down stream as smoothly as though they had been combed."

2.0 Description of the Study Area

The Palmer River lies in northeastern Rhode Island and southeastern Massachusetts. Approximately 90% of its watershed is located in Massachusetts. The upper freshwater reach of the Palmer River lies in the Town of Rehoboth. Smaller portions of the River extend into Seekonk, Attleboro, Swansea, Norton, Taunton, and Dighton.

Significant areas of the watershed drain to Shad Factory Pond and Warren Upper Reservoir, which are water supply reservoirs for the Bristol County (RI) Water Authority (BCWA). Downstream of the Shad Factory Pond Dam, the Palmer River flows along a sinuous course south into Rhode Island. Tidal influences in the Palmer River extend to the Shad Factory Dam with salinity intrusion possibly extending as far north as the Providence Street Bridge, downstream of the Dam. This reach of the Palmer River is characterized by a number of oxbows.

Shortly after the Palmer River passes seaward under the Route 6 (Fall River Avenue) Bridge, it enters the Town of Swansea and widens into a tidal embayment. The majority of the river has salt marshes along its banks and it is one of the least developed rivers in the State of Rhode Island. Belcher Cove extends to the east off the southern end of the lower Palmer River and is fed by two small streams that flow through the Town of Warren. At upper Grinnell Point, the Palmer flows through a constriction that is spanned by the East Bay Bicycle Path and Route 114 Bridge. A few hundred meters south of the Route 114 Bridge, the Palmer merges with the Barrington River at Tyler Point to form the Warren River.

Two facilities discharging to the Warren River are pertinent to the Palmer River because their effluent is carried into the Palmer River on the flood tide. The Warren Wastewater Treatment Facility (WWTF) and the Blount Seafood Corporation processing plant hold Rhode Island Pollution Discharge Elimination System (RIPDES) permits.

Table 1 summarizes relevant physical characteristics of the Palmer River as determined by Brown University (1997).

Table 1 Palmer River Physical Characteristics (Brown, 1997)

Depth	Mean High Water	1.9 m
	Mean Low Water	0.6 m
	Average	1.25 m
Surface Area		2.5×10^6 m^2
Volume		3.13×10^6 m^3
Flushing Time	Spring Tide	15.72 hrs
	Neap Tide	20.04 hrs
	Average	17.88 hrs

3.0 Water Quality Conditions in the Palmer River

RIDEM sampled the Palmer River as part of its assessment of the Palmer River. The study consisted of six cruises during March 1996 and July 1997 (RIDEM, 1999). Each survey was comprised of high and low slack tide surveys with water samples collected for fecal coliform and nutrient analyses and water column profiling for salinity, temperature, and dissolved oxygen. The study also included collecting macro-algae from identification to estimate density.

3.1 Dissolved Oxygen

During the RIDEM survey, dissolved oxygen in Belcher Cove was typically between 130 and 160 percent of saturation on most dates (measured during daylight hours, typically between 8:00 AM and 6:00 PM). Low values of 67% and 71% of saturation were observed during the low slack tide surveys in June and July 1996 (mid-morning measurements). The mean percent saturation of the lower third of the observations for the Belcher Cove station was 86%.

RIDEM also measured continuous dissolved oxygen concentrations for two weeks in June of 1998. These results showed very low dissolved oxygen levels between the hours of 4:00 PM and 10:00 AM, with most of the lowest levels occurring from midnight through 7:00 AM. The dissolved oxygen levels at these times were always below 5 mg/L and often approached 0 mg/L. The mean percent saturation of the lower third of the observations for the Belcher Cove station was 44%.

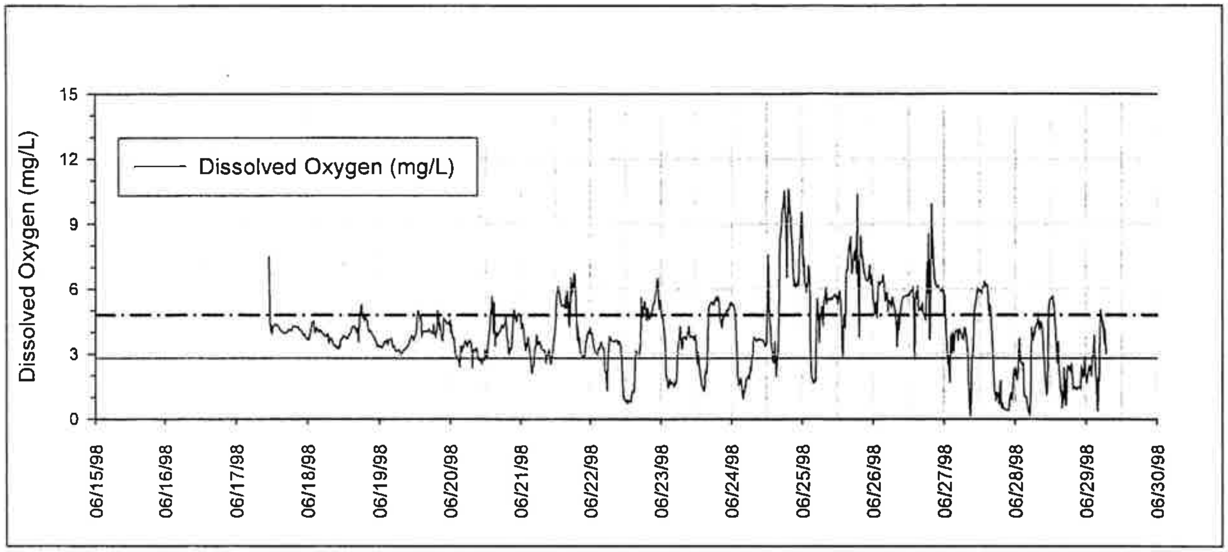

Figure 1 Belcher Cove Continuous Dissolved Oxygen Measurements (June 1998).

In September of 1994, Blount Seafood commissioned a water quality study of the Palmer River that included two days of water quality sampling during slack high and low tide for a suite of nutrients and measurements of salinity, temperature, and dissolved oxygen profiles. Measurements for this daytime study were taken at high and low tide on two successive days, between 9:00 AM and 11:00 AM in the morning and 2:00 PM and 4:00 PM in the afternoon. The study also included two sunrise surveys of dissolved oxygen levels at the three bridges in the Palmer and Barrington Rivers. Measurements were taken hourly between 5:00 AM and 8:00 AM or 9:00 AM on each sunrise survey (Rines, 1994).

The Blount study found that daytime dissolved oxygen levels throughout the area were near or above saturation values. None of the daytime values were considered to be low (all values greater than 7 mg/l). The station sampled in Belcher Cove was found to be considerably supersaturated during the daytime surveys, with oxygen levels varying between 9.50 to 15.76 mg/l. Values near the mouth of the Palmer River were generally lower and less variable, ranging between 7.48 to 9.61 mg/l. For the salinities and temperatures encountered, dissolved oxygen saturation levels would range between 7.5 to 7.7 mg/l. These values are higher than those found during the sunrise dissolved oxygen surveys. Oxygen levels at the Route 114 Bridge over the Palmer River ranged from 6.80 mg/l to 7.98 mg/l during the high tide survey. Oxygen levels at the same location ranged from 5.06 mg/l to 4.70 mg/l during the low tide survey (Rines, 1994). The Blount results confirm the RIDEM findings that oxygen levels rise in the morning hours after sunrise.

3.2 Nitrogen

Instream nitrogen concentrations measured in the Palmer River during the RIDEM survey are shown in Table 2.

Table 2 Palmer River Instream Nitrogen Concentrations

	Station ID	River Reach	Dissolved Inorganic Nitrogen (mg/L)			Total Nitrogen (mg/L)		
			High Tide	Low Tide	AVG	High Tide	Low Tide	AVG
Summer	5	Palmer River	0.061	0.039	0.050	0.540	0.431	0.485
May – October	4	Belcher Cove	0.027	0.019	0.023	0.534	0.464	0.499
Annual	5	Palmer River	0.068	0.042	0.055	0.502	0.413	0.458
	4	Belcher Cove	0.047	0.025	0.036	0.504	0.440	0.472

3.3 Eutrophication

Eutrophication in the Palmer River is evidenced by the excessive growth of green macroalgae and high chlorophyll a levels caused by nutrient enrichment. High chlorophyll a levels are an indication of a phytoplankton bloom in the water column. The excessive growth of macroalgae and phytoplankton demonstrates that the Palmer River is eutrophic, with excessive amounts of nitrogen entering the system and being assimilated by the large quantity of algae.

The most prominent macroalga growing in the Palmer River is *Ulva lactuca*. The alga begins by colonizing the scalloped edges of the river and in Belcher Cove in May and June and then moves inward toward the center of the river later in the summer. The growth of *Ulva* begins in May and peaks in early July with a mean of 48 g/m^2 and maximum of 155 g/m^2 (RIDEM, 1999). After the July peak, the growth declines to a mean low of 17g/m^2 in September and October and then increases again in November to a mean of 45 g/m^2 and a maximum of 159 g/m^2. After this point the *Ulva* dies off and does not return until the following spring.

Chlorophyll a levels were measured during the RIDEM study at two locations in the Palmer River. The measurements consisted of in-vivo measurements made with a Sea-Bird profiler combined with mid-depth (generally 0.5 to 1 m depth) water sample collections for laboratory chlorophyll-a analysis. Table 3 shows the low and high tide averages for the grab samples. The data was split into annul versus summer categories. Summer data is composed of data collected between May and October.

Table 3 Palmer River Instream Chlorophyll Concentrations

	Station	River Reach	Chlorophyll-a (μg/ l)		
			High Tide	Low Tide	AVG
Summer May – October	4	Palmer River	11.80	17.14	14.47
	5	Belcher Cove	19.48	17.51	18.50
Annual	4	Palmer River	13.72	18.21	15.97
	5	Belcher Cove	20.37	18.65	19.51

The chlorophyll data measured by the profiler was consistent with the grab samples that were taken. The tidally averaged data for each survey show a trend along the length of the Barrington, Palmer, and Warren Rivers; however the slope of the trend (i.e. increasing or decreasing chlorophyll-a level) is variable.

A chlorophyll bloom documented on May 9, 1996 demonstrated that downstream sources in the Warren River and upper Narragansett Bay could exert a significant influence on water conditions in the Palmer River. At that time chlorophyll-a levels in upper Narragansett Bay, just outside the mouth of the Warren River[1] ranged between 30 and 58 μg/l in the top 3 m of the water column. Concentrations decreased to slightly more than 30 μg/l in Belcher Cove. Chlorophyll-a concentrations dropped relatively rapidly between Belcher Cove and the central Palmer River, because upstream tributary flows were relatively high at the time. The influence of downstream conditions on May 9 was enhanced by the relatively rapid exchange between upper Narragansett Bay and the Barrington, Palmer, and Warren Rivers.

4.0 Nitrogen Sources to the Palmer River Estuary

Nitrogen loads to the Palmer River were calculated for the three major nitrogen sources, the Palmer River Watershed, the Warren WWTF, and Blount Seafood. Loads were calculated on both an annual and a summer basis. In this analysis, May through October was considered to represent the summer loading to the Palmer River.

4.1 Palmer River Watershed Nitrogen Loads

The nitrogen load from the Palmer River watershed was calculated using actual data from tributary streams and using a land use model.

Watershed Loads Calculated Using Tributary Data

Nitrogen loads for the Palmer River were calculated using RIDEM nitrogen concentration data and USGS flow data. In areas where data did not exist, sub-basin areas were used to scale nitrogen concentration, flow, or nitrogen load as needed.

The freshwater reaches of the Palmer River can be divided into two sub-basins. The first sub-basin consists of the watershed area of the upper Palmer River, which drains into Shad Factory Pond while the second sub-basin drains into Rocky Run. Rocky Run is a tributary that empties

[1] The station was located at Can Buoy 1 at the southwest corner of Rumstick Shoal.

into the tidal Palmer River shortly upstream of Interstate 195. Sub-basin watershed areas are shown in the following Table.

Table 4 Palmer River Sub-Watershed Areas.

Location	**Size (hectares)**
UPPER PALMER RIVER Drainage area upstream of the Shad Factory Pond outlet at Reed Street (RIDEM ID T3).	7979
ROCKY RUN Drainage area upstream of Davis Street (RIDEM ID T6).	3440 2235
Oak Swamp Brook Drainage area (RIDEM ID T4), including the drainage area between Rocky Run at Mason Street (RIDEM ID T5) and Rocky Run at Davis Street (RIDEM ID T6), as well as the area between Mason Street (RIDEM ID T5) and Oak Swamp Brook (RIDEM ID T4).	1205
LOWER PALMER RIVER Palmer River drainage area downstream of Shad Factory Pond (RIDEM ID T3) to confluence with Warren River, not including the Rocky Run Drainage Area (RIDEM ID T5).	2114
TOTAL PALMER RIVER	**13533**

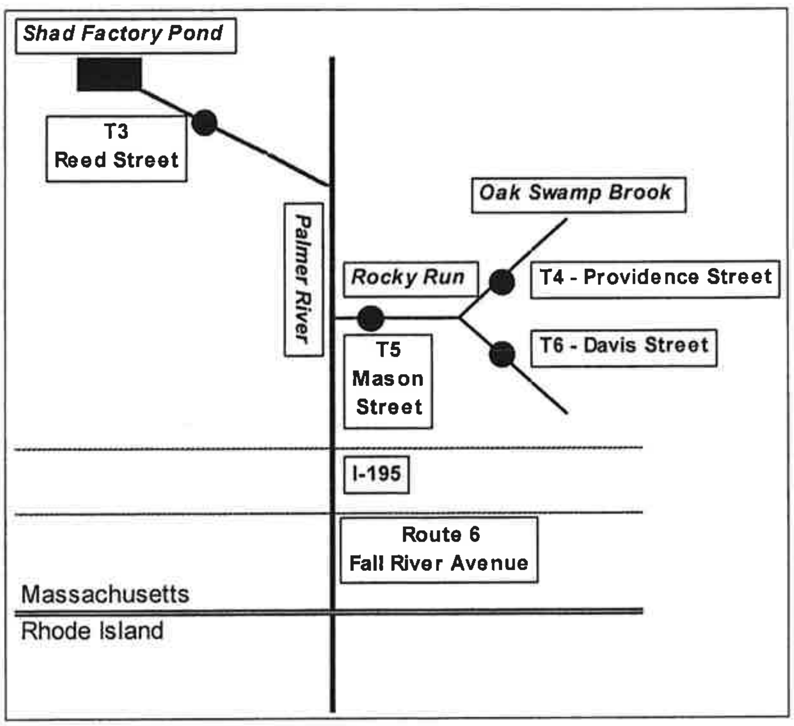

Figure 2 Schematic Diagram of the Upper Palmer River.

Although RIDEM measured discharge during its Warren River Estuary study, it was decided that it would be more appropriate to use discharge information available from the United States Geological Survey (USGS) when calculating nitrogen loads. USGS summarized data collected monthly at two Palmer River watershed-gauging stations located in the Palmer River at the Shad Factory Pond outlet and in Rocky Run at Davis Street. USGS used its data to calculate annual mean runoff for the 1987 water year from the two gauging stations and to estimate runoff for the Palmer River at the Route 6 Bridge. A regression analysis was performed by USGS and used to calculate long-term mean annual discharge values using estimated long-term monthly discharge values. The estimated long-term flow values at the Shad Factory Pond Outlet, at Davis Street, and at Route 6 are presented in Table 5 along with average discharge for the summer months between May and October (Reis, 1990).

Table 5 Palmer River USGS Discharge Data (Reis, 1990).

RIDEM ID	**Location**	**River**	**Annual Discharge m^3/sec**	**Summer Discharge May - October m^3/sec**
	Route 6 (Fall River Ave)	Palmer River	2.66	1.40
T6	Davis Street	Rocky Run	0.46	0.20
T3	Shad Factory Pond Outlet (Reed Street)	Palmer River	1.80	0.92

RIDEM collected nitrogen samples in the Palmer River at the Shad Factory Pond outlet at Reed Street and in Rocky Run upstream of its confluence with the Palmer River. The tributaries were sampled between nine and ten times in dry weather surveys. Dry weather surveys consisted of a single daily grab sample. Average summer and annual nitrogen concentrations were calculated using this data. Since only one of the dry weather surveys occurred outside of the summer months, the annual nitrogen concentrations are very similar to the summer nitrogen concentrations. Although RIDEM sampled the watershed once in wet weather, this data was not used when calculating average nitrogen concentrations because only one of the tributaries was sampled.

The Reed Street nitrogen load was calculated directly by multiplying the RIDEM nitrogen concentration data and the USGS flow data. The Rocky Run nitrogen load could not be directly calculated because the nitrogen and flow data were not collected at the same site. USGS did not measure flow at Mason Street, just upstream of Rocky Run's confluence with the Palmer River. Therefore, flow at Mason Street was estimated by multiplying the Davis Street discharge by the ratio of the Mason Street to Davis Street sub-watershed areas. This flow value was used, along with the RIDEM's nitrogen concentrations, to calculate the Rocky Run nitrogen load.

The Lower Palmer River nitrogen load was determined by multiplying the nitrogen load calculated at Reed Street in the upper Palmer River by the Reed Street and Lower Palmer River sub-watershed ratio. Although the Lower Palmer River nitrogen load includes some nitrogen input from Massachusetts between Reed Street and Fall River Avenue, it can be assumed that the Lower Palmer River nitrogen load is the watershed input for Rhode Island portion of the Palmer River watershed.

Table 6 Palmer River Watershed Summer Nitrogen Loads.

	Flow	NH_4	NO_x[1]	DIN[2]		TN	
	m^3/sec	mg / L	mg / L	mg / L	kg / day	mg / L	kg / day
Rocky Run	0.31	0.053	0.364	0.417	11.14	1.135	30.40
Shad Factory Pond Outlet	0.92	0.044	0.367	0.411	32.67	0.844	67.09
Lower Palmer River	NA	NA	NA	NA	8.66	NA	17.77

[1]NO_x is the sum of NO_2-N and NO_3-N.
[2]Dissolved Inorganic Nitrogen (DIN) load is the sum of NH_4 and NO_x.

Table 7 Palmer River Watershed Annual Nitrogen Loads.

	Flow	NH_4	NO_x[1]	DIN[2]		TN	
	m^3/sec	mg / L	mg / L	mg / L	kg / day	mg / L	kg / day
Rocky Run	0.71	0.055	0.359	0.414	25.40	1.096	67.23
Shad Factory Pond Outlet	1.8	0.045	0.383	0.429	66.72	0.859	133.59
Lower Palmer River	NA	NA	NA	NA	17.68	NA	35.39

[1]NO_x is the sum of NO_2-N and NO_3-N.
[2]Dissolved Inorganic Nitrogen (DIN) load is the sum of NH_4 and NO_x.

The total nitrogen loading to the Palmer River using this approach is 236.22 kg/day or 86,220 kg/year on an annual basis and 115.26 kg/day or 21,208 kg/summer between May and October.

Watershed Loads Calculated Using Buzzards Bay Project Land Use Loading Estimates

RIDEM also estimated total nitrogen loads from non-point sources using a method developed by the Buzzards Bay Project. The Buzzards Bay Project loading estimate assigns loading coefficients to different land use types. The estimated loading is calculated using these loading coefficients with the associated land use areas. Additionally, the watershed is divided into upper and lower watershed areas. The loading from the upper watershed is 70% of the loading from the lower watershed because it is assumed that some nutrient uptake will occur during transport to the main waterbody. In the Palmer River watershed, the upper watershed consisted of the drainage area for Shad Factory Pond. The lower watershed consisted of the drainage area for Rocky Run and the Palmer River watershed area downstream of Shad factory Pond, which has previously been referred to as the lower Palmer River.

The Residential Land Use coefficient was derived using the information in Table 8 and the following equation.

$$\text{Loading Coefficient} = \text{Housing Density} * \left(\text{Average Regional Occupancy} * \text{Individual Loading Rate} + \text{Lawn Loading Rate} + \text{Impervious Area Loading Rate} \right)$$

Table 8 Residential Land Use Loading Coefficients.

Residential Land Use Type	Housing Density units/ha	Average Regional Occupancy people/unit	Loading Rates			Loading Coefficient kg/ha/year
			Individuals kg/person	Lawns kg/unit	Impervious Area kg/unit	
R0: Residential Multi-Family	12.36	2.18	2.7	0.41	0.11	79.11
R1: Residential <¼ Acre Lots	9.27	2.18	2.7	0.82	0.11	63.13
R2: Residential ¼ to ½ Acre Lots	5.41	2.18	2.7	1.37	0.11	39.83
R3: Residential >½ Acre Lots	2.57	2.18	2.7	1.36	0.11	18.91

Table 9 contains the Buzzards Bay land use-based loading analysis for the Palmer River. The land use loading analysis estimated an annual nitrogen loading of 91,506 kg/year from the entire watershed. Some land use categories, including wetlands and salt marshes, have no loading coefficient because it is assumed that uptake of all nutrients will occur in these areas. Cropland and residential land use comprise the majority of the nitrogen loading in this watershed, with 28.5% and 23.2% of the total loading, respectively. The next highest loadings are from commercial property (14.3%) and participatory recreation (9.3%), which includes golf courses.

Table 9 Buzzards Bay Project Loading Estimates Using Land Use Data (Costa et al., 1999)

Land Use Type	Loading Coefficient kg/ha/yr	Upper Watershed Area[1] ha	Upper Watershed Loading[2] kg/yr	Lower Watershed Area[1] ha	Lower Watershed Loading kg/yr	Total Loading kg/yr	Percent Total Load %
Cropland	20	735.5	10297	790.6	15812	26109	28.5
Pasture	10	263.2	1842	107.5	1075	2917	3.2
Forest	0.167	5200.1	607	2730.3	455	1062	1.2
Non-Forested Wetland	0	152.1	0	117.5	0	0	0.0
Mining	7.3	26.0	133	12.6	92	225	0.2
Open Land	0.167	170.6	20	172.9	29	49	0.1
Participatory Recreation	29.3	194.6	3991	153.7	4503	8495	9.3
Spectator Recreation	29.3	15.6	320	18.9	554	874	1.0
R0: Residential Multi-Family	79.114	0.0	0	32.5	2571	2571	2.8
R1: Residential <¼ Acre Lots	63.126	7.1	314	31.9	2014	2327	2.5
R2: Residential ¼ to ½ Acre Lots	39.829	123.3	3438	129.6	5162	8599	9.4
R3: Residential >½ Acre Lots	18.909	873.8	11566	432.2	8172	19738	21.6
Salt Marsh	0	0.0	0	174.8	0	0	0.0
Commercial	121	32.6	2761	85.7	10370	13131	14.3
Industrial	15.8	6.3	70	72.5	1146	1215	1.3
Urban open	0.167	55.7	6	59.1	10	16	0.0
Transportation (Major Highways)	15.8	3.6	40	90.5	1430	1470	1.6
Waste Disposal	15.8	7.7	85	6.5	103	188	0.2
Water (Ponds, Other Freshwater)	0	77.3	0	43.7	0	0	0.0
Woody Perennial (Bogs, Orchards etc.)	17.6	19.6	241	9.4	165	407	0.4
Saltwater Beach	7.3	0.0	0	5.0	37	37	0.0
Urban Public	7.3	0.5	3	0.0	0	3	0.0
Transportation Facilities	15.8	0.0	0	4.6	73	73	0.1
Cemeteries	7.3	0.0	0	8.8	64	64	0.1
Nursery	20	0.0	0	5.6	112	112	0.1
Embayment	7.3	0.0	0	250.0	1825	1825	2.0
TOTAL		**7965.2**	**35733**	**5546.4**	**55773**	**91506**	

[1]The total watershed area is 26 hectares less than the total presented in Table 4.
[2]The loading includes a 30% attenuation factor.

Comparison Between Watershed Nitrogen Loading Values

Two different methods were used to calculate the Palmer River watershed nitrogen loading. When using actual tributary data, the annual nitrogen loading was found to be 86,220 kg/year. This value compares well to the annual nitrogen loading of 91,506 kg/year calculated using the Buzzards Bay Project land use loading coefficients. The difference is approximately 5000 kg/year (~14 kg/day) or 5%. The values are even closer together when one considers that the Buzzards Bay Project values include 1825 kg/year attributed to atmospheric deposition on the estuary that is not included in the other calculations. For the purposes of this evaluation, RIDEM will use the nitrogen loading value calculated using the tributary data, as it is RIDEM's position that this data more closely represent in-stream conditions.

4.2 Warren River RIPDES Sources

RIDEM requires both the Warren WWTF and Blount Seafood to monitor their effluent for the various forms of nitrogen. Plants are also required to record wastewater flow rates. This information was used to determine the nitrogen loads for the point sources.

Warren WWTF

Nitrogen loads were calculated using plant data from 2002 through 2004. This time period was chosen because, although the Warren WWTF has been monitoring the nitrogen in its effluent for many years, it was not until late 2002 that the plant was required to sample for all the nitrogen components (TKN, NH_3, NO_3, NO_2).

The summer and annual nitrogen loads were calculated using data that was collected by the plant twice per month between April and September and once per month for the remaining months of the year. The actual flow on the day that the effluent was sampled was used to calculate a load for each day.

Table 10 Warren WWTF Summer and Annual Nitrogen Loads.

	Flow	TKN		NH_3-N		NO_x-N		DIN		TN	
	MGD	mg / L	kg / day	mg / L	kg / day	mg / L	kg / day	mg / L	kg / day	mg / L	kg / day
Summer May – October	1.51	11.02	57.45	7.77	44.10	2.46	35.00	13.81	79.10	16.15	92.45
Annual	1.79	10.42	63.48	7.45	48.85	3.81	14.02	9.24	62.86	11.39	77.49

[1]NO_x-N is the sum of NO_2-N and NO_3-N.
[2]Total Nitrogen (TN) load is the sum of TKN and NO_x-N loads. Concentration is determined by dividing the TN load by the average flow.
[3]Dissolved Inorganic Nitrogen (DIN) load is the sum of NH_3-N and NO_x-N. Concentration is determined by diving the DIN load by the average flow.

Blount Seafood

Nitrogen loads were calculated for Blount Seafood using information from Outfall 002A, the mechanized clam processing discharge. Blount has an additional permitted outfall, Outfall 001A, for the discharge from a mussel storage system, but this outfall has not been active in over a decade and would not be expected to discharge significant quantities of nitrogen. Nitrogen loads were calculated using plant data from 2003 and 2004. This time period was chosen because, although Blount Seafood has been monitoring the nitrogen in its effluent for many years, it was not until 2003 that the plant was required to sample for all the nitrogen components (TKN, NH_3, NO_3, NO_2). The summer and annual nitrogen loads were calculated using data that was collected by the plant twice per month with the exception of data collected between January and May of 2003 when the plant only sampled once per month. Average monthly flow was used to calculate each load since RIDEM did not have information regarding which day the actual samples were taken.

Table 11 Blount Seafood Summer and Annual Nitrogen Loads.

	Flow	TKN		NH_3-N		NO_x-N		DIN		TN	
	MGD	mg / L	kg / day	mg / L	kg / day	mg / L	kg / day	mg / L	kg / day	mg / L	kg / day
Summer May – October	0.10	173.19	68.82	42.83	18.13	0.05	0.02	45.85	18.15	173.92	68.85
Annual	0.11	168.8	69.05	32.52	13.77	0.58	0.22	34.27	13.99	169.63	69.27

[1]NO_x-N is the sum of NO_2-N and NO_3-N.
[2]Total Nitrogen (TN) load is the sum of TKN and NO_x-N loads. Concentration is determined by diving the TN load by the average flow.
[3]Dissolved Inorganic Nitrogen (DIN) load is the sum of NH_3-N and NO_x-N. Concentration is determined by diving the DIN load by the average flow.

4.3 Total Nitrogen Load Entering the Palmer River

RIDEM and FDA conducted a dye study of the Warren, Palmer, and Barrington Rivers in 1995. Dye was released at the Warren WWTF during both an ebb and flood tide. The results of the study indicated that the travel time from the treatment facility in the Warren River to the Palmer and Barrington Rivers on the flood tide and to upper Narragansett Bay on the ebb tide is less than one hour. The study also concluded that most of the dye released on the flood tide entered the Palmer River rather than the Barrington River. Peak dye concentrations in the Palmer River were 4.3 ppb with a dilution ratio of 315:1 compared to peak dye concentrations in the Barrington River of 0.1 ppb with a dilution ratio of 12,040:1. Based on these values, it can be assumed that 98% of the effluent from the point sources enters the Palmer River on a flood tide (Pirillo and Goblick, 1995).

A 1989 dye study conducted by ASA for Blount Seafood supports the conclusion that the majority of effluent from the Warren River facilities enters the Palmer River versus the Barrington River. The data from this study shows that at least two-thirds of the dye from Blount Seafood entered the Palmer River (ASA, 1990).

Table 12 shows the total amount of nitrogen loading to the Palmer River. Nitrogen loads to Palmer River were calculated by summing the Palmer River watershed nitrogen load with the loads from the two Warren River point sources. No estimate was made concerning the impact of nitrogen in the Barrington River to the Palmer River. The table below assumes that all nitrogen from the Warren WWTF and Blount Seafood enters the Palmer River.

Table 12 Palmer River Nitrogen Loads

	Annual (January – December)				Summer (May – October)[1]			
	DIN		TN		DIN		TN	
	kg / day	kg / year	kg / day	kg / year	kg / day	kg / summer	kg / day	kg / summer
Rocky Run	25.40	9270	67.23	24540	11.14	2050	30.4	5594
Shad Factory Pond Outlet	66.72	24352	133.59	48761	32.67	6011	67.09	12345
Lower Palmer River	17.68	6452	35.39	12919	8.66	1593	17.77	3270
Palmer River Watershed	109.8	40074	236.21	86620	52.47	9654	115.26	21209
Warren WWTF	62.86	22945	77.49	28285	79.10	14555	92.45	17011
Blount Seafood	13.99	5106	69.27	25284	18.15	3340	68.85	12668
SUM	**186.65**	**68,125**	**382.97**	**140,189**	**149.72**	**27,549**	**276.56**	**50,888**

[1]Summer is considered to be 184 days between May and October.

5.0 Existing Approaches to Determine Allowable Nitrogen Loading

The relationship between nutrient loadings and water quality response of an estuary is complex for a number of reasons. These complicating factors include the size and shape of the estuary, the flushing time, the indirect nature of the connection between dissolved oxygen response and loadings, the temporal variability of dissolved oxygen, phytoplankton, and macroalgae.

The following is a brief summary of approaches that RIDEM and other organizations have used to estimate the allowable nitrogen loading to coastal ecosystems.

5.1 Shallow Ecosystem Mesocosm Experiments

Researchers have had difficulties developing a relationship between amount of nutrient input and ecosystem response for shallow coastal systems. Researchers found that in lagoon mesocosm experiments, enrichments up to 8 mmol per m^3 were reduced to undetectable levels in a matter of hours in the summer and that there was no relationship found between average inorganic nitrogen concentration and nitrogen input (Nixon et al 2001).

Other factors besides depth, water residence time, and nitrogen input predict the dominant plant type in very shallow marine systems. Researchers found there was no predictable pattern from seagrasses to macroalage to phytoplankton or from seagrasses to phytoplankton to macroalage. There is a separation between systems dominated by macroalage and seagrasses when looking at nitrogen input per unit volume, but phytoplankton-dominated systems appear across the system.

URI researchers conducted experiments to quantify the effects of different levels of nutrient enrichment on the plant communities of temperate coastal lagoons, specifically the lagoons of the northeast U.S (Taylor et al. 1999). Ten mesocosms, each containing coastal water, lagoon sediments, and plants and animals found in natural lagoons, were subjected to five levels of enrichment and plant community response was evaluated. The unpredictable range in concentration from year to year was not related to differences in inorganic nitrogen loading. Although eelgrass beds were sustained in the unenriched control mesocosms, phytoplankton chlorophyll in unenriched control mescocosms varied from summer to summer and sometimes from tank to tank. Since no strong relationship between dissolved inorganic nitrogen loading and chlorophyll a was found, the mesocosm is of limited use when evaluating nitrogen thresholds in the Palmer River.

5.2 Buzzards Bay Project (BBP)

The Buzzards Bay Program (BBP) in Massachusetts developed empirical relationships between nitrogen loadings and eutrophication response from observations made in a number of estuaries. Ecosystem responses of the sample estuaries may be sorted into groups that are observed to support certain designated uses, which are in turn related to water quality classifications.

The BBP approach uses land use information from the State GIS or from parcel information to estimate present and potential future nitrogen loads. Loading rates and calculation procedures are outlined in Costa et al (1999) and Costa et al (1994). More than 50% of the nitrogen to Buzzards Bay as a whole is discharged by point sources, principally municipal wastewater treatment facility outfalls. In most Buzzards Bay embayments, however, non-point sources of nitrogen, especially from on-site wastewater disposal systems (septic systems) and fertilizer used on lawns, golf courses, and agricultural land are the principal source of nitrogen.

The BBP approach is considered by RIDEM to offer a number of advantages for use in Rhode Island based on physical and biological similarities outlined below that make the use of loading - estuarine response relationships for Buzzards Bay appropriate in the Palmer River:

1. The BBP approach has been developed for estuaries that are physically similar to RI estuaries such as the Palmer River. The similarities include:
   - Geometry (depth and size),
   - Tidal regime,
   - Drainage area characteristics (land use and size),
   - Climatic conditions such as rainfall and seasonal temperature variations,
   - Ambient seaward water chemical and thermal conditions.

2. Plant and animal communities affecting water quality in and around Buzzards Bay, including the plankton and macroalgal species are similar to those in Rhode Island.

3. The nature of nitrogen sources to the Palmer River is similar to Buzzards Bay, with point sources responsible for roughly 50% of the estimated load. The remaining sources are predominately septic systems, and agricultural sources.

Eutrophication Index

A Eutrophication Index (EI) was developed by the Buzzards Bay Project (Costa, 1999) to assist in determining the level of nutrient enrichment a waterbody is experiencing at any given time. The EI uses water quality data including oxygen saturation levels, secchi depth, dissolved organic nitrogen, chlorophyll and total organic nitrogen, assigns them a score which is then translated into the Eutrophication Index. The EI uses a scale of 0 to 100 points where 0 equals the most eutrophic and 100 is equivalent to a pristine waterbody.

Table 13 Buzzards Bay Project Eutrophication Index endpoints.

Parameter	0 Points	100 Points
Summer Oxygen Saturation (mean of the lowest 1/3), %	40%	90%
Secchi depth, m	0.6	3.0
Dissolved inorganic nitrogen (DIN), μM	10.00	1.00
Chlorophyll-a, μg/L	10.0	3.0
Total organic nitrogen (TON), mg/l	0.60	0.28

The two sampling stations in the Palmer River were station 5, located in the central Palmer River, and station 4, in Belcher Cove. All parameters, listed above were measured at these stations (except dissolved oxygen expressed as percent saturation which was computed from dissolved oxygen concentration and temperature measurements). Samples were taken during the spring and summer of 1996 and 1997 (March – September). The mean secchi depth for the Warren River stations was used for the Palmer River. This was done because the Palmer River is very shallow and the secchi disc was still visible at the bottom depth, therefore its depth was not representative of the water clarity. The dissolved oxygen component was calculated from the results of a two-week YSI sonde continuous deployment in late June1998 in Belcher Cove.

The EI was calculated for the stations in the Palmer River (Table 14) and the results indicate that the Palmer River is eutrophic with an EI score of 32. Eutrophication Index Scores of 65 to 100 are considered "good to excellent" water quality, 35 to 65 are considered "fair to good" water quality, and less than 35 are considered typical of eutrophic conditions. The Buzzards Bay Project estimated that an appropriate Eutrophication Index value for Outstanding Natural Resource Waters (ONRW) is 65, for SA waters is 50, and for SB waters is 40. Rhode Island designates waters as Special Resource Protection Waters, whose designated uses are essentially equivalent to those of ONRWs. Since the Palmer River is designated as a Special Resource Protection Water, it should have an EI goal of 65 or better.

Table 14 Palmer River Eutrophication Index Calculation (Costa et al., 1999).

Parameter	Palmer River		Belcher Cove	
	Value	EI Score	Value	EI Score
Summer O_2 Saturation, %	44%	11.8	44%	11.8
Secchi Depth, m	1.45 m	54.8	1.45 m	54.8
DIN, μM	3.95 μM	40.3	2.56 μM	59.2
Chlorophyll a, μg/l	16 μg/l	0	19.51 μg/l	0
TON, mg/l	0.402 mg/l	52.5	0.436 mg/l	41.9
	Average	32	**Average**	34

Allowable Loading

The relationship between the nitrogen loading rate and Eutrophication Index (EI) for Buzzards Bay estuaries is presented in Figure 3 using data provided by the Buzzards Bay Project. As the figure shows, the BBP quantified environmental response (EI) as a function of the loading rate per unit estuary volume per Vollenweider flushing term. Nitrogen Loading rates for ONRW, SA, and SB waters were taken from the corresponding Eutrophication Indices for 65, 50, and 45, respectively.

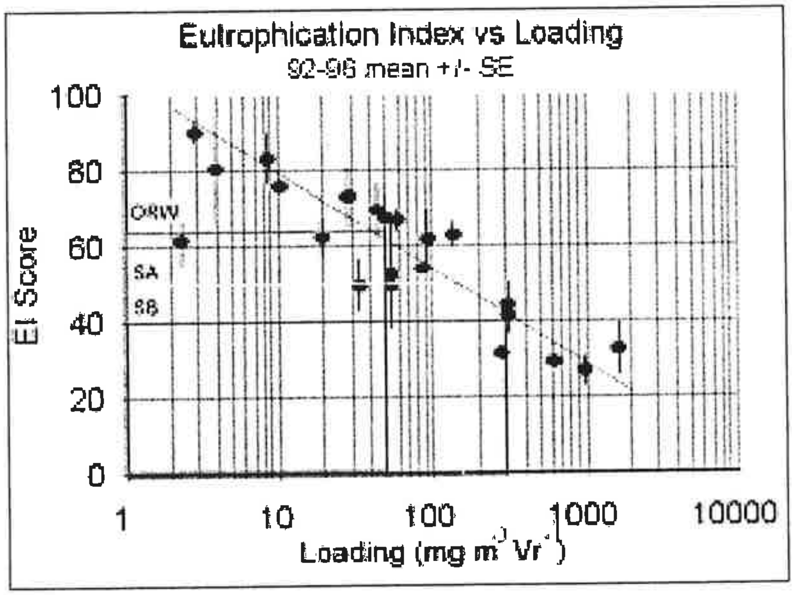

Figure 3 Eutrophication Index Versus Loading Graph (Buzzards Bay Project).

The BBP set EI goal of 65 for ONRW waters, respectively. The corresponding loading rate for an ONRW, assuming a shallow estuary having a mean depth less than 2 m, is 50 mg m^{-3} per Vollenweider residence time (Vr). To translate this loading rate into an annual load, the calculation below developed by the Buzzards Bay Project was used. This calculation was designed to determine the annual load (in kg/year) for specific water bodies using a specific loading rate. It is presented in spreadsheet format at the following website: http://www.buzzardsbay.org/nitrmang/embnlim.xls

The calculation for annual load is:

$$\text{Annual Load (in kg yr}^{-1}\text{)} = \frac{\text{Loading rate x volume at half tide (in m}^3\text{) x } (1+\tau_w^{1/2})}{\tau_w \div 1{,}000{,}000}$$

Where τ_w is the hydraulic turnover time in years and the Vollenweider flushing term is $\tau_w/(1+\tau_w^{1/2})$.

For the Palmer River, with a flushing time of 17.88 hours, a mean volume of 3.13 x 10^6 m^3, and a loading rate of 50 mg m^{-3} Vr^{-1}, the corresponding assimilative capacity of the Palmer River is 80,011 kg/yr.

5.3 Instream Concentration

The MA Estuaries Project is attempting to develop site-specific nitrogen thresholds that can be used as a management tool to identify corrective and protective measures to protect water quality in 89 embayments in southeastern Massachusetts. The intent of the project is to link measured nitrogen concentrations to the more diagnostic biological and chemical indicators of habitat quality. Analysis of preliminary data collected in several Falmouth estuaries suggest that quantitative nitrogen criteria can be developed. The total nitrogen target levels are loosely based on the previous Buzzards Bay Program results, but also include site-specific consideration of nitrogen concentrations and indicators of embayment health (dissolved oxygen, photoplankton densities, water clarity, sediment type and carbon concentrations, macroalgae, eelgrass and benthic communities).

Two significant results of the MA work are that mean chlorophyll levels of 10 ug/l and TN values of 0.39 mg/l appear to represent the threshold between suitable and impaired waters (Howes et. al.). Table 15 summarizes threshold TN concentrations and the resulting observations of embayment health.

Table 15 MA Guidelines for Total Nitrogen and Environmental Health (Howes et. al.).

Condition	Threshold Nitrogen Concentrations (mg/l)	Observations
Excellent	< 0.30	
Good	0.30-0.39	Eelgrass beds present, benthic animal diversity and shellfish productivity high, oxygen depletions to <4 mg/L are rare, chlorophyll 3-5 µg/l.
Moderate Quality	0.39-0.50	Above this TN range, loss of diverse animal communities and replacement by smaller, shorter-lived animals of intermediate burrowing capabilities, and shellfisheries may shift to more resistant species. Oxygen levels do not generally fall below 4 or 5 mg/l, phytoplankton blooms raise chlorophyll-a levels to around 10 µg/l. Macro-algae may be present.
Significant Impairment	0.50-0.70	Large phytoplankton blooms, chlorophyll a of approximately 20 µg/l. Stressful oxygen conditions, major phytoplankton blooms, complete loss of eelgrass, periodic fish kills, macro-algal accumulations and aesthetic (odor) problems are observed. Stress tolerant species persist.
Severe Degradation	>0.70	Complete or near complete loss of oxygen periodically in bottom waters. Macro-algal accumulations and fish kills are observed periodically. Drift algae, lift-off mats and near complete loss of benthic animal communities occurs during a portion of the summer.

Palmer River data and observations are consistent with an estuary that exhibits significant impairment/moderate quality.

5.4 Summary

The following table summarizes the allowable instream concentration and/or loads that the previously described BBP and Instream Concentration approaches would find to be protective. RIDEM chose to use the BBP allowable loading to set nitrogen reduction targets because of the direct comparison between existing nitrogen loads and allowable nitrogen loads. The annual allowable total nitrogen load for the Palmer River is 80,011 kg/year.

Table 16 Summary of Allowable Nitrogen Loads and Concentrations.

Approach	Description	Allowable
Buzzards Bay	RIDEM Load	80,011 kg/year
Instream Concentration	Total Nitrogen	0.39 mg/L
	Chlorophyll	10 µg/L

6.0 Required Reductions and Conclusion

As discussed in the previous section, RIDEM chose the Buzzards Bay approach to set allowable total nitrogen limits for the Palmer River. The allowable nitrogen limits were allocated among the three nitrogen sources to the Palmer River, the two RIPDES point sources and the Palmer River watershed.

6.1 Point Source Existing Load Adjustments

The existing summer, winter, and annual nitrogen loads from the two RIPDES point sources were recalculated using a dataset that was extended to January 2007. These recalculated values were used in setting the nitrogen reductions.

The monthly total nitrogen load for the Warren WWTF data was calculated for each month using the average flow and maximum total nitrogen concentration reported from the discharge monitoring report (DMR) for each month. All data reported from December 2002 to January 2007 was used, with the exception of one outlying data point for June 2003. Blount Seafood's monthly total nitrogen load was calculated using the average flow and average total nitrogen concentration reported on DMRs. (Blount is required to report both monthly average and maximum daily total nitrogen, whereas the Warren WWTF is only required to report maximum daily total nitrogen.) All data reported for Blount from June 2003 to January 2007 was used with the exception of two outlying data points from June 2003 and February 2004. RIDEM used these monthly values to calculate the existing summer, winter, and annual total nitrogen loads. To do this, RIDEM calculated the 95th percentile values of all data for the months of May through October and used this as the existing summer load[2]. The 95th percentile values of the November through April data were used as the existing winter load. The existing annual load was the 95th percentile value for all the data (January through December). When setting the existing nitrogen loads for the point sources, the log normal 95th percentile values were used to be consistent with the RIPDES program's procedures to use 95th percentile values for calculating historical discharge concentrations when determining interim limits. The current point source nitrogen loads are shown in Table 17.

[2] In the previous sections, the existing nitrogen loads from both the point sources and the watershed were calculated by averaging the concentration and discharge data.

Table 17 Point Source Existing Total Nitrogen Loads.

	Summer		Winter		Annual	
	kg/day	kg/Summer	kg/day	kg/Winter	kg/day	kg/year
Warren WWTF	175.3	32,255	135.8	24,580	162.2	59,203
Blount	156.8	28,851	124.6	16,109	124.6	45,479

6.2 Required Reductions and Conclusion

The following reduction scenario meets the allowable annual total nitrogen load of 80,011 kg/year from all nitrogen sources. The reduction scenario also meets an allowable summer total nitrogen load of 34,500 kg/summer that was calculated using the existing total nitrogen load from all sources. RIDEM determined that 43.1% of the current annual load is discharged during the summer months; therefore, the allowable summer load was calculated by multiplying the allowable annual load by 43.1%.

The reductions needed to meet the allowable summer load were calculated first. Summer discharge for the Warren WWTF was set to 90% of design flow while Blount Seafood was set at design flow. The 90% value was chosen based on RIDEM work in the Providence and Seekonk Rivers. When evaluating nitrogen targets and wastewater treatment facility load reductions for the Providence and Seekonk Rivers, RIDEM determined that the average May through October 1995-1996 flows were 90% of the January through December 1995-1996 flows from the impacted municipal wastewater treatment facilities (RIDEM, 2004).

In order to meet the annual and summer allowable nitrogen loads, the chosen scenario sets the Warren WWTF allowable summer total nitrogen concentration at 5 mg/L, an 80% reduction in summer load. Blount Seafood was also allocated an 80% summer reduction in load, which is equivalent to a total nitrogen concentration of 40.4 mg/L at design flow. These reductions were sufficient to meet the allowable summer loading to the Palmer River. No watershed reductions would be needed to meet the summer allowable loading. However, summer point source reductions were not sufficient to meet the allowable annual total nitrogen load of 80,011 kg/year. Meeting the allowable annual load also requires an annual watershed reduction and a winter point source load reduction. The point sources were allocated a 20% winter reduction in load, while the watershed was allocated an annual 59% reduction. The winter point source reductions are equivalent to total nitrogen concentrations of 14.3 mg/L for the Warren WWTF and 93.9 mg/L for Blount Seafood at their corresponding design flows. When the winter point source reductions were combined with the summer point source reductions, the Warren WWTF and Blount were assigned a 56% and 59% reduction, respectively. Table 18 details this reduction scenario.

Table 18 Reduction Scenario Needed to Meet Allowable Loads

Summer RIPDES: Warren 5 mg/l, Blount equivalent % reduction in load
Winter RIPDES: 20% Reduction
Annual Watershed: 59% Reduction

	Existing Winter Load (kg/yr)	Required Winter Load (kg/yr)	Percent Winter Reduction	Existing Summer Load (kg/yr)	Required Summer Load[1] (kg/yr)	Percent Summer Reduction	Existing Annual Load (kg/yr)	Required Annual Load (kg/yr)	Percent Annual Reduction
Warren WWTF[2]	24,580	19,664	20.0%	32,255	6,309	80.4%	59,203	25,973	56.1%
Blount[2]	16,109	12,887	20.0%	28,851	5,636	80.4%	45,479	18,523	59.3%
Total NPDES	**40,689**	**32,551**	**20.0%**	**61,106**	**11,945**	**80.4%**	**104,682**	**44,496**	**57.5%**
Watershed	**65,411**	**26,819**	**59.0%**	**21,209**	**8,695**	**59.0%**	**86,620**	**35,514**	**59.0%**
TOTAL		**59,370**			**20,640**			**80,010**	

[1] Summer Loads are based on 184 days between May and October

[2] Point source loads are based on the log normal 95 percentile values of actual DMR data for the following months: winter (November – April), summer (May – October), and annual (January – December).

Based on the above analysis, the Warren WWTF is being assigned a summer monthly average total nitrogen limit of 5.0 mg/l during the months of May through October and a winter monthly average total nitrogen limit of 14.3 mg/l during the months of November through April. Similarly, Blount Seafood is being assigned an equivalent percent reduction in its total nitrogen discharges, which equates to a summer monthly average total nitrogen limit of 40.4 mg/l during the months of May through October and a winter monthly average total nitrogen limit of 93.9 mg/l during the months of November through April. These limits, when combined with the watershed reductions, will meet the annual and summer total nitrogen load targets.

REFERENCES

Brown University. 1997. Oceangraphy of the Palmer/Warren River Estuary System. GE111 Fall 1997, Estuarine Oceanography, Providence, RI.

Costa, J. E., D. Janik, N. MacGaffey, and D. Martin. 1994. *Use of a Geographic Information System to Estimate Nitrogen Loading to Coastal Watersheds*. Buzzards Bay Project Technical Report. Draft, March 2, 1994, 21p.

Costa, J. E., B. L. Howes, D. Janik, D. Aubrey, E. Gunn, A. E. Giblin. 1999. *Managing anthropogenic nitrogen inputs to coastal embayments: Technical basis and evaluation of a management strategy adopted for Buzzards Bay.* Buzzards Bay Project Technical Report. 56 pages. Draft final, September 24, 1999.

Doherty, Amy. 1995. Historical Distributions of Eelgrass (Zostera marina) in Narragansett Bay, Rhode Island, 1850-1995. Senior Thesis. Brown University.

Howes, Ramsey, and Kelley. Nitrogen Modeling to Support Watershed Management: Comparison of Approaches and Sensitivity Analysis. Project No. 00-06/104 Prepared for the Massachusetts Department of Environmental Protection and the US Environmental Protection Agency. Accessed March 23, 2007 http://www.oceanscience.net/estuaries/pdf/nitrpt.pdf].

Kopp, B. S. , A. M. Doherty, and S. W. Nixon. 1995. *A Guide to Site-Selection for Eelgrass Restoration Projects in Narragansett Bay.* Report for RI Aqua Fund Program, Narragansett, RI.

Nixon, S. B. Buckley, S. Granger, and J. Bintz. 2001. *Responses of Very Shallow Marine Ecosystems to Nutrient Enrichment*. Human and ecological Risk Assessment. V.7 No.5, pp. 1457-1481.

Governor's Narragansett Bay and Watershed Planning Commission, Nutrient and Bacteria Pollution Panel, 2004. *Nutrient and Bacteria Pollution Panel Initial Report*, March 3, 2004. [http://www.ci.uri.edu/GovComm/Documents/Phase1Rpt/Docs/Nutrient-Bacteria.pdf].

Pirillo, P. and G. Goblick. 1995. *Hydrography of Warren, RI Wastewater Effluent*. Food and Drug Administration, NE Technical Services Unit and Rhode Island Department of Environmental Management, Division of Water Resources, Providence, RI.

RIDEM. 1999. *Characterization Studies to Support TMDL Development for the Barrington, Palmer and Warren River Watershed.* Providence, RI: Rhode Island Department of Environmental Management, Office of Water Resources.

RIDEM. 2004. *Evaluation of Nitrogen Targets and WWTF Load Reductions for the Providence and Seekonk Rivers.* Providence, RI: Rhode Island Department of Environmental Management, Office of Water Resources.

RIDEM. 2008. *State of Rhode Island 2008 303(d) List: List of Impaired Waters, Final April 1, 2008,* Rhode Island Department of Environmental Management, Office of Water Resources, Providence, RI.

Ries, K. G. 1990. *Estimating Surface-Water runoff to Narragansett Bay, Rhode Island and Massachusetts.* U. S. Geological Survey, Water-Resoures Investigations Report 89-4164. Providence, RI: U. S. Department of the Interior.

Rines, H. and S. Feng. 1990. *Blount Seafood Dye Study.* Applied Science Associates Project No. 88-63. Narragansett, RI.

Rines, Henry M. 1994. *Data Report for a Dissolved Oxygen Study of the Warren River Area, Narragansett Bay, for Blount Seafood.* Applied Science Associates Project No. 94-79. Narragansett, RI.

Stanley, Wallace P. (pseudonym for Henry Cady) 1891. *Our Week Afloat; or How we explored the Pequonset River.* Belford-Clarke Co. Chicago.

Taylor, D.I., Nixon, S.W., Granger, S.L., and Buckley, B.A. 1999. *Responses of Coastal Lagoon Plant Communities to Levels of Nutrient Enrichment: A Mesocosm Study.* Estuaries. 22(4): 1041-1056.