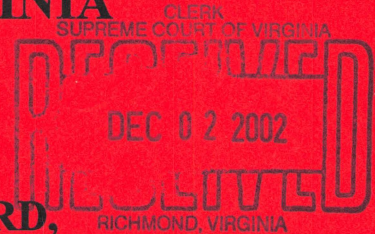


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IN THE

SUPREME COURT OF VIRGINIA

RECORD NO. 021507



**STATE WATER CONTROL BOARD,
DEPARTMENT OF ENVIRONMENTAL QUALITY
AND COUNTY OF HANOVER, VIRGINIA,**

Appellants,

v.

**FRANCES BROADDUS CRUTCHFIELD
AND HENRY RUFFIN BROADDUS,**

Appellees.

**JOINT APPENDIX
VOLUME III of III**

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 - B. July 20, 1998, letter from W.S. Shaw, Engineering Field Director, Office of Water Programs, (DOH) to J.R. Bell, Regulatory Services Supervisory (DEQ) regarding Hanover County Totopotomoy STW VPDES Draft Permit (2nd and 3rd revised drafts)

- C. July 31, 1998, letter from Bernard J. Grace, Environmental Engineer (EPA, Region III) to M. Dale Phillips, Technical Services Administrator (DEQ) regarding reissuance of draft VPDES Permit VA0089915 Totopotomoy WWTP,
- D. November 6, 1998, letter from Robert C. Singleton III, Environmental Engineer (EPA, Region III) to M. Dale Phillips (DEQ) regarding reissuance of draft VPDES Permit VA0089915 for Totopotomoy WWTP, Hanover County, VA
- E. January 6, 1999, Memorandum from Katherine Barrett (Richmond Regional Planning District Commission) to Allan Brockenbrough, II (DEQ) regarding "Environmental Review and Comment of the Totopotomoy WWTP, Proposed VPDES Permit Issuance Public Notice (VA0089915)
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- H. March 11, 1999, letter from Karen L. Mayne, U.S. Department of the Interior, Fish and Wildlife Service, to Mr. Allan Brockenbrough (DEQ) containing comments regarding freshwater mussel survey report dated January 12, 1999
- I. March 29, 1999, letter from Robert C. Singleton III (EPA, Region III), to M. Dale Phillips (DEQ) regarding issuance of the draft VPDES Permit VA0089915
- J. April 27, 1999, letter from J.R. Bell, Jr. to Karen L. Mayne (U.S. Fish and Wildlife Service)
- K. May 11, 1999, letter from Karen Mayne (U.S. Fish and Wildlife Service) to Steven P. Herzog (Hanover County) regarding U.S. Fish and Wildlife Service recommendations for an additional survey for the dwarf wedge mussel
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- M. August 30, 1999, letter from Ronald L. Taylor (Hazen and Sawyer) to Karen Mayne (U.S. Fish and Wildlife Service) enclosing the additional mussel survey for the Pamunkey River in the vicinity of the proposed discharge for the Totopotomoy WWTP
- N. September 8, 1999, letter from Karen Mayne (U.S. Fish and Wildlife Service) to Ronald Taylor (Hazen and Sawyer) regarding their review of additional mussel survey (dated August 19, 1999)

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- A. March 11, 1999, Minute No. 11, State Water Control Board Meeting, regarding the "Proposed Issuance of Permit No. VA0089915, Totopotomoy WWTP, Hanover County"**
- B. March 11, 1999, Transcript of State Water Control Board Meeting, "Discussion - Totopotomoy WWTP, Hanover County"**

MEMORANDUM

DEPARTMENT OF ENVIRONMENTAL QUALITY Piedmont Regional Office

4949-A Cox Road, Glen Allen, VA 23060

804/527-5020

SUBJECT: Issuance of VPDES Permit No. VA0089915
Totopotomoy WWTP - Hanover County

TO: James R. Golden
Regional Permit Manager

FROM: Allan Brockenbrough, II via J. R. Bell, Jr.
Environmental Engineer Senior Water Permits Manager

DATE: April 28, 1999

COPIES: DEQ-DWPC, EPA Region III, VDH-ECEEFO

04-459

Legal Name of Owner: County of Hanover

Application Submitted By: Richard R. Johnson
County Administrator

Application Date: The initial application and permit fee were received on May 11, 1997. Supplemental information was received on June 25, 1997, July 31, 1997, April 20, 1998, May 6, 1998 and October 13, 1998. The application was considered complete on October 13, 1998.

Type of Discharge: Proposed municipal sewage discharge.

Wastewater Treatment Facilities: The proposed treatment facility consists of screening, grit removal, an activated sludge treatment plant (biological nutrient removal mode), effluent filtration, UV disinfection and post aeration. Sludge will be aerobically digested, dewatered and either land applied or sent to a landfill for disposal.

Receiving Stream:

Stream:	Pamunkey River
Basin:	York River
Subbasin:	N/A
Section:	1
Class:	II
Special Standards:	a

Public Notice: The application and draft permit have received public notice in accordance with the VPDES Regulation and responses to the public notice indicated that the discharge is controversial. A public hearing

on the proposed permit issuance was held in Hanover Courthouse on January 19, 1999. Issues raised during the public hearing and the public comment period included 1.) impact on dissolved oxygen levels

CONCURRENCES							
SYMBOL	D	PRO	PRO	PRO			
SURNAME	D	ABII	KW	JCS			
DATE	D	4/28/99	4/29/99	4.28.99			



COMMONWEALTH of VIRGINIA
DEPARTMENT OF ENVIRONMENTAL QUALITY

James S. Gilmore, III
Governor

John Paul Woodley, Jr.
Secretary of Natural Resources

PIEDMONT REGIONAL OFFICE

4949-A Cox Road
Glen Allen, Virginia 23060
(804) 527-5020
Fax (804) 527-5106
<http://www.deq.state.va.us>

April 28, 1999

Dennis H. Treacy
Director

Gerard Seeley, Jr.
Piedmont Regional Director

Mr. Frank W. Harksen, Jr., Director
Department of Public Utilities
County of Hanover
P. O. Box 470
Hanover, VA 23069

CERTIFIED MAIL
RETURN RECEIPT REQUESTED

Re: Issuance of VPDES Permit No. VA0089915
Totopotomoy WWTP - Hanover County

Dear Mr. Harksen:

The Deputy Director has approved the enclosed effluent limitations and monitoring requirements for the above referenced permit. This approval is in accordance with the enclosed memorandum.

Your permit is also enclosed. In accordance with the permit, you are required to submit Discharge Monitoring Reports (DMRs) to:

Department of Environmental Quality
Piedmont Regional Water Office
4949-A Cox Road
Glen Allen, VA 23060

001-480

The reporting form is included with the permit. You will be responsible for obtaining additional copies of the DMR. The first DMR for the month in which the discharge commences is due by the 10th day of the following month.

As provided by Rule 2A:2 of the Supreme Court of Virginia, you have thirty days from the date of service (the date you actually received this decision or the date it was mailed to you, which ever occurred first) within which to appeal this decision by filing a notice of appeal in accordance with the Rules of the Supreme Court of Virginia with the Director, Virginia Department of Environmental Quality. In the event that this decision is served on you by mail, three days are added to that period.

Alternatively, any owner under Section 62.1-44.16, 62.1-44.17 and 62.1-44.19 of the State Water Control Law aggrieved by any action of the State Water Control Board taken without a formal hearing, or by inaction of the Board, may demand in writing a formal hearing of such owner's grievance, provided a petition requesting such hearing is filed with the Board. Said petition must meet the requirements set forth in Section 1.23(b) of the Board's Procedural Rule No. 1. In cases involving actions of the Board, such petition must be filed within thirty days after notice of such action is mailed to such owner by certified mail.

Mr. Frank W. Harksen, Jr.
April 28, 1999
Page 2

A Reliability Class I is assigned to this facility and this facility has a class I licensed operator requirement.

If you have any questions, please call Mr. Allan Brockenbrough at 527-5027.

Sincerely,


James J. Golden
Regional Permit Manager

AB/
Enclosures: Memorandum
Permit No. VA0089915

cc: DEQ-DWPC
VDH-ECEEFO
EPA, Region III (3WP12)

0- 461

MEMORANDUM

DEPARTMENT OF ENVIRONMENTAL QUALITY *Piedmont Regional Office*

4949-A Cox Road, Glen Allen, VA 23060

804/327-5020

SUBJECT: Issuance of VPDES Permit No. VA0089915
Totopotomoy WWTP - Hanover County

TO: James J. Golden
Regional Permit Manager

FROM: Allan Brockenbrough, II *ABT* via J. R. Bell, Jr. *JRB*
Environmental Engineer Senior Water Permits Manager

DATE: April 28, 1999

COPIES: DEQ-DWPC, EPA Region III, VDH-ECEEFO

0. 462

Legal Name of Owner: County of Hanover

Application Submitted By: Richard R. Johnson
County Administrator

Application Date: The initial application and permit fee were received on May 11, 1997. Supplemental information was received on June 25, 1997, July 31, 1997, April 20, 1998, May 6, 1998 and October 13, 1998. The application was considered complete on October 13, 1998.

Type of Discharge: Proposed municipal sewage discharge.

Wastewater Treatment Facilities: The proposed treatment facility consists of screening, grit removal, an activated sludge treatment plant (biological nutrient removal mode), effluent filtration, UV disinfection and post aeration. Sludge will be aerobically digested, dewatered and either land applied or sent to a landfill for disposal.

Receiving Stream:

Stream:	Pamunkey River
Basin:	York River
Subbasin:	N/A
Section:	1
Class:	II
Special Standards:	a

Public Notice: The application and draft permit have received public notice in accordance with the VPDES Regulation and responses to the public notice indicated that the discharge is controversial. A public hearing on the proposed permit issuance was held in Hanover Courthouse on January 19, 1999. Issues raised during the public hearing and the public comment period included 1.) impact on dissolved oxygen levels

MEMORANDUM - Issuance of VPDES Permit No. VA0089915
Totopotomoy WWTP - Hanover County
Page Two

Public Notice (cont.): in the Pamunkey River, 2.) possible toxic impacts in the river, 3.) impact on endangered species, 4.) discharge location, 5.) wetlands impacts, 6.) nutrient impacts, 7.) water supply issues, 8.) temperature impacts and 9.) other miscellaneous issues unrelated to water quality and the VPDES permit. These issues were summarized in a memorandum to the Board dated March 3, 1999.

Planning: The discharge is not addressed in any planning document but will be included when the plan is updated.

EPA Comments: By letters dated August 5, 1998, November 6, 1998 and March 29, 1999, EPA indicated that they had no objections to the permit issuance.

VDH Comments: By letters dated June 3, 1998 and July 20, 1998, the Virginia Department of Health stated that they had no objections to the permit issuance.

Previous Board Action: On March 11, 1999, the Board approved issuance of the VPDES permit with three modifications as recommended by the staff. The modifications were made in response to public comments and included 1.) a reduction of the monthly average TSS limitations to 10 mg/l, 2.) an increase in the minimum DO limitation to 6.5 mg/l and 3.) inclusion of a special condition requiring the permittee to perform an instream benthics monitoring program.

Staff Comments: The proposed discharge is controversial. With the inclusion of the three modifications outlined above under Previous Board Action, the staff believes that all of the issues raised during the public hearing and comment period have been adequately addressed. Hanover County projects completion of the wastewater treatment plant in 2003.

By letter dated March 11, 1999, the U.S. Fish and Wildlife Service (USFWS) requested that the permit not be issued until the applicant perform a second mussel survey to determine whether any endangered or rare species are present in the vicinity of the proposed discharge. The staff proposes to issue the permit as approved by the Board but has agreed that the permit may be modified if any endangered species are found and it is demonstrated that the present permit requirements are not protective of the species.

Issuance of the VPDES permit has been delayed due to the public hearing, the need for EPA to review modifications approved by the Board and by the need to respond to USFWS comments received after the Board action.

0. 463

MEMORANDUM - Issuance of VPDES Permit No. VA0089915
Totopotomoy WWTP - Hanover County
Page Three

Staff Comments (cont.): The staff believes that the attached effluent limitations will maintain the Water Quality Standards adopted by the Board.

Basis for Effluent Limits: Best engineering judgement.

Licensed Operator
Requirements: The staff believes that a class I licensed operator is required.

STAFF RECOMMENDATIONS:

The staff recommends that the following be approved for the Deputy Director:

1. Approve the attached effluent limitations and monitoring requirements.
2. Issue VPDES Permit No. VA0089915.
3. Approve the discharge proposal as being subject to the requirements of a Reliability Class I facility.

APPROVED: _____

James J. Golden
Regional Permit Manager

DATE: _____

4/26/99

0. 1464

PERMITTEE, ADDRESS (INCLUDE
FACILITY NAME/LOCATION IF DIFFERENT)

NAME County of Hanover
ADDRESS P. O. Box 470
HANOVER VA 23069

FACILITY Totopotomoy WWTP

COMMONWEALTH OF VIRGINIA
DEPARTMENT OF ENVIRONMENTAL QUALITY
NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM (NPDES)
DISCHARGE MONITORING REPORT (DMR)

VA0089915
PERMIT NUMBER

001
DISCHARGE
NUMBER

MONITORING PERIOD
FROM YEAR MO DAY TO YEAR MO DAY

Municipal Major 9/1999
DEPT. OF ENVIRONMENTAL QUALITY
(REGIONAL OFFICE)
Piedmont Regional Office
4949-A Cox Road
Glen Allen VA 23060

(804) 527-5020

NOTE: READ PERMIT AND GENERAL INSTRUCTIONS
BEFORE COMPLETING THIS FORM.

PARAMETER		QUANTITY OR LOADING			QUALITY OR CONCENTRATION				NO. EX.	FREQUENCY OF ANALYSIS	SAMPLE TYPE
		AVERAGE	MAXIMUM	UNITS	MINIMUM	AVERAGE	MAXIMUM	UNITS			
001 FLOW	REPORTED				*****	*****	*****				
	PERMIT REQUIREMENT	5.0	NL	MGD	*****	*****	*****			CONT	REC
002 PH	REPORTED	*****	*****			*****					
	PERMIT REQUIREMENT	*****	*****		6.0	*****	9.0	SU		1/DAY	GRAB
004 TOTAL SUS. SOLIDS	REPORTED				*****						
	PERMIT REQUIREMENT	189	284	KG/D	*****	10.0	15.0	MG/L		1/DAY	24HC
006 FECAL COLIFORM	REPORTED	*****	*****		*****						
	PERMIT REQUIREMENT	*****	*****		*****	200	NL	N/CML		1/DAY	GRAB
007 DIS. OXYGEN	REPORTED	*****	*****			*****	*****				
	PERMIT REQUIREMENT	*****	*****		6.5	*****	*****	MG/L		1/DAY	GRAB
012 TOTAL PHOSPHORUS	REPORTED		*****		*****		*****				
	PERMIT REQUIREMENT	38	*****	KG/D	*****	2.0	*****	MG/L		1/DAY	24HC
013 TOTAL NITROGEN	REPORTED		*****		*****		*****				
	PERMIT REQUIREMENT	NL	*****	KG/D	*****	NL	*****	MG/L		1/W	24HC
068 TKN (N-KJEL)	REPORTED				*****						
	PERMIT REQUIREMENT	57	85	KG/D	*****	3.0	4.5	MG/L		1/DAY	24HC

ADDITIONAL PERMIT REQUIREMENTS OR COMMENTS

BYPASSES AND OVERFLOWS	TOTAL OCCURRENCES	TOTAL FLOW (M. G.)	TOTAL BODS (K. G.)	OPERATOR IN RESPONSIBLE CHARGE			DATE					
				TYPED OR PRINTED NAME	SIGNATURE	CERTIFICATE NO.	YEAR	MO.	DAY			
<small>I CERTIFY UNDER PENALTY OF LAW THAT THIS DOCUMENT AND ALL ATTACHMENTS WERE PREPARED UNDER MY DIRECTION OR SUPERVISION IN ACCORDANCE WITH A SYSTEM DESIGNED TO ASSURE THAT QUALIFIED PERSONNEL PROPERLY GATHER AND EVALUATE THE INFORMATION SUBMITTED. BASED ON MY INQUIRY OF THE PERSON OR PERSONS WHO MANAGE THE SYSTEM OR THOSE PERSONS DIRECTLY RESPONSIBLE FOR GATHERING THE INFORMATION, THE INFORMATION SUBMITTED IS TO THE BEST OF MY KNOWLEDGE AND BELIEF TRUE, ACCURATE AND COMPLETE. I AM AWARE THAT THERE ARE SIGNIFICANT PENALTIES FOR SUBMITTING FALSE INFORMATION, INCLUDING THE POSSIBILITY OF FINE AND IMPRISONMENT FOR KNOWING VIOLATIONS. SEE 18 U.S.C. A 1001 AND 18 U.S.C A 1015. (Penalties under these statutes may include fines up to \$10,000 and/or maximum imprisonment of between 6 months and 3 years.)</small>				PRINCIPAL EXECUTIVE OFFICER OR AUTHORIZED AGENT			TELEPHONE					
				TYPED OR PRINTED NAME	SIGNATURE	AREA CODE	NUMBER	YEAR	MO.	DAY		

PERMITTEE. 2/ADDRESS (INCLUDE
FACILITY NAME/LOCATION IF DIFFERENT)

NAME County of Hanover
ADDRESS P. O. Box 470
HANOVER VA 23069

FACILITY Totopotomoy WWT

COMMONWEALTH OF VIRGINIA
DEPARTMENT OF ENVIRONMENTAL QUALITY
NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM (NPDES)
DISCHARGE MONITORING REPORT (DMR)

VA0089915

PERMIT NUMBER

001

DISCHARGE
NUMBER

Municipal Major

1/1999

DEPT. OF ENVIRONMENTAL QUALITY
(REGIONAL OFFICE)

Piedmont Regional Office
4949-A Cox Road
Glen Allen VA 23060

(804) 527-5020

NOTE: READ PERMIT AND GENERAL INSTRUCTIONS
BEFORE COMPLETING THIS FORM.

MONITORING PERIOD						
YEAR	MO	DAY	YEAR	MO	DAY	

FROM

TO

PARAMETER		QUANTITY OR LOADING			QUALITY OR CONCENTRATION				NO. EX.	FREQUENCY OF ANALYSIS	SAMPLE TYPE
		AVERAGE	MAXIMUM	UNITS	MINIMUM	AVERAGE	MAXIMUM	UNITS			
159 CBOD5	REPORTED				*****						
	PERMIT REQUIREMENT	189	284	KG/D	*****	10.0	15.0	MG/L		1/DAY	24HC
	REPORTED										
	PERMIT REQUIREMENT										
	REPORTED										
	PERMIT REQUIREMENT										
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	REPORTED										
	PERMIT REQUIREMENT										

ADDITIONAL PERMIT REQUIREMENTS OR COMMENTS

BYPASSES AND OVERFLOWS	TOTAL OCCURRENCES	TOTAL FLOW (M.G.)	TOTAL BOD5 (K.G.)	OPERATOR IN RESPONSIBLE CHARGE			DATE					
				TYPED OR PRINTED NAME	SIGNATURE	CERTIFICATE NO.	YEAR	MO.	DAY			
<small>I CERTIFY UNDER PENALTY OF LAW THAT THIS DOCUMENT AND ALL ATTACHMENTS WERE PREPARED UNDER MY DIRECTION OR SUPERVISION IN ACCORDANCE WITH A SYSTEM DESIGNED TO ASSURE THAT QUALIFIED PERSONNEL PROPERLY GATHER AND EVALUATE THE INFORMATION SUBMITTED. BASED ON MY INQUIRY OF THE PERSON OR PERSONS WHO MANAGE THE SYSTEM OR THOSE PERSONS DIRECTLY RESPONSIBLE FOR GATHERING THE INFORMATION, THE INFORMATION SUBMITTED IS TO THE BEST OF MY KNOWLEDGE AND BELIEF TRUE, ACCURATE AND COMPLETE. I AM AWARE THAT THERE ARE SIGNIFICANT PENALTIES FOR SUBMITTING FALSE INFORMATION, INCLUDING THE POSSIBILITY OF FINE AND IMPRISONMENT FOR KNOWING VIOLATIONS. SEE 15 U.S.C. § 1091 AND 33 U.S.C. § 1319. (Fines under these statutes may include fines up to \$10,000 and/or maximum imprisonment of between 6 months and 5 years.)</small>				PRINCIPAL EXECUTIVE OFFICER OR AUTHORIZED AGENT			TELEPHONE					
				TYPED OR PRINTED NAME	SIGNATURE	AREA CODE	NUMBER	YEAR	MO.	DAY		



COMMONWEALTH of VIRGINIA
DEPARTMENT OF ENVIRONMENTAL QUALITY

Permit No.: VA0089915
Effective Date: April 28, 1999
Expiration Date: April 28, 2004

**AUTHORIZATION TO DISCHARGE UNDER THE
VIRGINIA POLLUTANT DISCHARGE ELIMINATION SYSTEM
AND
THE VIRGINIA STATE WATER CONTROL LAW**

In compliance with the provisions of the Clean Water Act as amended and pursuant to the State Water Control Law and regulations adopted pursuant thereto, the following owner is authorized to discharge in accordance with the effluent limitations, monitoring requirements, and other conditions set forth in this permit.

Owner: County of Hanover
Facility Name: Totopotomoy WWTP
City: N/A
County: Hanover
Facility Location: north of Pole Green Rd., Hanover County

The owner is authorized to discharge to the following receiving stream:

Stream: Pamunkey River
River Basin: York River
River Subbasin: N/A
Section: 1
Class: II
Special Standards: a

The authorized discharge shall be in accordance with this cover page, Part I - Effluent Limitations and Monitoring Requirements and Part II - Conditions Applicable To All VPDES Permits, as set forth herein.


Deputy Director, Department of Environmental Quality

4/28/99

Date

C. 1467

A. EFFLUENT LIMITATIONS AND MONITORING REQUIREMENTS

1. During the period beginning with the permit's effective date and lasting until the permit's expiration date the permittee is authorized to discharge from outfall 001.

Upon commencement of discharge from the 5 MGD treatment facilities, such discharges shall be limited and monitored by the permittee as specified below:

EFFLUENT CHARACTERISTICS	DISCHARGE LIMITATIONS					MONITORING REQUIREMENTS		
	MONTHLY AVERAGE		WEEKLY AVERAGE		MINIMUM	MAXIMUM	FREQUENCY	SAMPLE TYPE
Flow (MGD) ²	NL		NA		NA	NL	Continuous	TIRE *
CBOD ₅	10.0 mg/l	189 kg/d	15.0 mg/l	284 kg/d	NA	NA	1/Day	24 HC
Suspended Solids	10.0 mg/l	189 kg/d	15.0 mg/l	284 kg/d	NA	NA	1/Day	24 HC
TKN	3.0 mg/l	67 kg/d	4.5 mg/l	85 kg/d	NA	NA	1/Day	24 HC
Total Phosphorus	2.0 mg/l	38 kg/d	NA		NA	NA	1/Day	24 HC
Total Nitrogen	NL	NL	NA		NA	NA	1/Week	24 HC
Fecal Collform	200 N/100 ml ³		NA		NA	NL	1/Day between 10 am and 4 pm	Grab
pH (standard units)	NA		NA		6.0	9.0	1/Day	Grab
Dissolved Oxygen	NA		NA		6.5 mg/l	NA	1/Day	Grab

NL = No Limitation, monitoring only

NA = Not Applicable

* = Totalizing Indicating and Recording Equipment

2. The design flow of this treatment facility is 5.0 MGD.

3. Geometric mean

4. There shall be no discharge of floating solids or visible foam in other than trace amounts.

A. EFFLUENT LIMITATIONS AND MONITORING REQUIREMENTS

1. During the period beginning with the permit's effective date and lasting until the permit's expiration date the permittee is authorized to discharge from outfall 001.

Upon commencement of discharge from the 10 MGD treatment facilities, such discharges shall be limited and monitored by the permittee as specified below:

EFFLUENT CHARACTERISTICS	DISCHARGE LIMITATIONS					MONITORING REQUIREMENTS		
	MONTHLY AVERAGE		WEEKLY AVERAGE		MINIMUM	MAXIMUM	FREQUENCY	SAMPLE TYPE
Flow (MGD) ²	NL		NA		NA	NL	Continuous	TIRE [*]
CBOD ₅	10.0 mg/l	379 kg/d	15.0 mg/l	568 kg/d	NA	NA	1/Day	24 HC
Suspended Solids	10.0 mg/l	379 kg/d	15.0 mg/l	568 kg/d	NA	NA	1/Day	24 HC
TKN	3.0 mg/l	114 kg/d	4.5 mg/l	170 kg/d	NA	NA	1/Day	24 HC
Total Phosphorus	2.0 mg/l	76 kg/d	NA		NA	NA	1/Day	24 HC
Total Nitrogen	NL	NL	NA		NA	NA	1/Week	24 HC
Fecal Coliform	200 N/100 ml ³		NA		NA	NL	1/Day between 10 am and 4 pm	Grab
pH (standard units)	NA		NA		6.0	9.0	1/Day	Grab
Dissolved Oxygen	NA		NA		6.5 mg/l	NA	1/Day	Grab

NL = No Limitation, monitoring only

NA = Not Applicable

* = Totalizing Indicating and Recording Equipment

2. The design flow of this treatment facility is 10.0 MGD.

3. Geometric mean

4. There shall be no discharge of floating solids or visible foam in other than trace amounts.

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A. SEWAGE SLUDGE LIMITATIONS AND MONITORING REQUIREMENTS

Paragraphs A.5. and A.6. only apply to sludges which are land applied.

5. During the period beginning with the permit's effective date and lasting until the permit's expiration date, the permittee is authorize to manage sewage sludge according to the approved Sludge Management Plan.

The pollutants in sewage sludge shall be limited and monitored by the permittee as specified below:

a. Annual Sludge Production Data

Report annual total amount of sludge produced, in dry metric tons, by your facility and annual amount of sludge, in dry metric tons, used or disposed in various methods.

b. Chemical Pollutant Limitations

SLUDGE CHARACTERISTICS	LIMITATIONS		MONITORING REQUIRMENTS	
	CEILING CONCENTRATION MAXIMUM (mg/kg)	MONTHLY AVERAGE (mg/kg)	FREQUENCY	SAMPLE TYPE
Percent Solids	NA	NL	1/Quarter	Composite
Total Arsenic	75	41	1/Quarter	Composite
Total Cadmium	85	39	1/Quarter	Composite
Total Copper	4,300	1,500	1/Quarter	Composite
Total Lead	840	300	1/Quarter	Composite
Total Mercury	57	17	1/Quarter	Composite
Total Molybdenum	75	NA	1/Quarter	Composite
Total Nickel	420	420	1/Quarter	Composite
Total Selenium	100	100	1/Quarter	Composite
Total Zinc	7,500	2,800	1/Quarter	Composite

NL = No Limitation, monitoring only

* Dry weight basis, unless otherwise stated.

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c. Pathogen Reduction Limitations

Class B, Alternative 2, aerobic digestion - Sewage sludge shall be treated by a process of agitating sludge with air or oxygen to maintain aerobic conditions for a period ranging from 60 days at 15°C to 40 days at 20°C.

d. Vector Attraction Reduction Limitations

Alternative 4, SOUR - The specific oxygen uptake rate (SOUR) for the aerobically treated sewage sludge shall be equal to or less than 1.5 mg of oxygen per hour per gram of total solids (dry weight basis) at a temperature of 20°C.

6. All samples shall be collected and analyzed in accordance with the approved O & M Manual.

B. Other Requirements or Special Conditions

1. A written notice and a plan of action for ensuring continued compliance with the terms of this permit shall be submitted to the DEQ, Piedmont Regional Office when the monthly average flow influent to the sewage treatment works reaches 95 percent of the design capacity authorized in this permit for each month of any three consecutive month period. The written notices shall be submitted within 30 days and the plan of action shall be received at the Piedmont Regional Office no later than 90 days from the third consecutive month for which the flow reached 95 percent of the design capacity. The plan shall include the necessary steps and prompt schedule of implementation for controlling any current or reasonably anticipated problem resulting from high influent flows. Failure to submit an adequate plan in a timely manner shall be deemed a violation of the permit.
2. The permittee in accordance with the Sewerage Regulations shall obtain a Certificate to Construct (CTC) and a Certificate to Operate (CTO) from the DEQ, Water Division Regional Office prior to constructing wastewater treatment facilities and operating the facilities respectively. The permittee shall submit an Operations and Maintenance (O&M) manual to the Piedmont Regional Office for approval prior to submittal of a statement of completion for the construction of the facility. Future changes to the facility must be addressed by the submittal of a revised O&M Manual within 90 days of the changes. Noncompliance with the CTC, CTO, or O&M manual shall be deemed a violation of the permit.
3. The permittee shall employ or contract at least one wastewater works operator who holds a current wastewater license appropriate for the permitted facility. A Class I licensed operator is required for this facility. The license shall be issued in accordance with Title 54.1 of the Code of Virginia and the regulations of the Board for Waterworks and Wastewater Works Operators. The permittee shall notify the Department in writing whenever he is not complying, or has grounds for anticipating he will not comply with this requirement. The notification shall include a statement of reasons and a prompt schedule for achieving compliance.
4. This permit shall be modified or alternatively revoked and reissued to include new or alternative nutrient limitations should the Board adopt nutrient standards for the Chesapeake Bay and tributary river basins, or if a future water quality regulation, statute, or water quality management plan requires new or alternative nutrient control.
5. Indirect Dischargers

The permittee shall provide adequate notice to the Department of the following:

- a. Any new introduction of pollutants into the treatment works from an indirect discharger which would be subject to Section 301 or 306 of Clean Water Act and the State Water Control Law if it were directly discharging those pollutants; and
- b. Any substantial change in the volume or character of pollutants being introduced into the treatment works by a source introducing pollutants into the treatment works at the time of issuance of this permit.

Adequate notice shall include information on (i) the quality and quantity of effluent introduced into the treatment works, and (ii) any anticipated impact of the change on the

quantity or quality of effluent to be discharged from the treatment works. Reports made to DEQ under the Industrial Pretreatment Program requirements (Part I.C.) may be used to fulfill this requirement.

6. The Board may promptly modify or revoke and reissue this permit if any applicable standard for sewage sludge use or disposal promulgated under Section 405(d) of the Clean Water Act is more stringent than any requirements for sludge use or disposal in this permit, or controls a pollutant or practice not limited in this permit.
7. The Sludge Management Plan (SMP) is conditionally approved with the issuance of this permit, provided that a complete SMP is submitted and approved prior to implementation of the specific sludge use or disposal practices. Upon approval, the SMP becomes an enforceable part of the permit. The permit may be modified or alternately revoked and reissued to incorporate limitations/conditions necessitated by the chosen sewage sludge use or disposal practices.

Special Conditions Nos. 8 and 9 only apply to sludges which are land applied.

8. The permittee is required to retain the following information for at least 5 years:

- a. The concentration of each pollutant in Part I.A.5.;
- b. The description of how the pathogen reduction requirements in Part I.A.5.c. are met;
- c. A description of how the vector attraction reduction requirements in Part I.A.5.d. are met;
- d. A description of how the management practices specified in the approved Sludge Management Plan and/or this permit are met;
- e. A description of how the site restrictions specified in the approved Sludge Management Plan and/or this permit are met;
- f. The following certification statement shall be signed by a responsible official and provided with each of the quarterly Pathogen Reduction and Vector Attraction Reduction demonstrations included in the annual report required under B.9. below:

"I certify, under penalty of law, that the pathogen requirements in 9 VAC 25-31-710 A, vector attraction reduction requirements in 9 VAC 25-31-720 B.4., the management practices in 9 VAC 25-31-550, and the site restrictions in 9 VAC 25-31-710 B.5. have been met. This determination has been made under my direction and supervision in accordance with the system designed to ensure that qualified personnel properly gather and evaluate the information used to determine that the pathogen requirements, vector attraction reduction requirements, site management practices, and site restrictions have been met. I am aware that there are significant penalties for false certification including the possibility of fine and imprisonment."

9. The permittee shall provide the results of all monitoring performed in accordance with Part I.A., and information on management practices, land application sites, site restrictions (if applicable), and appropriate certifications not later than February 19 of each year to the regional office of the Department of Environmental Quality. Each report is for the previous calendar year's activity. If no sewage sludge was applied to the land during the reporting period, "no sewage sludge was applied" shall be reported.

C. Pretreatment Program

1. Within 60 days of the issuance of a Certificate to Construct for the Totopotomoy WWTP, the permittee must submit a Plan of Study to the Department of Environmental Quality (DEQ) which describes in detail the steps it will undertake to develop a pretreatment program. At a minimum, the Plan of Study shall include specific dates by which the following activities will be accomplished.
 - a. Survey of Industrial Users, including identification of Significant Industrial Users* and the character and volume of pollutants contributed to the treatment works by each discharger. The DEQ Discharger Survey Form, or equivalent form that includes the quantity and quality of the wastewater shall be used.
 - b. Submission of results of the discharger survey required in (a).
 - c. Submission of the data and calculations used to develop technically-based local limits.
 - d. Development and submission of the legal authority, permit boiler plate, an ERP, and interjurisdictional agreements, where necessary, to the DEQ for approval.
 - e. Submission of an evaluation of financial programs, revenue sources and qualified personnel necessary to implement a pretreatment program.
 - f. Submission of a detailed description of the procedures to design and implement a monitoring and enforcement program, including a description of the required monitoring equipment to be utilized for monitoring or analysis of industrial wastes.
 - g. Submission of a request for pretreatment program approval of all required elements within one year of the effective or modification date of this permit. This request must be accompanied by a statement of endorsement by the local board or governing body responsible for the program and an attorney's evaluation of the POTVW's authority to implement the program.
2. Within 60 days of its receipt, the DEQ shall evaluate the Plan of Study and shall establish a schedule of compliance for the development and submission of a pretreatment program. Upon written approval by the DEQ, this schedule shall become an enforceable condition of this permit.
3. Should evaluation by the DEQ of results of the Industrial User survey conducted in accordance with (1) (a) and (1) (b) above indicate that the permittee is not required to implement a pretreatment program, the requirements for program development described in (1) (c) through (1) (g) above may be suspended by the DEQ.
4. Notwithstanding Paragraph (1)(a) above, unless the DEQ determines (in accordance with Paragraph (3) above), that the permittee is not required to implement a pretreatment program, the permittee shall:
 - a. Submit to the DEQ a progress report on actions taken to develop a pretreatment program within 90 days of the effective or modification date of this permit.

- b. Submit to the DEQ an approvable pretreatment program and a request for approval within one year of the effective or modification date of this permit.
- c. Upon approval, the program implementation becomes a part of this permit.

* A significant industrial user is one that: (a) has a process wastewater** flow of 25,000 gallons or more per average work day; (b) contributes a process wastestream which makes up 5 percent or more of the average dry weather hydraulic or organic capacity of the POTW; (c) is subject to categorical pretreatment standards; or (d) has significant impact, either singularly or in combination with other Industrial Users, on the treatment works or the quality of its effluent.

** Process wastewater excludes sanitary wastewater, non-contact cooling water and boiler blowdown.

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D. Toxics Management Program

1. Biological Monitoring:

a. In accordance with the schedule in (3) below and commencing within three months following issuance of the Certificates to Operate (CTO's) for the 5 MGD and 10 MGD facilities, the permittee shall conduct quarterly acute and chronic toxicity tests for a period of one year using 24-hour flow- proportioned composite samples of final effluent from outfall 001. The acute tests shall be 48-hour static tests using Ceriodaphnia dubia and Pimephales promelas, both conducted in such a manner and at sufficient dilutions for calculation of a valid LC_{50} . The chronic tests shall be static renewal tests using C. dubia and P. promelas. The C. dubia test shall be a 3-brood survival and reproduction test and the P. promelas test shall be a 7-day larval survival and growth test. These chronic tests shall be conducted in such a manner and at sufficient dilutions to determine the "No Observed Effect Concentration" (NOEC) for survival and reproduction or growth. The permittee may provide additional samples to address data variability during the one year period of initial data generation. These data may be included in the evaluation of effluent toxicity. The results of all such additional analyses shall be reported. Technical assistance in developing the procedures for these tests shall be provided by the Department of Environmental Quality staff, if requested by the permittee. Test protocols and the use of alternative species shall be approved by the Department of Environmental Quality staff prior to initiation of testing.

b. The following criteria shall be used in evaluating the toxicity test data generated in 1.a. above:

- (1) LC_{50} greater than or equal to 100% effluent in six of the total of eight acute toxicity tests, or in at least 75% of the tests conducted, if more than eight tests are conducted, and
- (2) No Observed Effect Concentration (NOEC) greater than or equal to the Instream Waste Concentration (IWC) of 9.4% for the 5 MGD facility and 18.7% for the 10 MGD facility, in six of the total of eight chronic toxicity tests, or in at least 75% of the tests conducted if more than eight tests are conducted.

Any effluent failing either of the above criteria shall be considered to have demonstrated actual or potential toxicity and a Toxicity Reduction Evaluation (TRE) will be required.

- c. If, prior to completing the monitoring requirements specified in 1.a. above, it is determined that the effluent fails the decision criteria outlined in 1.b., a TRE may be required. Upon notification by the DEQ that a TRE is required, the permittee shall initiate a TRE and may stop conducting the toxicity tests of 1.a.
- d. Following completion of the testing of the outfall as above, the permittee shall continue acute and chronic toxicity testing of the outfall annually. The first annual tests shall be conducted within three months from the last quarterly tests. The test organisms shall be those identified as the most sensitive species from the quarterly acute and chronic tests or alternative species approved by the Department of Environmental Quality staff. Annual testing of the outfall is not required in cases where the need for a TRE of the outfall has been established.

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- e. If, in the testing according to 1.d. above, any of the annual acute toxicity tests yields an LC_{50} of less than 100% effluent or any annual chronic toxicity test yields an NOEC of less than the IWC of 9.4% for the 5 MGD facility and 18.7% for the 10 MGD facility, the test shall be repeated within three months.
- (1) If the retest also indicates an LC_{50} of less than 100% effluent or an NOEC of less than the IWC, quarterly toxicity testing as in 1.a. above shall commence within three months. The results of these tests will be included in the evaluation of the need for toxicity reduction.
- (2) If the retest does not confirm the results of the first test, then annual testing in accordance with the annual compliance schedule shall resume.

2. **Toxicity Reduction Evaluation:**

- a. If the results of this Toxics Management Program or other available information indicate that the wastewaters are actually or potentially toxic, the permittee shall submit:

- (1) a Toxicity Reduction Evaluation (TRE) plan, or
- (2) at the permittee's option, an instream impact study plan, and
- (3) an accompanying implementation schedule

within 120 days of the notification of such a determination by the Department of Environmental Quality.

- b. The requirement of this plan shall be to:

- (1) assure the absence of actual or potential toxicity, or
- (2) to demonstrate that there is, or would be, no adverse impact from the discharge on all reasonable and beneficial uses of the state's waters.

- c. Upon completion of the review of the plan, the permittee shall implement the plan and the permit may be modified or alternatively revoked and reissued in order to reflect appropriate permit conditions and a compliance schedule.

3. **Reporting Schedule:**

The permittee shall submit 2 copies of the results of the toxicity tests analyses specified in this Toxics Management Program in accordance with the following schedule:

a. Submit toxicity test protocols for approval	Within two months following the issuance of the Certificates to Operate (CTO's) for the 5 MGD and 10 MGD facilities
b. Conduct first quarterly biological tests	Within three months following the issuance of the Certificates to Operate (CTO's) for the 5 MGD and 10 MGD facilities

c. Submit results of all tests conducted during the first quarter	With the Discharge Monitoring Report (DMR) for the fourth month following the issuance of the Certificates to Operate (CTO's) for the 5 MGD and 10 MGD facilities
d. Conduct second quarterly biological tests	Within six months following the issuance of the Certificates to Operate (CTO's) for the 5 MGD and 10 MGD facilities
e. Submit results of all tests conducted during the second quarter	With the DMR submitted for the seventh month following the permit effective date
f. Conduct third quarterly biological tests	Within nine months following the issuance of the Certificate to Operate (CTO's) for the 5 MGD and 10 MGD facilities
g. Submit results of all tests conducted during the third quarter	With the DMR submitted for the tenth month following the issuance of the Certificates to Operate (CTO's) of the 5 MGD and 10 MGD facilities
h. Conduct fourth quarterly biological tests	Within twelve months following the issuance of the Certificates to Operate (CTO's) for the 5 MGD and 10 MGD facilities
i. Submit results of all tests conducted during the fourth quarter	With the DMR submitted for the thirteenth month following the issuance of the Certificates to Operate (CTO's) for the 5 MGD and 10 MGD facilities
j. Conduct first annual biological tests	Within fifteen months following the issuance of the Certificates to Operate (CTO's) for the 5 MGD and 10 MGD facilities
k. Submit results of first annual biological tests	With the DMR submitted for the sixteenth month following the issuance of the Certificates to Operate (CTO's) for the 5 MGD and 10 MGD facilities
l. Conduct subsequent annual biological tests	Within subsequent twelve month periods from 3.j.
m. Submit results of subsequent annual biological tests	With the DMR submitted every 12 months from 3.k.

0. 478

4. In-Stream Macroinvertebrate Monitoring

The permittee shall perform an annual quantitative benthic macroinvertebrate study on the Pamunkey River to assess impacts of the Totopotomoy WWTP discharge. The study shall be conducted between August 15th and October 15th beginning in 2002. The study design, including sampling locations, survey methods, data analysis, etc. shall be submitted to and approved by DEQ Water Division staff prior to initiation of testing.

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E. Chemical Monitoring

The permittee shall monitor the effluent at Outfall 001 for the following substances according to the indicated sample type and frequency. The data shall be submitted with the DMR following the month in which the analyses were conducted. It is the responsibility of the permittee to ensure that proper QA/QC protocols are followed during the sample gathering and analytical procedures. The Department will use this data for making specific permit decisions in the future. This permit may be modified or alternatively revoked and reissued to incorporate limits for any substance listed below.

Substance	Analysis Number	Quantification level	Sample Type	Frequency
Metals				
Arsenic (dissolved)	(i)	(i)	3g	A
Cadmium (dissolved)	(i)	(i)	3g	A
Chromium III (dissolved)*	(i)	(i)	3g	A
Chromium VI (dissolved)*	(i)	(i)	3g	A
Copper (dissolved)	(i)	(i)	3g	A
Lead (dissolved)	(i)	(i)	3g	A
Mercury (total recoverable)	(i)	(i)	3g	A
Nickel (dissolved)	(i)	(i)	3g	A
Selenium (dissolved)	(i)	(i)	3g	A
Silver (dissolved)	(i)	(i)	3g	A
Zinc (dissolved)	(i)	(i)	3g	A
Pesticides/PCB's				
Aldrin	608	0.5	3g	B
Chlorpyrifos (Dursban)	622	0.2	3g	B
Chlordane	608	0.2	3g	B
DDT	608	0.1	3g	B
Demeton	(ii)	--	3g	B
2,4 Dichlorophenoxy acetic acid (2,4-D)	(ii)	--	3g	B
Dieldren	608	0.1	3g	B
Endosulfan I	608	0.1	3g	B
Endosulfan II	608	0.1	3g	B
Endosulfan sulfate	608	0.1	3g	B
Endrin	608	0.1	3g	B
Guthion	622	--	3g	B
Heptachlor	608	0.1	3g	B

Substance	Analysis Number	Quantification level	Sample Type	Frequency
Lindane (Hexachlorocyclohexane)	608	0.1	3g	B
Malathion	(ii)	---	3g	B
Methoxychlor	(ii)	0.2	3g	B
Mirex	(ii)	---	3g	B
Parathion	(ii)	---	3g	B
PCB-1016	608	1.0	3g	B
PCB-1221	608	1.0	3g	B
PCB-1232	608	1.0	3g	B
PCB-1242	608	1.0	3g	B
PCB-1248	608	1.0	3g	B
PCB-1254	608	1.0	3g	B
PCB-1260	608	1.0	3g	B
2,4,5-Trichlorophenoxy propionic acid (Silvex)	(ii)	---	3g	B
Toxaphene	608	5.0	3g	B
Base/Neutral Extractables				
Anthracene	625	10.0	3g	B
Benzo(a)anthracene	625	10.0	3g	B
Benzo(b)fluoranthene	625	10.0	3g	B
Benzo(k)fluoranthene	625	10.0	3g	B
Benzo(a)pyrene	625	10.0	3g	B
Chrysene	625	10.0	3g	B
Di-2-Ethylhexyl Phthalate	625	10.0	3g	B
Dibenzo(a,h)anthracene	625	20.0	3g	B
Indeno(1,2,3-cd)pyrene	625	20.0	3g	B
1,2-Dichlorobenzene	625	10.0	3g	B
1,3-Dichlorobenzene	625	10.0	3g	B
1,4-Dichlorobenzene	625	10.0	3g	B
2,4-Dinitrotoluene	625	10.0	3g	B
Fluoranthene	625	10.0	3g	B
Fluorene	625	10.0	3g	B
Pyrene	625	10.0	3g	B

Substance	Analysis Number	Quantification level	Sample Type	Frequency
Naphthalene	625	10.0	3g	B
Isophorone	625	10.0	3g	B
Volatiles				
Benzene	624	10.0	3g	B
Bromoform	624	10.0	3g	B
Carbon Tetrachloride	624	10.0	3g	B
Chlorodibromomethane	624	10.0	3g	B
Chloroform	624	10.0	3g	B
Chloromethane	624	20.0	3g	B
Dichloromethane	624	20.0	3g	B
Dichlorobromomethane	624	20.0	3g	B
1,2-Dichloroethane	624	10.0	3g	B
Ethylbenzene	624	10.0	3g	B
Monochlorobenzene	624	50.0	3g	B
Tetrachloroethylene	624	10.0	3g	B
Toluene	624	10.0	3g	B
Trichloroethylene	624	10.0	3g	B
Vinyl Chloride	624	10.0	3g	B
Acid Extractables				
Pentachlorophenol	625	50.0	3g	B
Phenol	625	10.0	3g	B
2,4,6-Trichlorophenol	625	10.0	3g	B
Miscellaneous				
Cyanide	EPA 335.2 or 335.3	10.0	g	B
Dioxin	EPA 1613	0.00001	c	C
Hardness	(ii)	--	c	A
Tributyltin	NBSIR 85- 32.95 or (ii)	--	c	C
Xylene (total)	EPA SW 846 Method 8020	--	3g	B

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- If the result of a Total Chromium analysis is less than or equal to the QL of the method used to measure Total Chromium and that QL is less than or equal to the Target QL identified below for Chromium VI, the results for Chromium III and Chromium VI can be reported as not quantifiable.

Units for the quantification level are micrograms/liters unless otherwise specified.

Dashes (—) mean that the QL is at the discretion of the permittee.

Sample Type: c = 24 hour composite unless otherwise specified
 g = Grab
 3g = 1 grab sample every eight hours. Permittee shall analyze each sample individually and report the average of the three samples. Alternative laboratory compositing procedures may be approved on a case by case basis.

Frequency: A = Once per 6 months
 B = Once per year
 C = Once per permit term

Quality control/assurance information shall be submitted to document that the required quantification level has been attained for all parameters listed above. Alternatively, the permittee may retain the QA/QC information on file and submit a statement certifying that the required quantification levels have been attained.

- (ii) A specific analysis is not specified for these materials. An appropriate analysis shall be selected from the following list of EPA methods to achieve a quantification level (QL) that is equal to or less than the target QL listed in the following table:

<u>Parameter</u>	<u>Target QL (ug/l)</u>	<u>EPA Methods</u>
Arsenic	409	206.2, 206.3, 200.7, 200.8, 200.9, 1632
Cadmium	1.2	213.1, 213.2, 200.7, 200.8, 200.9, 1637, 1638, 1639, 1640
Chromium	217	218.1, 218.2, 218.3, 200.7, 200.8, 200.9, 1639
Chromium VI	26	218.4, 1636
Copper	12	220.1, 220.2, 200.7, 200.8, 200.9, 1638, 1640
Lead	9	239.1, 239.2, 200.8, 200.9, 1637, 1640
Mercury	0.037	245.1, 200.7, 200.8, 1631
Nickel	21	249.1, 249.2, 200.7, 200.8, 200.9, 1638, 1639, 1640
Selenium	12	270.2, 200.7, 200.8, 200.9, 1638, 1639
Silver	1.6	272.1, 272.2, 200.7, 200.8, 200.9, 1638
Zinc	108	289.1, 289.2, 200.7, 200.8, 1638, 1639

- (iii) Any approved method presented in 40 CFR Part 136

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CONDITIONS APPLICABLE TO ALL VPDES PERMITS

A. Monitoring.

1. Samples and measurements taken as required by this permit shall be representative of the monitored activity.
2. Monitoring shall be conducted according to procedures approved under Title 40 Code of Federal Regulations Part 136 or alternative methods approved by the U.S. Environmental Protection Agency, unless other procedures have been specified in this permit.
3. The permittee shall periodically calibrate and perform maintenance procedures on all monitoring and analytical instrumentation at intervals that will insure accuracy of measurements.

B. Records.

1. Records of monitoring information shall include:
 - a. The date, exact place, and time of sampling or measurements;
 - b. The individual(s) who performed the sampling or measurements;
 - c. The date(s) and time(s) analyses were performed;
 - d. The individual(s) who performed the analyses;
 - e. The analytical techniques or methods used; and
 - f. The results of such analyses.
2. Except for records of monitoring information required by this permit related to the permittee's sewage sludge use and disposal activities, which shall be retained for a period of at least five years, the permittee shall retain records of all monitoring information, including all calibration and maintenance records and all original strip chart recordings for continuous monitoring instrumentation, copies of all reports required by this permit, and records of all data used to complete the application for this permit, for a period of at least 3 years from the date of the sample, measurement, report or application. This period of retention shall be extended automatically during the course of any unresolved litigation regarding the regulated activity or regarding control standards applicable to the permittee, or as requested by the Board.

C. Reporting Monitoring Results.

1. The permittee shall submit the results of the monitoring required by this permit not later than the 10th day of the month after monitoring takes place, unless another reporting schedule is specified elsewhere in this permit. Monitoring results shall be submitted to:

Department of Environmental Quality
Piedmont Regional Office
4949-A Cox Road
Glen Allen, VA 23060

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2. Monitoring results shall be reported on a Discharge Monitoring Report (DMR) or on forms provided, approved or specified by the Department.

3. If the permittee monitors any pollutant specifically addressed by this permit more frequently than required by this permit using test procedures approved under Title 40 of the Code of Federal Regulations Part 136 or using other test procedures approved by the U.S. Environmental Protection Agency or using procedures specified in this permit, the results of this monitoring shall be included in the calculation and reporting of the data submitted in the DMR or reporting form specified by the Department.
4. Calculations for all limitations which require averaging of measurements shall utilize an arithmetic mean unless otherwise specified in this permit.

D. Duty to Provide Information.

The permittee shall furnish to the Department, within a reasonable time, any information which the Board may request to determine whether cause exists for modifying, revoking and reissuing, or terminating this permit or to determine compliance with this permit. The Board may require the permittee to furnish, upon request, such plans, specifications, and other pertinent information as may be necessary to determine the effect of the wastes from his discharge on the quality of state waters, or such other information as may be necessary to accomplish the purposes of the State Water Control Law. The permittee shall also furnish to the Department upon request, copies of records required to be kept by this permit.

E. Compliance Schedule Reports.

Reports of compliance or noncompliance with, or any progress reports on, interim and final requirements contained in any compliance schedule of this permit shall be submitted no later than 14 days following each schedule date.

F. Unauthorized Discharges.

Except in compliance with this permit, or another permit issued by the Board, it shall be unlawful for any person to:

1. Discharge into state waters sewage, industrial wastes, other wastes, or any noxious or deleterious substances; or
2. Otherwise alter the physical, chemical or biological properties of such state waters and make them detrimental to the public health, or to animal or aquatic life, or to the use of such waters for domestic or industrial consumption, or for recreation, or for other uses.

G. Reports of Unauthorized Discharges.

Any permittee who discharges or causes or allows a discharge of sewage, industrial waste, other wastes or any noxious or deleterious substance into or upon state waters in violation of Part II.F; or who discharges or causes or allows a discharge that may reasonably be expected to enter state waters in violation of Part II.F, shall notify the Department of the discharge immediately upon discovery of the discharge, but in no case later than 24 hours after said discovery. A written report of the unauthorized discharge shall be submitted to the Department, within five days of discovery of the discharge. The written report shall contain:

1. A description of the nature and location of the discharge;
2. The cause of the discharge;
3. The date on which the discharge occurred;

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4. The length of time that the discharge continued;
5. The volume of the discharge;
6. If the discharge is continuing, how long it is expected to continue;
7. If the discharge is continuing, what the expected total volume of the discharge will be; and
8. Any steps planned or taken to reduce, eliminate and prevent a recurrence of the present discharge or any future discharges not authorized by this permit.

Discharges reportable to the Department under the immediate reporting requirements of other regulations are exempted from this requirement.

H. Reports of Unusual or Extraordinary Discharges.

If any unusual or extraordinary discharge including a bypass or upset should occur from a treatment works and the discharge enters or could be expected to enter state waters, the permittee shall promptly notify, in no case later than 24 hours, the Department by telephone after the discovery of the discharge. This notification shall provide all available details of the incident, including any adverse affects on aquatic life and the known number of fish killed. The permittee shall reduce the report to writing and shall submit it to the Department within five days of discovery of the discharge in accordance with Part II.1.2. Unusual and extraordinary discharges include but are not limited to any discharge resulting from:

1. Unusual spillage of materials resulting directly or indirectly from processing operations;
2. Breakdown of processing or accessory equipment;
3. Failure or taking out of service some or all of the treatment works; and
4. Flooding or other acts of nature.

I. Reports of Noncompliance

The permittee shall report any noncompliance which may adversely affect state waters or may endanger public health.

1. An oral report shall be provided within 24 hours from the time the permittee becomes aware of the circumstances. The following shall be included as information which shall be reported within 24 hours under this paragraph:
 - a. Any unanticipated bypass; and
 - b. Any upset which causes a discharge to surface waters.
2. A written report shall be submitted within 5 days and shall contain:
 - a. A description of the noncompliance and its cause;
 - b. The period of noncompliance, including exact dates and times, and if the noncompliance has not been corrected, the anticipated time it is expected to continue; and
 - c. Steps taken or planned to reduce, eliminate, and prevent reoccurrence of the noncompliance.

The Board may waive the written report on a case-by-case basis for reports of noncompliance under Part II.1 if the oral report has been received within 24 hours and no adverse impact on state waters has been reported.

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3. The permittee shall report all instances of noncompliance not reported under Parts II.I.1 or 2, in writing, at the time the next monitoring reports are submitted. The reports shall contain the information listed in Part II.I.2.

NOTE: The immediate (within 24 hours) reports required in Parts II G, H and I may be made to the Department's Regional Office at (804) 527-5020 (voice) or (804) 527-5106 (fax). For reports outside normal working hours, leave a message and this shall fulfill the immediate reporting requirement. For emergencies, the Virginia Department of Emergency Services maintains a 24 hour telephone service at 1-800-468-8892.

J. Notice of Planned Changes.

1. The permittee shall give notice to the Department as soon as possible of any planned physical alterations or additions to the permitted facility. Notice is required only when:
 - a. The permittee plans alteration or addition to any building, structure, facility, or installation from which there is or may be a discharge of pollutants, the construction of which commenced:
 - (1) After promulgation of standards of performance under Section 306 of Clean Water Act which are applicable to such source; or
 - (2) After proposal of standards of performance in accordance with Section 306 of Clean Water Act which are applicable to such source, but only if the standards are promulgated in accordance with Section 306 within 120 days of their proposal;
 - b. The alteration or addition could significantly change the nature or increase the quantity of pollutants discharged. This notification applies to pollutants which are subject neither to effluent limitations nor to notification requirements specified elsewhere in this permit; or
 - c. The alteration or addition results in a significant change in the permittee's sludge use or disposal practices, and such alteration, addition, or change may justify the application of permit conditions that are different from or absent in the existing permit, including notification of additional use or disposal sites not reported during the permit application process or not reported pursuant to an approved land application plan.
2. The permittee shall give advance notice to the Department of any planned changes in the permitted facility or activity which may result in noncompliance with permit requirements.

K. Signatory Requirements.

1. Applications. All permit applications shall be signed as follows:
 - a. For a corporation: by a responsible corporate officer. For the purpose of this section, a responsible corporate officer means: (i) A president, secretary, treasurer, or vice-president of the corporation in charge of a principal business function, or any other person who performs similar policy- or decision-making functions for the corporation, or (ii) the manager of one or more manufacturing, production, or

- operating facilities employing more than 250 persons or having gross annual sales or expenditures exceeding \$25 million (in second-quarter 1980 dollars), if authority to sign documents has been assigned or delegated to the manager in accordance with corporate procedures;
- b. For a partnership or sole proprietorship: by a general partner or the proprietor, respectively; or
 - c. For a municipality, state, federal, or other public agency: By either a principal executive officer or ranking elected official. For purposes of this section, a principal executive officer of a public agency includes: (i) The chief executive officer of the agency, or (ii) a senior executive officer having responsibility for the overall operations of a principal geographic unit of the agency.
2. Reports, etc. All reports required by permits, and other information requested by the Board shall be signed by a person described in Part II.K.1, or by a duly authorized representative of that person. A person is a duly authorized representative only if:
- a. The authorization is made in writing by a person described in Part II.K.1;
 - b. The authorization specifies either an individual or a position having responsibility for the overall operation of the regulated facility or activity such as the position of plant manager, operator of a well or a well field, superintendent, position of equivalent responsibility, or an individual or position having overall responsibility for environmental matters for the company. (A duly authorized representative may thus be either a named individual or any individual occupying a named position.); and
 - c. The written authorization is submitted to the Department.
3. Changes to authorization. If an authorization under Part II.K.2 is no longer accurate because a different individual or position has responsibility for the overall operation of the facility, a new authorization satisfying the requirements of Part II.K.2 shall be submitted to the Department prior to or together with any reports, or information to be signed by an authorized representative.
4. Certification. Any person signing a document under Parts II.K.1 or 2 shall make the following certification:
- "I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations."

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L. Duty to Comply.

The permittee shall comply with all conditions of this permit. Any permit noncompliance constitutes a violation of the State Water Control Law and the Clean Water Act, except that noncompliance with certain provisions of this permit may constitute a violation of the State Water Control Law but not the Clean Water Act. Permit noncompliance is grounds for enforcement action; for permit termination, revocation and reissuance, or modification; or denial of a permit renewal application.

The permittee shall comply with effluent standards or prohibitions established under Section 307(a) of the Clean Water Act for toxic pollutants and with standards for sewage sludge use or disposal established under Section 405(d) of the Clean Water Act within the time provided in the regulations that establish these standards or prohibitions or standards for sewage sludge use or disposal, even if this permit has not yet been modified to incorporate the requirement.

M. Duty to Reapply.

If the permittee wishes to continue an activity regulated by this permit after the expiration date of this permit, the permittee shall apply for and obtain a new permit. All permittees with a currently effective permit shall submit a new application at least 180 days before the expiration date of the existing permit, unless permission for a later date has been granted by the Board. The Board shall not grant permission for applications to be submitted later than the expiration date of the existing permit.

N. Effect of a Permit.

This permit does not convey any property rights in either real or personal property or any exclusive privileges, nor does it authorize any injury to private property or invasion of personal rights, or any infringement of federal, state or local law or regulations.

O. State Law.

Nothing in this permit shall be construed to preclude the institution of any legal action under, or relieve the permittee from any responsibilities, liabilities, or penalties established pursuant to any other state law or regulation or under authority preserved by Section 510 of the Clean Water Act. Except as provided in permit conditions on "bypassing" (Part II.U), and "upset" (Part II.V) nothing in this permit shall be construed to relieve the permittee from civil and criminal penalties for noncompliance.

P. Oil and Hazardous Substance Liability.

Nothing in this permit shall be construed to preclude the institution of any legal action or relieve the permittee from any responsibilities, liabilities, or penalties to which the permittee is or may be subject under Sections 62.1-44.34:14 through 62.1-44.34:23 of the State Water Control Law.

Q. Proper Operation and Maintenance.

The permittee shall at all times properly operate and maintain all facilities and systems of treatment and control (and related appurtenances) which are installed or used by the permittee to achieve compliance with the conditions of this permit. Proper operation and maintenance also includes effective plant performance, adequate funding, adequate staffing, and adequate laboratory and process controls, including appropriate quality assurance procedures. This provision requires the

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operation of back-up or auxiliary facilities or similar systems which are installed by the permittee only when the operation is necessary to achieve compliance with the conditions of this permit.

R. Disposal of solids or sludges.

Solids, sludges or other pollutants removed in the course of treatment or management of pollutants shall be disposed of in a manner so as to prevent any pollutant from such materials from entering state waters.

S. Duty to Mitigate.

The permittee shall take all reasonable steps to minimize or prevent any discharge or sludge use or disposal in violation of this permit which has a reasonable likelihood of adversely affecting human health or the environment.

T. Need to Halt or Reduce Activity not a Defense.

It shall not be a defense for a permittee in an enforcement action that it would have been necessary to halt or reduce the permitted activity in order to maintain compliance with the conditions of this permit.

U. Bypass.

1. "Bypass" means the intentional diversion of waste streams from any portion of a treatment facility. The permittee may allow any bypass to occur which does not cause effluent limitations to be exceeded, but only if it also is for essential maintenance to assure efficient operation. These bypasses are not subject to the provisions of Parts II.U.2 and U.3.
2. Notice
 - a. Anticipated bypass. If the permittee knows in advance of the need for a bypass, prior notice shall be submitted, if possible at least ten days before the date of the bypass.
 - b. Unanticipated bypass. The permittee shall submit notice of an unanticipated bypass as required in Part II.I.
3. Prohibition of bypass.
 - a. Bypass is prohibited, and the Board may take enforcement action against a permittee for bypass, unless:
 - (1) Bypass was unavoidable to prevent loss of life, personal injury, or severe property damage;
 - (2) There were no feasible alternatives to the bypass, such as the use of auxiliary treatment facilities, retention of untreated wastes, or maintenance during normal periods of equipment downtime. This condition is not satisfied if adequate back-up equipment should have been installed in the exercise of reasonable engineering judgment to prevent a bypass which occurred during normal periods of equipment downtime or preventive maintenance; and
 - (3) The permittee submitted notices as required under Part II.U.2.

- b. The Board may approve an anticipated bypass, after considering its adverse effects, if the Board determines that it will meet the three conditions listed above in Part II.U.3.a.

V. Upset.

1. An upset constitutes an affirmative defense to an action brought for noncompliance with technology based permit effluent limitations if the requirements of Part II.V.2 are met. A determination made during administrative review of claims that noncompliance was caused by upset, and before an action for noncompliance, is not a final administrative action subject to judicial review.
2. A permittee who wishes to establish the affirmative defense of upset shall demonstrate, through properly signed, contemporaneous operating logs, or other relevant evidence that:
 - a. An upset occurred and that the permittee can identify the cause(s) of the upset;
 - b. The permitted facility was at the time being properly operated;
 - c. The permittee submitted notice of the upset as required in Part II.I; and
 - d. The permittee complied with any remedial measures required under Part II.S.
3. In any enforcement proceeding the permittee seeking to establish the occurrence of an upset has the burden of proof.

W. Inspection and Entry.

The permittee shall allow the Director, or an authorized representative, upon presentation of credentials and other documents as may be required by law, to:

1. Enter upon the permittee's premises where a regulated facility or activity is located or conducted, or where records must be kept under the conditions of this permit;
2. Have access to and copy, at reasonable times, any records that must be kept under the conditions of this permit;
3. Inspect at reasonable times any facilities, equipment (including monitoring and control equipment), practices, or operations regulated or required under this permit; and
4. Sample or monitor at reasonable times, for the purposes of assuring permit compliance or as otherwise authorized by the Clean Water Act and the State Water Control Law, any substances or parameters at any location.

For purposes of this section, the time for inspection shall be deemed reasonable during regular business hours, and whenever the facility is discharging. Nothing contained herein shall make an inspection unreasonable during an emergency.

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X. Permit Actions.

Permits may be modified, revoked and reissued, or terminated for cause. The filing of a request by the permittee for a permit modification, revocation and reissuance, or termination, or a notification of planned changes or anticipated noncompliance does not stay any permit condition.

Y. Transfer of permits.

1. Permits are not transferable to any person except after notice to the Department. Except as provided in Part II.Y.2, a permit may be transferred by the permittee to a new owner or operator only if the permit has been modified or revoked and reissued, or a minor modification made, to identify the new permittee and incorporate such other requirements as may be necessary under the State Water Control Law and the Clean Water Act.
2. As an alternative to transfers under Part II.Y.1, this permit may be automatically transferred to a new permittee if:
 - a. The current permittee notifies the Department at least 30 days in advance of the proposed transfer of the title to the facility or property;
 - b. The notice includes a written agreement between the existing and new permittees containing a specific date for transfer of permit responsibility, coverage, and liability between them; and
 - c. The Board does not notify the existing permittee and the proposed new permittee of its intent to modify or revoke and reissue the permit. If this notice is not received, the transfer is effective on the date specified in the agreement mentioned in Part II.Y.2.b.

Z. Severability.

The provisions of this permit are severable, and if any provision of this permit or the application of any provision of this permit to any circumstance, is held invalid, the application of such provision to other circumstances, and the remainder of this permit, shall not be affected thereby.

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VPDES PERMIT PROGRAM FACT SHEET

This document gives pertinent information concerning the VPDES permit listed below and is being processed as a major municipal permit. The process consists of updating the effluent limitations and monitoring requirements for the existing facility.

1. Facility Name and Address:

SIC Code: 4952 (Sewerage Systems)

Totopotomoy WWTP
County of Hanover
Department of Public Utilities
P. O. Box 470
Hanover, VA 23069

Location: north of Pole Green Rd. in Hanover County

2. Permit No. VA0089915

Expiration Date:

3. Owner Contact:

Richard R. Johnson
County Administrator
Telephone No.: (804) 537-6005

4. Permit Drafted By:

Allan Brockenbrough

Date: 5/27/1998

Revisions:

" "
" "
" "
" "

6/26/1998

7/2/1998

10/14/1998

3/11/1999

DEQ Regional Office:

Piedmont Regional Office

Reviewed By:



Date:

3/15/99

5. Receiving Waters Classification:

Receiving Stream: Pamunkey River
Basin: York River
Subbasin: N/A
Section: 1
Class: II
Special: a

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7-Day, 10-Year Low Flow: 42.1 MGD
1-Day, 10-Year Low Flow: 38.1 MGD
30-Day, 5-Year Low Flow: 50.9 MGD
Harmonic Mean Flow: 211.6 MGD

6. Statutory or Regulatory Basis for Special Conditions and Effluent Limitations:

(X) State Water Control Law

() EPA Guidelines

(X) Clean Water Act

(X) Water Quality Standards

(X) Permit Regulation (SWCB VPDES Regulation)

() Other

(X) EPA NPDES Regulation (Federal Register)

7. Licensed Operator Requirements: Class I

8. Reliability Class: Class I

9. Permit Characterization:

- | | | | |
|-------------------------------------|---------|-------------------------------------|------------------------------------|
| <input type="checkbox"/> | Private | <input type="checkbox"/> | Effluent Limited |
| <input type="checkbox"/> | Federal | <input checked="" type="checkbox"/> | Water Quality Limited |
| <input type="checkbox"/> | State | <input checked="" type="checkbox"/> | Toxics Monitoring Program Required |
| <input checked="" type="checkbox"/> | POTW | <input checked="" type="checkbox"/> | Pretreatment Program Required |
| | | <input type="checkbox"/> | Possible Interstate Effect |
| | | <input type="checkbox"/> | Compliance Schedule Required |
| | | <input type="checkbox"/> | Interim Limits in Permit |
| | | <input type="checkbox"/> | Interim Limits in Other Document |

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10. Attach a schematic of Wastewater Treatment System(s), and provide a general description of the production cycle(s) and activities of the facility.

See Attachment A - plant schematic

11. Discharges Location Description: Provide USGS Topo which indicates the discharge location, significant discharger (s), water intakes, and other items of interest.

See Attachment B - Topo Maps

12. Discharge Description:

See Table I

13. Receiving Waters Information: Attach any memoranda or other information which helped to develop permit conditions, i.e., PReP complaints, special water quality studies, biological and/or chemical data, etc.

See Attachment C - Stream Sanitation Analysis
See Attachment D - Toxics Management Program
See Attachment E - Mixing Analysis

14. Site Inspection: Date: 11/21/97 Performed by: Allan Brockenbrough

15. Effluent Screening:

See Attachment F - Calculation of Quantification Levels

16. Effluent Limits:

See Table II for listing of effluent limitations and basis for limits

17. Special Conditions: List and give a brief rationale for all special conditions contained in the permit.

B.1. 95% Capacity Reopener

Rationale: Required by 9 VAC 25-31-200, §B.4.

B.2. CTO, CTC, O&M Manual Requirement

Rationale: Required by Code of Virginia § 62.1-44.19; VR 355-17-102.14, 1.15. Procedure for Obtaining a Construction permit, F. Operation and Maintenance Manuals; VR 355-17-102.20, 1.21. Issuance of the Operation Permit; VDH Sewage handling and Disposal Regulations § 2.16. Issuance of the construction permit, §2.22 Issuance of the operation permit.

B.3. Licensed Operator Requirement

Rationale: The VDH/SWCB Sewerage Regulations specifies a manning and classification schedule of wastewater treatment plant operators, based on plant capacity and specific treatment types. The Code of Virginia 54.1-2300 et seq, Rules and Regulations for Waterworks and Wastewater Works Operators, requires licensure of operators. The licensed operator requirements apply to wastewater treatment works based on flow and treatment type, there is no distinction between municipal and industrial.

B.4. Nutrient Enriched Waters Reopener

Rationale: 9 VAC 25-40, Policy for Nutrient Enriched Waters, allows reopening of permits if total phosphorus and total nitrogen in a discharge potentially exceed specified concentrations. The policy also anticipates that future nutrient limits may be needed to control aquatic plants.

B.5. Indirect Dischargers Requirement

Rationale: 9 VAC 25-31-200, §B. establishes notification requirements for the introduction of new pollutants into the POTW wastestream by an indirect discharger.

B.6. Sludge Reopener

Rationale: §405(d) of the Clean Water Act requires proper treatment and disposal of biosolids.

B.7. Sludge Management Plan

Rationale: Section 9 VAC 25-31-220B.2. of the VPDES Permit Regulation requires that the permit include appropriate conditions for the use or disposal of sewage sludge.

B.8. Sludge Management Plan Record Keeping Requirements

Rationale: Section 9 VAC 25-31-220B.2. of the VPDES Permit Regulation requires that the permit include appropriate conditions for the use or disposal of sewage sludge.

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B.9. Land Application of Sludge Annual Reporting Requirements

Rationale: Section 9 VAC 25-31-220B.2. of the VPDES Permit Regulation requires that the permit include appropriate conditions for the use or disposal of sewage sludge.

C. Pretreatment Program

Rationale: 9 VAC 25-31-730 establishes the responsibilities of state and local government, industry and the public to implement the National Pretreatment Standards and Requirements to control pollutants which pass through or interfere with treatment processes in POTWs or which may contaminate sewage sludge.

D. Toxics Monitoring Program Requirements

Rationale: The control of toxic pollutants is required by 9 VAC-31-220

E. Water Quality Standards Monitoring and Reopener

Rationale: State Water Control Law §62.1-44.21 authorizes the Board to request information needed to determine the discharge's impact on State waters. States are required to review data on discharges to identify actual or potential toxicity problems, or the attainment of water quality goals, according to 40 CFR Part 131, Water Quality Standards, subpart 131.11. If modifications to secondary treatment requirements are proposed, 40 CFR Part 125, Criteria and Standards for the NPDES, subpart 125.62 requires the establishment of a monitoring program.

9 VAC 25-31-220, §D. Water Quality Standards dictates that permits shall include limits to prevent violations of water quality standards. CFR Part 131, Water Quality Standards, requires the State to adopt water quality criteria to protect designated water uses (subpart 131.11), and review, modify and adopt water quality standards periodically (subpart 131.20). Section 302 of the Clean Water Act authorizes effluent limitations to be established which will contribute to the attainment or maintenance of the water quality.

18. **Material Stored:** List the type and quantity of wastes, fluids, or pollutants being stored at this facility. Briefly describe the storage facilities and list, if any, measures taken to prevent the stored material from reaching State waters.

The POTW stores and uses a variety of chemicals in the treatment process. Lime, ferric chloride, alum and various polymers will likely be stored under roof in such a manner as to prevent an accidental discharge. Final design of the storage facilities has not been completed.

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19. **Changes to Permit:** Use Table III to record changes in the permit limitations from the previously issued permit and/or during the permit processing period. Incorporate communications with applicant, VDH, EPA and any other agency where comments resulted in changes to the permit. List any changes associated with the special conditions or reporting requirements and the reasons for the changes.

a. 6/26/98 Revisions

- (1) Part I.B.2. - Schedule for submission of O&M Manual revised in response to permittee's comments.
- (2) Part I.C.1. - Schedule for submission of Pretreatment Program Plan of Study revised in response to permittee's comment.
- (3) Part I.A.1. (pp. 1 and 2 of 15) - Wording changed to clearly authorize discharge from both the 5.0 MGD and 10 MGD facilities. Change made in response to permittee's comment.
- (4) Parts I.A.5. - 6., I.B.8. - Clarified to indicate that these sections only apply if land application is selected as the disposal option under the final sludge management plan and to clarify the intent of the certification statement in Part I.B.8.f.
- (5) Part I.B.9. - Annual report requirement added in accordance with agency guidance.

b. 10/14/98 Revision

- (1) On 10/13/98, DEQ received a modification to the permit application requesting that the outfall location be moved approximately 0.6 mile. This change resulted in revision of the second page of Attachment B to this Fact Sheet and no change to the permit itself.

c. 3/11/99 Revision

- (1) On 3/11/99, the State Water Control Board directed DEQ staff to include an instream benthic macroinvertebrate study in the permit in response to comments received from the public. This requirement can be found in Part I.C.4. of the permit.

20. **Variances/Alternate Limits or Conditions:** Provide justification or refutation rationale for modifications or alternatives to required permit conditions/limitations. This includes, but is not limited to:
- waivers from testing requirements
 - variances from technology guidelines or water quality standards
 - variances from VPDES permit manual guidance

N/A

21. **Public Notice Information:**

Comment period Start Date: December 17, 1998
 End Date: February 4, 1999

A public hearing on the proposed VPDES permit was held in Hanover Courthouse on January 19, 1999. Comments received at the public hearing and during the subsequent comment period included concerns with Dissolved Oxygen levels in the Pamunkey River, toxicity impacts, endangered species, outfall location, nutrients, wetlands impacts, water supply issues, temperature impacts and numerous

miscellaneous local planning issues outside of the purview of the VPDES permitting process. The comments were summarized and presented to the State Water Control Board at their 3/11/99 meeting. The Board voted to direct the staff to issue the permit with changes noted in this fact sheet (decrease TSS limits of 10 mg/l monthly average, increase minimum DO limits to 6.5 mg/l, include requirement for an instream macroinvertebrate study).

All pertinent information is on file and may be inspected, and arrangements made for copying by contacting Allan Brockenbrough at:

Virginia DEQ
Piedmont Regional Office
4949-A Cox Road
Glen Allen, VA 23060
Telephone No. (804) 527-5027

22. Sludge Use or Disposal: Provide description of sewage sludge land application plan elements addressed in permit, if applicable.

See Parts I.A.5., I.A.6., I.B.7. and I.B.8. Sludge from this facility will be either land applied by an independent contractor or sent to a landfill. The permit includes sludge monitoring for a "pollutant concentration" sludge as well as conditional approval of the Sludge Management Plan and sludge record keeping requirements.

23. Additional Comments:

- a. This permit addresses a newly proposed discharge so anti-degradation procedures were followed. The receiving stream (Pamunkey River) was determined to be a Tier II water and wasteload allocations were calculated accordingly. See Attachment F for application of antidegradation procedures in calculating quantification levels for metals monitoring. The effluent limitations included in Attachment C are also considered to have negligible impact on the receiving stream and thus, are in compliance with antidegradation procedures for Tier II waters.
- b. As an initial permit issuance, no existing effluent limitations have been relaxed or eliminated so antibacksliding is not a factor.

TABLE I
NUMBER AND DESCRIPTION OF OUTFALLS

OUTFALL NUMBER	DISCHARGE SOURCE (1)	TREATMENT (2)	FLOW (3)
001	Municipal and industrial wastewater from Hanover County	Screening, grit removal, activated sludge aeration basins (BNR mode), secondary clarifiers, UV disinfection and post aeration	5 and 10 MGD

(1) List operations contributing to flow.

(2) Give brief description, unit by unit.

(3) Give maximum 30 day average flow for industry, and design flow for municipal. 0.1410

TABLE II
EFFLUENT LIMITATIONS FOR MUNICIPAL PERMITS

() Interim Limitations
(X) Final Limitations

Outfall Nos. 001
Design Flow 5.0 MGD

Effective Dates - From: permit issuance
To: permit expiration

PARAMETER	EFFLUENT GUIDELINES/ JUDGEMENT	WATER* QUALITY	DISCHARGE LIMITATIONS						MONITORING	
			MONTHLY AVERAGE		WEEKLY AVERAGE		MINIMUM	MAXIMUM	FREQUENCY	SAMPLE TYPE
			mg/l	kg/d	mg/l	kg/d				
CBOD ₅	BEJ		10.0	189	15.0	284	NA	NA	1/Day	24 Hr Comp
TSS	BEJ		10.0	189	15.0	284	NA	NA	1/Day	24 Hr Comp
TKN	BEJ		3.0	57	4.5	85	NA	NA	1/Day	24 Hr
pH (S.U.)	BEJ		NA		NA		6.0	9.0	1/Day	Grab
Dissolved Oxygen	BEJ		NA		NA		6.5 mg/l	NA	1/Day	Grab
Total Phosphorus	BEJ		2.0	38	NA		NA	NA	1/Day	24 HC
Fecal Coliform	BEJ		200 N/100 ml (geometric mean)		NA		NA	NL	1/Day	Grab

*Key

1. VWCB Water Quality Standards
2. Other (e.g. Policy for Nutrient Enriched Waters, Toxics Regulation)

Permit No. VA0089915
Fact Sheet
Page 7 of 10

0.001

**TABLE II
EFFLUENT LIMITATIONS FOR MUNICIPAL PERMITS**

() Interim Limitations
(X) Final Limitations

Outfall Nos. 001
Design Flow 10.0 MGD

Effective Dates - From: permit issuance
To: permit expiration

PARAMETER	EFFLUENT GUIDELINES/ JUDGEMENT	WATER* QUALITY	DISCHARGE LIMITATIONS						MONITORING	
			MONTHLY AVERAGE		WEEKLY AVERAGE		MINIMUM	MAXIMUM	FREQUENCY	SAMPLE TYPE
			mg/l	kg/d	mg/l	kg/d				
CBOD ₅	BEJ		10.0	379	15.0	568	NA	NA	1/Day	24 Hr Comp
TSS	BEJ		10.0	379	15.0	568	NA	NA	1/Day	24 Hr Comp
TKN	BEJ		3.0	114	4.5	170	NA	NA	1/Day	24 Hr
pH (S.U.)	BEJ		NA		NA		6.0	9.0	1/Day	Grab
Dissolved Oxygen	BEJ		NA		NA		6.5 mg/l	NA	1/Day	Grab
Total Phosphorus	BEJ		2.0	76	NA		NA	NA	1/Day	24 HC
Fecal Colliform	BEJ		200 N/100 ml (geometric mean)		NA		NA	NL	1/Day	Grab

*Key

1. VWCB Water Quality Standards
2. Other (e.g. Policy for Nutrient Enriched Waters, Toxics Regulation)

Permit No. VA0089915
Fact Sheet
Page 8 of 10

0.1615

Table III

PERMIT PROCESSING CHANGE SHEET

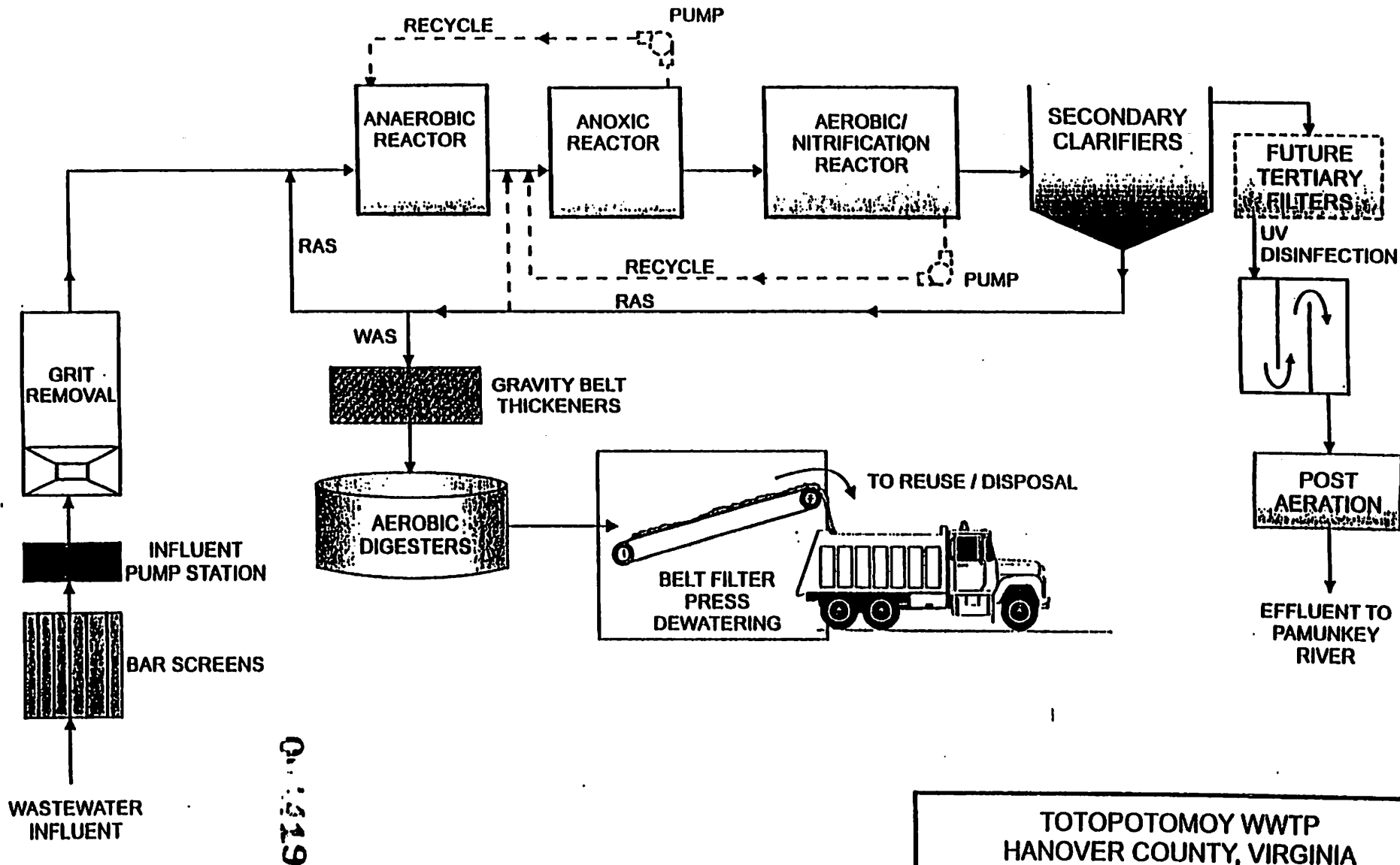
1. EFFLUENT LIMITATIONS AND MONITORING REQUIREMENTS

Outfall No.	Parameter Changed	Monitoring Requirement Changed		Effluent Limits Changed		Rationale	Date and Initials
		From	To	From	To		
001	Suspended Solids (5 MGD facility): Monthly Average Weekly Average	NC	NC	10 mg/l 189 kg/d 15 mg/l 284 kg/d	15 mg/l 284 kg/d 22.5 mg/l 426 kg/d	TSS changed, in accordance with permittee's request, to level at which VDH would not require installation of effluent filters. TSS limit is not water quality-based and modification is not expected to affect water quality in the receiving stream.	7/2/98 ABII
001	Suspended Solids (10 MGD facility): Monthly Average Weekly Average	NC	NC	10 mg/l 379 kg/d 15 mg/l 568 kg/d	15 mg/l 568 kg/d 22.5 mg/l 852 kg/d	TSS changed, in accordance with permittee's request, to level at which VDH would not require installation of effluent filters. TSS limit is not water quality-based and modification is not expected to affect water quality in the receiving stream.	7/2/98 ABII
001	Suspended Solids (5 MGD facility): Monthly Average Weekly Average	NC	NC	15 mg/l 284 kg/d 22.5 mg/l 426 kg/d	10 mg/l 189 kg/d 15 mg/l 284 kg/d	As directed by the State Water Control Board, the TSS limitations were changed back as originally drafted in order to obtain the effluent reliability associated with effluent filters.	3/11/99 ABII

001	Suspended Solids (10 MGD facility):	NC	NC			As directed by the State Water Control Board, the TSS limitations were changed back as originally drafted in order to obtain the effluent reliability associated with effluent filters.	3/11/99 ABII
	Monthly Average			15 mg/l 568 kg/d	10 mg/l 379 kg/d		
	Weekly Average			22.5 mg/l 852 kg/d	15 mg/l 568 kg/d		
001	Dissolved Oxygen (5 and 10 MGD)	NC	NC	5.0 mg/l	6.5 mg/l	As directed by the State Water Control Board, the DO limitation was increased in order to further offset the CBOD discharge and to meet the antidegradation policy in the initial instream mix.	3/11/99 ABII

NC denotes no change

000000



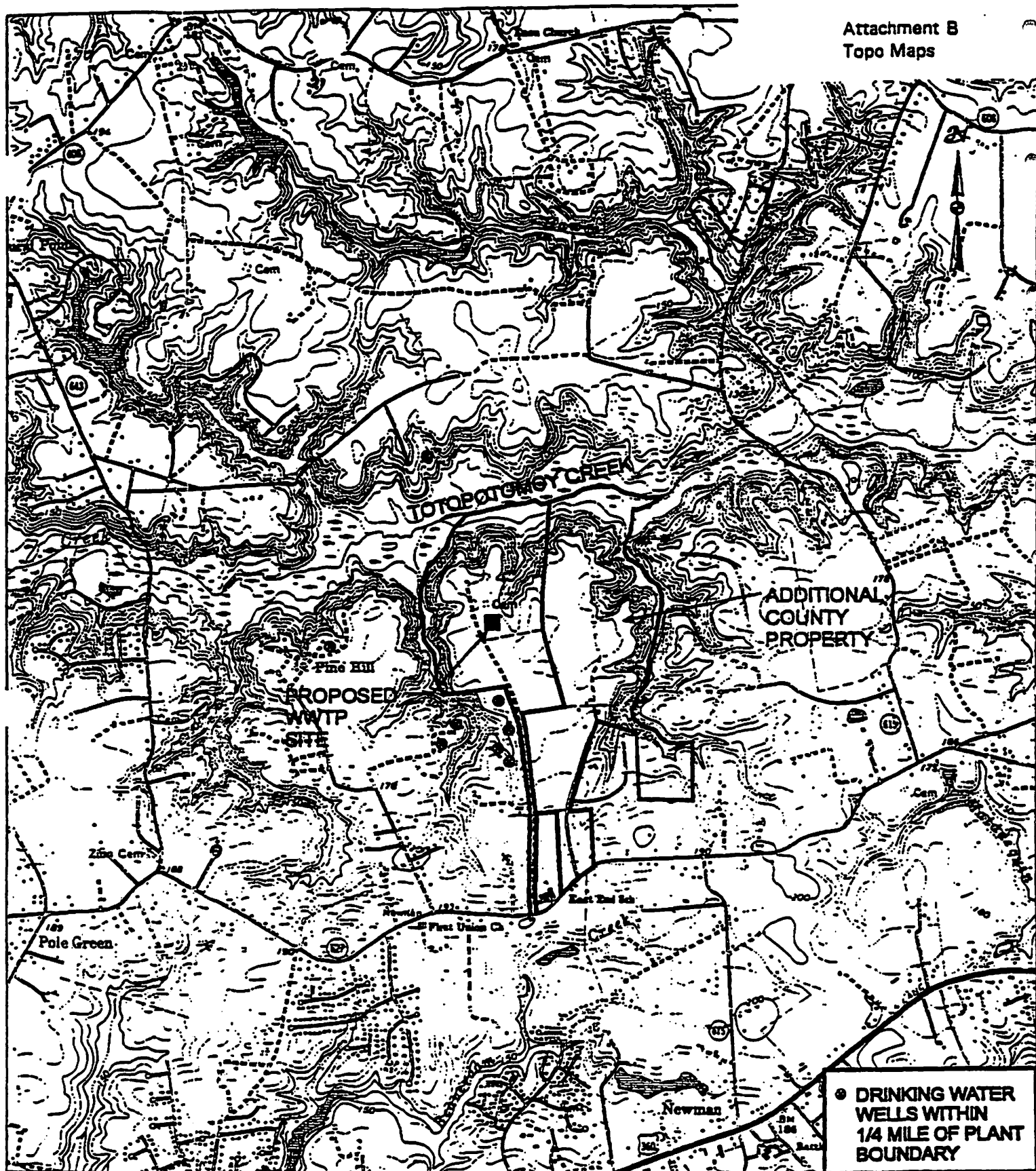
HAZEN AND SAWYER

TOTOPOTOMOY WWTP
HANOVER COUNTY, VIRGINIA

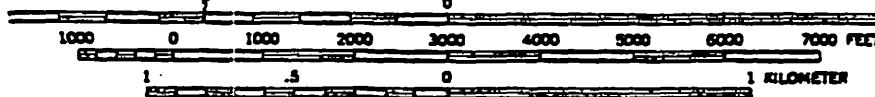
PROCESS FLOW SCHEMATIC
DISCHARGE SERIAL NO.001

APRIL, 1998

SHEET 1 of 1



LAT. $37^{\circ} 37' 30''$
LONG. $77^{\circ} 20' 0''$ SCALE 1:24 000



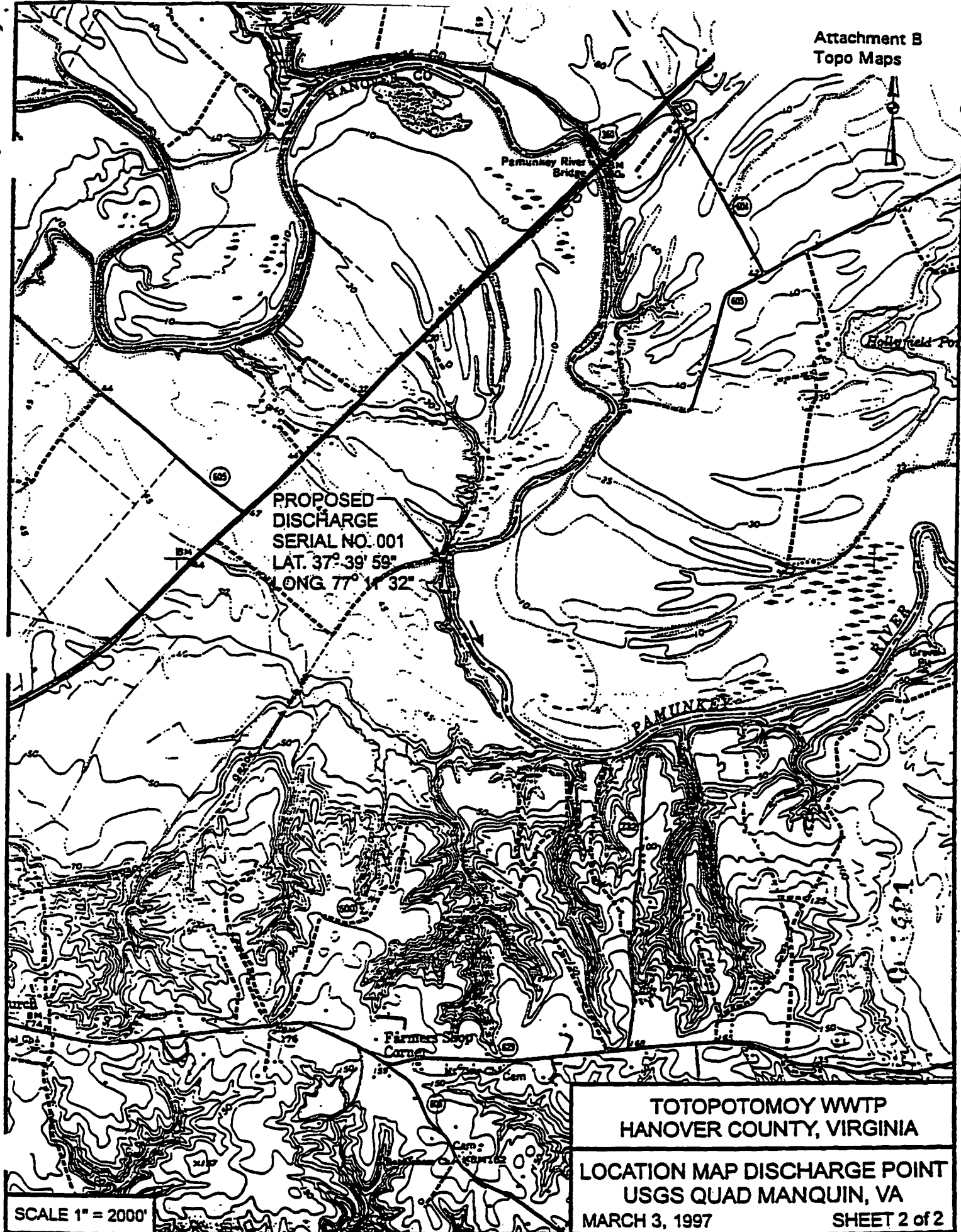
CONTOUR INTERVAL 10 FEET
NATIONAL GEODETTIC VERTICAL DATUM OF 1929

TOTOPOTOMOY WWTP
HANOVER COUNTY, VIRGINIA

LOCATION MAP WWTP SITE
USGS QUAD STUDLEY, VA

MARCH 3, 1997

SHEET 1 of 2



MEMORANDUM

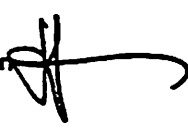
DEPARTMENT OF ENVIRONMENTAL QUALITY
Piedmont Regional Office

4949-A Cox Road, Glen Allen, VA 23060-6296

804/527-5020

SUBJECT: Results of Stream Sanitation Analysis and Effluent Limit Recommendations
Totopotomoy Wastewater Treatment Plant - Hanover County
Discharge to Pamunkey River

TO: Curt Linderman

FROM: Jon van Soestbergen 

DATE: June 2, 1997

COPIES: Allan Brockenbrough, File

A stream sanitation analysis for the proposed Totopotomoy wastewater treatment plant (WWTP) discharge to the Pamunkey River was received April 28, 1997. A flow frequency analysis by Paul Herman dated May 6, 1997 for the Pamunkey River at the discharge location was also received. The proposed discharge will be to the Pamunkey River at river mile 8-PMK054.89 (latitude/longitude 37°39'59"/077°14'32") in watershed VAP-F13E. The Pamunkey River is tidally influenced at the proposed discharge location. The application for VPDES permit submitted by the County indicates an initial design flow of 5 MGD, with future expansion to 10 MGD. Fresh water inflow (background 7Q10) at the point of discharge is 65.2 cfs (42.1 MGD).

Seasonal dissolved oxygen (DO) violations in the tidally influenced reaches of the Pamunkey River are well documented (DEQ Memoranda, October 1, 1990, March 19, 1996). The violations are considered to be the result of natural conditions caused by extensive marshlands that border the tidal Pamunkey River. Although the frequency of violations has been insufficient in the past to consider the river impaired for 305(b) assessment purposes, the assimilative capacity of the river with respect to DO is considered to be fully allocated.

Because the river reach to which the proposed WWTP will discharge is considered fully allocated, a best professional judgment (BPJ) approach to establishing VPDES permit limits to maintain DO concentrations in the Pamunkey River is recommended. This approach is supported by DEQ's Water Permits Support Division (M.D. Phillips, e-mail communication, March 17, 1997). The basis for the BPJ approach is A.J. Anthony's Swamp Limits memorandum (A.J. Anthony, 1987), which recommends the following effluent limits, regardless of discharge flow:

cBOD ₅ :	10 mg/l
TSS:	10 mg/l
TKN:	3 mg/l
Cl ₂ :	0.011 mg/l

A DO limit of 5.0 mg/l is recommended to reflect projected background conditions in the Pamunkey River.

If you have any questions or need additional information, let me know.

0.1422

Stream Sanitation Analysis - Pamunkey River at Proposed Totopotomoy WWTP Discharge
Page 2

References

- Alling, Mark, "Tidal Pamunkey River Dissolved Oxygen Study, Performed June 1 - October 31, 1997", DEQ Memorandum to Curt Linderman, March 19, 1996.
- Alling, Mark, "Dissolved Oxygen Standard Violations on the Pamunkey River Near the Proposed New Kent County STP", DEQ Memorandum to Allan Brockenbrough, October 1, 1990.
- Phillips, M.D., "Discharge to Pamunkey River", DEQ Internal E-mail to Allan Brockenbrough, March 17, 1997.
- Anthony, A.J., "Advisory Notification of Effluent Limits for Swamp and Marsh Waters", DEQ Memorandum to Larry Lawson, March 9, 1987.

04-1423



MEMORANDUM

DEPARTMENT OF ENVIRONMENTAL QUALITY
Piedmont Regional Office


4949-A Cox Road

Glen Allen, VA 23060

804/527-5020

SUBJECT: Proposed Totopotomoy Wastewater Treatment Plant, Hanover County
Toxics Management Program Special Condition

TO: Allan Brockenbrough

FROM: Jody Bryan 

DATE: May 1, 1998

COPIES: Deborah DeBiasi, CO - TMP

The DEQ Piedmont Regional Office is in the process of drafting a VPDES permit for a proposed 5 MGD (with expansion to 10 MGD) wastewater treatment facility in Hanover County. The facility will be called the Totopotomoy Wastewater Treatment Plant because it will be located near Totopotomoy Creek, however, the effluent will be piped eight miles east to the Pamunkey River. Treatment at the facility is to include screening, grit removal, primary clarifiers, mixing/aeration tanks (biological nutrient removal), secondary clarifiers, ultraviolet disinfection, and post aeration prior to discharge via outfall 001 to the Pamunkey River. Using a 7Q10 of 53.4 MGD for the Pamunkey River at the proposed outfall site, the Instream Waste Concentration (IWC) of the effluent is calculated to be 9.4% for the 5 MGD plant and the IWC for the 10 MGD expansion is 18.7%.

According to current permitting guidance and DEQ policy, all POTWs discharging 1 MGD or greater should contain a Toxics Management Program (TMP) special condition in the VPDES permit. The purpose of the TMP is to determine if the effluent causes, or has reasonable potential to cause, acute or chronic toxicity to aquatic life in the receiving stream. In the attached TMP for the proposed 5 MGD facility and 10 MGD expansion, I recommend quarterly acute and chronic toxicity tests for a period of one year, beginning three months after issuance of the Certificate to Operate (CTO) for the newly constructed plant. The test organisms required are *Ceriodaphnia dubia* and *Pimephales promelas* in both the acute and chronic testing. Chronic test dilutions should bracket the IWC of 9.4% effluent for the 5 MGD facility; once the 10 MGD expansion is operational, the chronic test dilutions should bracket the IWC of 18.7%.

Please incorporate the attached TMP into the draft permit.

0-1424

E. Toxics Management Program

1. Biological Monitoring:

- a. In accordance with the schedule in (3) below and commencing within three months following issuance of the Certificates to Operate (CTO's) for the 5 MGD and 10 MGD facilities, the permittee shall conduct quarterly acute and chronic toxicity tests for a period of one year using 24-hour flow- proportioned composite samples of final effluent from outfall 001. The acute tests shall be 48-hour static tests using Ceriodaphnia dubia and Pimephales promelas, both conducted in such a manner and at sufficient dilutions for calculation of a valid LC_{50} . The chronic tests shall be static renewal tests using C. dubia and P. promelas. The C. dubia test shall be a 3-brood survival and reproduction test and the P. promelas test shall be a 7-day larval survival and growth test. These chronic tests shall be conducted in such a manner and at sufficient dilutions to determine the "No Observed Effect Concentration" (NOEC) for survival and reproduction or growth. The permittee may provide additional samples to address data variability during the one year period of initial data generation. These data may be included in the evaluation of effluent toxicity. The results of all such additional analyses shall be reported. Technical assistance in developing the procedures for these tests shall be provided by the Department of Environmental Quality staff, if requested by the permittee. Test protocols and the use of alternative species shall be approved by the Department of Environmental Quality staff prior to initiation of testing.

- b. The following criteria shall be used in evaluating the toxicity test data generated in 1.a. above:

- (1) LC_{50} greater than or equal to 100% effluent in six of the total of eight acute toxicity tests, or in at least 75% of the tests conducted, if more than eight tests are conducted, and
- (2) No Observed Effect Concentration (NOEC) greater than or equal to the Instream Waste Concentration (IWC) of 9.4% for the 5 MGD facility and 18.7% for the 10 MGD facility, in six of the total of eight chronic toxicity tests, or in at least 75% of the tests conducted if more than eight tests are conducted.

Any effluent failing either of the above criteria shall be considered to have demonstrated actual or potential toxicity and a Toxicity Reduction Evaluation (TRE) will be required.

- c. If, prior to completing the monitoring requirements specified in 1.a. above, it is determined that the effluent fails the decision criteria outlined in 1.b., a TRE may be required. Upon notification by the DEQ that a TRE is required, the permittee shall initiate a TRE and may stop conducting the toxicity tests of 1.a.
- d. Following completion of the testing of the outfall as above, the permittee shall continue acute and chronic toxicity testing of the outfall annually. The first annual tests shall be conducted within three months from the last quarterly tests. The test organisms shall be those identified as the most sensitive species from the quarterly acute and chronic tests or alternative species

01-1425

approved by the Department of Environmental Quality staff. Annual testing of the outfall is not required in cases where the need for a TRE of the outfall has been established.

- e. If, in the testing according to 1.d. above, any of the annual acute toxicity tests yields an LC_{50} of less than 100% effluent or any annual chronic toxicity test yields an NOEC of less than the IWC of 9.4% for the 5 MGD facility and 18.7% for the 10 MGD facility, the test shall be repeated within three months.
 - (1) If the retest also indicates an LC_{50} of less than 100% effluent or an NOEC of less than the IWC, quarterly toxicity testing as in 1.a. above shall commence within three months. The results of these tests will be included in the evaluation of the need for toxicity reduction.
 - (2) If the retest does not confirm the results of the first test, then annual testing in accordance with the annual compliance schedule shall resume.

2. Toxicity Reduction Evaluation:

- a. If the results of this Toxics Management Program or other available information indicate that the wastewaters are actually or potentially toxic, the permittee shall submit:
 - (1) a Toxicity Reduction Evaluation (TRE) plan, or
 - (2) at the permittee's option, an instream impact study plan, and
 - (3) an accompanying implementation schedulewithin 120 days of the notification of such a determination by the Department of Environmental Quality.
- b. The requirement of this plan shall be to:
 - (1) assure the absence of actual or potential toxicity, or
 - (2) to demonstrate that there is, or would be, no adverse impact from the discharge on all reasonable and beneficial uses of the state's waters.
- c. Upon completion of the review of the plan, the permittee shall implement the plan and the permit may be modified or alternatively revoked and reissued in order to reflect appropriate permit conditions and a compliance schedule.

3. Reporting Schedule:

The permittee shall submit 2 copies of the results of the toxicity tests analyses specified in this Toxics Management Program in accordance with the following schedule:

0-1425

a. Submit toxicity test protocols for approval	Within two months following the issuance of the Certificates to Operate (CTO's) for the 5 MGD and 10 MGD facilities
b. Conduct first quarterly biological tests	Within three months following the issuance of the Certificates to Operate (CTO's) for the 5 MGD and 10 MGD facilities
c. Submit results of all tests conducted during the first quarter	With the Discharge Monitoring Report (DMR) for the fourth month following the issuance of the Certificates to Operate (CTO's) for the 5 MGD and 10 MGD facilities
d. Conduct second quarterly biological tests	Within six months following the issuance of the Certificates to Operate (CTO's) for the 5 MGD and 10 MGD facilities
e. Submit results of all tests conducted during the second quarter	With the DMR submitted for the seventh month following the permit effective date
f. Conduct third quarterly biological tests	Within nine months following the issuance of the Certificate to Operate (CTO's) for the 5 MGD and 10 MGD facilities
g. Submit results of all tests conducted during the third quarter	With the DMR submitted for the tenth month following the issuance of the Certificates to Operate (CTO's) of the 5 MGD and 10 MGD facilities
h. Conduct fourth quarterly biological tests	Within twelve months following the issuance of the Certificates to Operate (CTO's) for the 5 MGD and 10 MGD facilities
i. Submit results of all tests conducted during the fourth quarter	With the DMR submitted for the thirteenth month following the issuance of the Certificates to Operate (CTO's) for the 5 MGD and 10 MGD facilities
j. Conduct first annual biological tests	Within fifteen months following the issuance of the Certificates to Operate (CTO's) for the 5 MGD and 10 MGD facilities
k. Submit results of first annual biological tests	With the DMR submitted for the sixteenth month following the issuance of the Certificates to Operate (CTO's) for the 5 MGD and 10 MGD facilities

0. 427

l. Conduct subsequent annual biological tests	Within subsequent twelve month periods from 3.j.
m. Submit results of subsequent annual biological tests	With the DMR submitted every 12 months from 3.k.

0. 428

Attachment E Mixing Analysis

The proposed Totopotomoy WWTP will discharge to the Pamunkey River through a diffuser located on the bottom of the river. The proposed diffuser will extend one third of the way across the river and will consist of 14 6-inch ports spaced 6 feet apart. The ports will be located approximately 1 foot off of the river bottom.

Hydraulic modeling results were submitted by the permittee to establish the extent of mixing in the Pamunkey River which is tidal at the outfall location. Version 3.1 of the CORMIX model was run with input parameters based on a field survey and results from the Virginia Institute of Marine Science's hydrodynamic model of the York River based on the HEM-3D model (see attached).

The results of the CORMIX modeling indicate that a significant amount of tidal mixing occurs in the Pamunkey River. However the CORMIX modeling was limited to a single ebb tide condition and did not reflect the impact of a continuous discharge over numerous tidal cycles. The results of the modeling were accurate enough to establish that the diffuser provides sufficient mixing to establish a complete mix with the freshwater flow in the Pamunkey River under 7Q10 and 1Q10 conditions. Establishing a complete mix with the freshwater inflow and not accounting for tidally induced mixing is a conservative approach consistent with permitting actions for other similarly situated dischargers in the upper James River estuary.

Q: 429

Dated: 04/)

PERMIT INFORMATION TRACKING (APPTAB)

VPDES Permit No. VA0089915

FACILITY NAME : Totopolomoy WWTP

PW : Allan Brockenbrough

FACILITY

Name: Totopolomoy WWTP

Address: P. O. Box 470

City: HANOVER

State, Zip: VA, 23089

Telephone: (804) 537-8005

Fax:

County: Hanover

Fips Code: 085

Planning District: 15

Facility Topo No : 128A

Facility Topo Name: STUDLEY

Chesapeake Bay: Y

Type of Ownership: Pub

Operation Company:

PERMIT

Major/Minor: M

Indust/Municipal: M

Activity Type: I

Reopeners:

Number of Outfalls: 1

Internal Outfalls :

Reliability Class: I

Operator Required:

ACTIVITY:

COMMENTS: 10/13/98 - applicant modifies application to move outfall

10/19/98 - outfall relocation to EPA

11/08/98 - EPA concurrence

01/19/99 - scheduled public hearing date

3/11/99 - approved by SWCB

3/16/99 - USFWS objection rec'd, issuance pending response

OWNER

Name: County of Hanover

Address: P. O. Box 470

City: HANOVER

State, Zip: VA, 23089

Telephone: (804) 537-8005

Fax:

NEWSPAPER

Newspaper: Herald Progress

Street: 11293 Air Park Road

City, ST Zip: Ashland, VA 23005

PROCESSING DATES

Effective Date: 04/28/99

Expiration Date: 04/28/04

Date Signed: 04/28/99

Reissuance App Due: / /

Application Received: 04/11/97

LOCATION:

INDUSTRIAL ACTIVITY:

025-0

025-0

Dated: 04/28/99

PERMIT INFORMATION TRACKING (APPTAB)

VPDES Permit No. VA0089915

Facility Name : Tolopolomoy WWTP

PW : Allan Brockenbrough

Processing Dates:

Owner Notify	/ /	App to VDH	04/25/97	DP to OWRM	07/06/98	DN Newspaper	12/09/98
APP Due	/ /	VDH Concur	05/20/97	OWRM Concur	/ /	DP to DGIF	12/10/98
App Rec'd	04/11/97	APP to VMRC	/ /	DP to VDH	06/01/98	DP to VMRC	/ /
App Retn'd	04/25/97	APP to DSS	05/20/97	VDH Concur	06/05/98	DP to VIMS	/ /
App Rec'd2	06/23/97	APP to OWRM	07/06/98	DP to EPA	07/06/98	DP to ADJ	/ /
App Retn'd2	08/25/97	OWRM Concur	/ /	EPA Concur	08/07/98	PN Publish	12/17/98
App Rec'd3	04/20/98	Site Visit	11/21/97	DP to Own	06/01/98	PN Hear	01/19/99
App Retn'd3	05/04/98	COMPLETE	10/13/98	Owner Comm	06/15/98	DMR Due	06/10/99
App Rec'd4	05/08/98	Draft Perm	10/14/98	DP to Own2	06/26/98	Signed	04/28/99
App Comp RO	05/08/98	Plan Concur	06/02/98	Owner Concur	/ /	Effective	04/28/99
				PN Auth.	08/24/98	Expiration	04/28/04

Permit Contact:

Contact Name : Richard R. Johnson
Contact Title : Acting County Administrator
Address : P. O. Box 470
City, State, Zip: HANOVER VA, 23089
Telephone : (804) 537-8005
Fax :

Comment : 10/13/98 - applicant modifies application to move outfall
10/19/98 - outfall relocation to EPA
11/08/98 - EPA concurrence
01/19/99 - scheduled public hearing date
3/11/99 - approved by SWCB
3/16/99 - USFWS objection rec'd, issuance pending response

Dated: 04/26/09

VPDES Permit No. VA0089915

PIPE INFORMATION

FACILITY NAME : Totopotomoy WWTP

(APPTAB)

PW : Allan Brockenbrough

OUTFALL No.001

Design Flow : 5
SIC Code : 4952
Toxic Limit :
TMP Status :
Treat Type : TBUU

Stream : Pamunkey River
Riv Basin : York River
Subbasin : N/A
Water Body :
Section : 1
Class : II
Spec Stds : a

Latitude : 373927 N
Longitude : 0771109 W

7Q10 : 42.1
7Q10 High : 125.8
1Q10 : 38.1
1Q10 High : 102.8
30Q5 : 50.9

Harmonic

Mean Flow : 211.6
IWC1 :
IWC2 :
IWC3 :
IWC4 :
IWC5 :
IWC6 :

OUTFALL No.

Design Flow :
SIC Code :
Toxic Limit :
TMP Status :
Treat Type :

Stream :
Riv Basin :
Subbasin :
Water Body :
Section :
Class :
Spec Stds :

Latitude :
Longitude :

7Q10 :
7Q10 High :
1Q10 :
1Q10 High :
30Q5 :

Harmonic

Mean Flow :
IWC1 :
IWC2 :
IWC3 :
IWC4 :
IWC5 :
IWC6 :

OUTFALL No.

Design Flow :
SIC Code :
Toxic Limit :
TMP Status :
Treat Type :

Stream :
Riv Basin :
Subbasin :
Water Body :
Section :
Class :
Spec Stds :

Latitude :
Longitude :

7Q10 :
7Q10 High :
1Q10 :
1Q10 High :
30Q5 :

Harmonic

Mean Flow :
IWC1 :
IWC2 :
IWC3 :
IWC4 :
IWC5 :
IWC6 :

-820-

01.1332

Appendix A

VIMS Data

C-433



The College of
WILLIAM & MARY

Chartered 1693

Virginia Institute of Marine Science
School of Marine Science

Department of Physical Sciences
P.O. Box 1346
Gloucester Point, Virginia 23062-1346
USA
804/684-7000, FAX 804/684-7105

February 5, 1998

Mr. Robert E. Fergen
Hazen and Sawyer
4011 West Chase Blvd.
Raleigh, NC 27607

Dear Mr. Fergen,

We have completed the model simulation of the York River system using the VIMS HEM-3D (Three-Dimensional Hydrodynamic-Eutrophication Model). The simulation conditions are per your specification; they are:

Mean tidal range at river mouth
Upstream freshwater discharges in:
Pamunkey River = 64 cfs.
Mattaponi River = 15 cfs.

Enclosed please find two figures presenting temporal variation of surface elevation and current velocity at two locations in the Pamunkey River, as you specified. The cross-sectioned area at the two locations are:

	Area, below mean sea level m^2	Width at mean sea level m
360 Bridge	105.3	58.5
Downstream location	139	69.5

0. 1434

VIMS

Page Two

An electronic file of the time series data is being transmitted separately. Please do not hesitate to contact me if you should have any questions.

You may reimburse our cost by preparing a check in the amount of \$1,000.00, payable to the Virginia Institute of Marine Science, and mailing it to my attention.

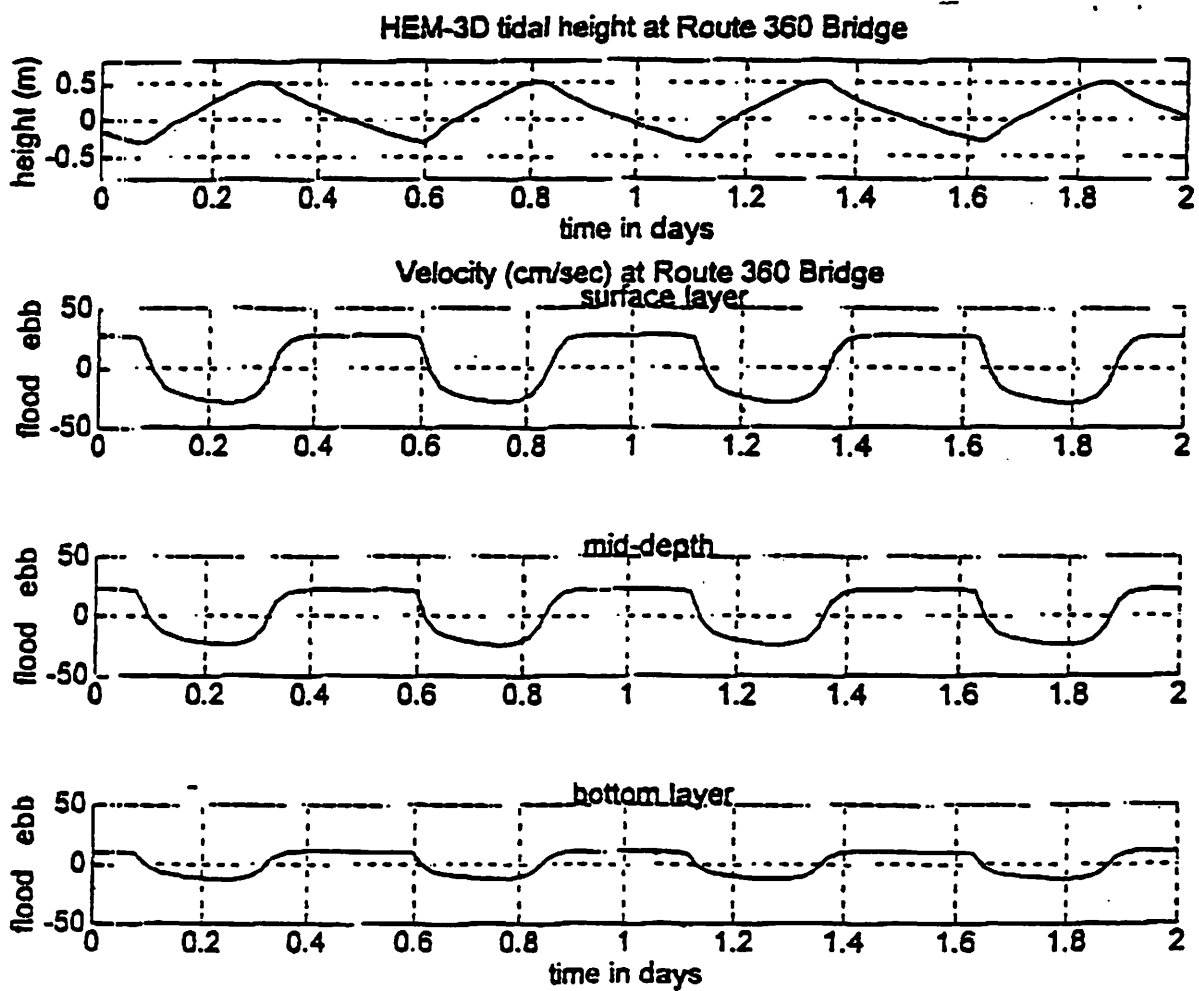
Sincerely yours,

Albert Y. Kuo

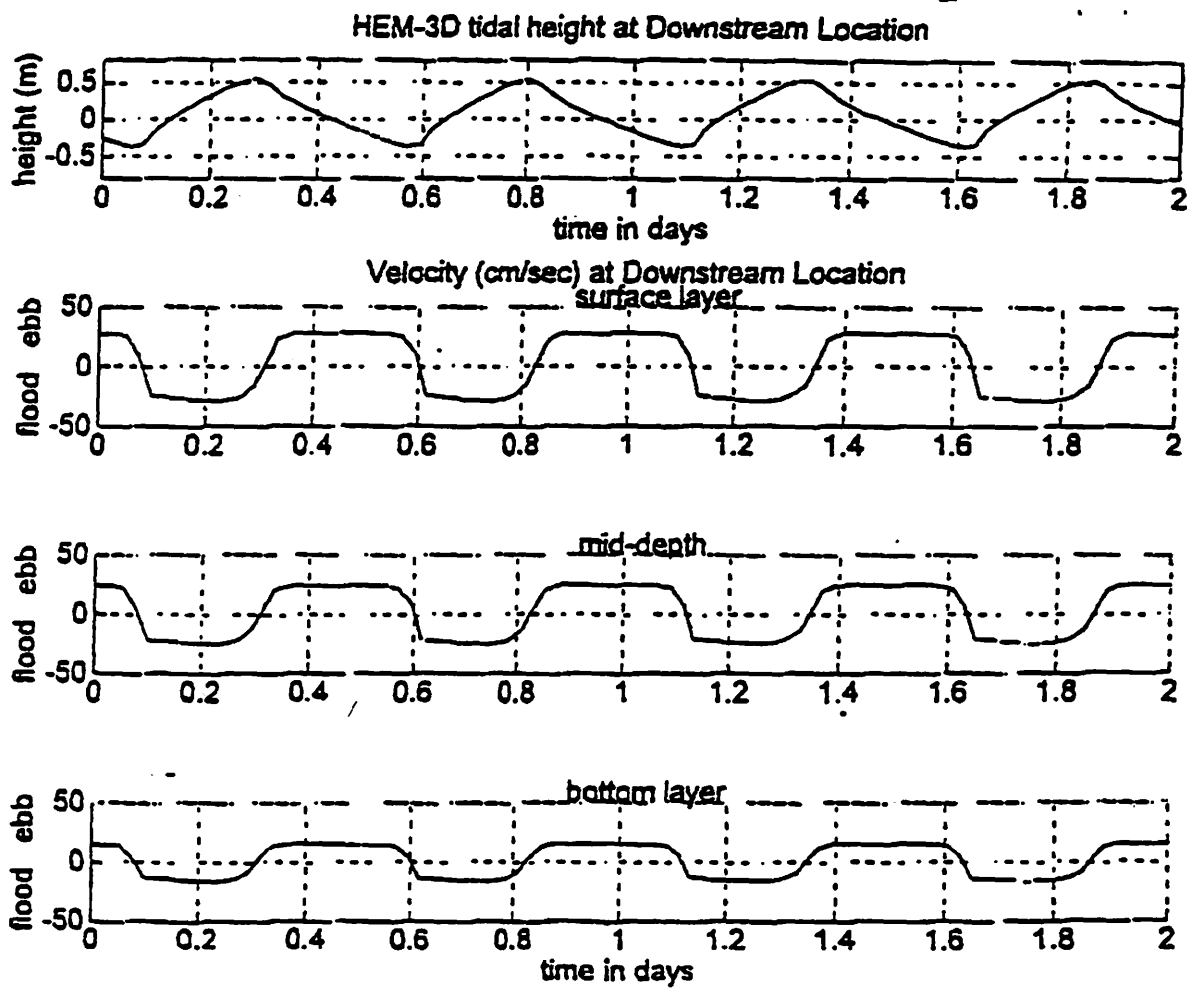
Albert Y. Kuo
Professor
Department of Physical Sciences

AYK: chh

0. 435



C. 1436



0-1437

Author: ,Albert Y. Kuo [S' :kuo@vims.edu] at HS_HOLLYWOOD
 Date: 2/5/98 2:28 PM
 Priority: Normal
 TO: Henning Huang at HAS-RALEIGH
 Subject: Model output

Dear Mr. Huang:

The followings are the model outputs, I am also faxing a letter and figures to Mr. Fergen.

Albert Kuo

>Output for Hazen & Sawyer Run

> Location: Route 360 Bridge latitude: 37 41'07" long: 77 deg 10'59"
 > columns 1-6 as follows: 1-counter, 2-model time (hrs), 3-tidal height (m),
 > 4-surface current (cm/sec), 5-midwater current (cm/sec),
 > 6-bottom current (cm/sec)

> 1	800.09000	-.22150	-.94696	-1.81353	-1.19678
> 2	800.61000	-.08400	-16.48441	-13.54062	-6.59538
> 3	801.13000	.00797	-21.05166	-17.43761	-8.58890
> 4	801.65000	.09376	-24.12322	-20.02951	-9.95559
> 5	802.16000	.17740	-26.50879	-22.05151	-11.07034
> 6	802.68000	.26080	-28.23064	-23.50924	-11.91052
> 7	803.20000	.34420	-29.17219	-24.32556	-12.42415
> 8	803.72000	.42170	-29.11388	-24.30326	-12.50527
> 9	804.23000	.48600	-27.50004	-22.97586	-11.89886
> 10	804.75000	.52370	-22.96215	-19.18024	-9.96862
> 11	805.27000	.50350	-11.47079	-9.40369	-4.80989
> 12	805.79000	.39040	12.56307	11.31112	5.62641
> 13	806.30000	.29870	23.70646	19.76538	10.03413
> 14	806.82000	.22580	26.10062	21.72907	10.97618
> 15	807.34000	.16020	26.87234	22.33446	11.20891
> 16	807.86000	.09795	26.85864	22.29845	11.12281
> 17	808.37000	.03886	26.89465	22.31216	11.05421
> 18	808.89000	-.01793	27.04727	22.40648	11.02146
> 19	809.41000	-.07360	27.28051	22.57629	11.01923
> 20	809.93000	-.12850	27.53605	22.75122	11.02146
> 21	810.44000	-.18030	27.48633	22.68431	10.90398
> 22	810.96000	-.22870	27.26680	22.47338	10.72150
> 23	811.48000	-.27310	26.77803	22.04292	10.43630
> 24	812.00000	-.30800	25.01156	20.55429	9.67003
> 25	812.51000	-.22260	-.77518	-1.67866	-1.16016
> 26	813.03000	-.08393	-16.53004	-13.57560	-6.61064
> 27	813.55000	.00838	-21.09278	-17.47260	-8.60690
> 28	814.07000	.09454	-24.18154	-20.07922	-9.98028
> 29	814.58000	.17790	-26.50019	-22.04292	-11.06450
> 30	815.10000	.26100	-28.21694	-23.49553	-11.89988
> 31	815.62000	.34390	-29.08298	-24.25355	-12.38865
> 32	816.14000	.42060	-29.01096	-24.21754	-12.45862
> 33	816.65000	.48520	-27.47774	-22.96215	-11.88771
> 34	817.17000	.52290	-22.93985	-19.15794	-9.95833
> 35	817.69000	.50250	-11.38418	-9.32875	-4.76908
> 36	818.21000	.38910	12.70301	11.40665	5.66362
> 37	818.72000	.29780	23.69276	19.76027	10.02916
> 38	819.24000	.22490	26.09203	21.72907	10.97258
> 39	819.76000	.15940	26.85864	22.33446	11.20616
> 40	820.28000	.09718	26.83634	22.28475	11.11338
> 41	820.79000	.03842	26.84493	22.27615	11.03312
> 42	821.31000	-.01835	27.01986	22.38417	11.00980
> 43	821.83000	-.07383	27.23939	22.54029	11.00173

$\bar{U} = 15.7$ $Q = 16.53 \text{ m}^3/\text{s}$

$\bar{U} = 20.2$ $Q = 21.27 \text{ m}^3/\text{s}$

$\bar{U} = 15.7$

0.438

$\bar{U} = 20.1$

> 44	822.33000	-.12880	27.30803	22.72832	11.00980
> 45	822.86000	-.18070	27.44173	22.64831	10.88649
> 46	823.38000	-.221	27.23079	22.43737	10.70538
> 47	823.90000	-.27290	26.72832	22.00691	10.42018
> 48	824.42000	-.30760	24.93955	20.49598	9.63865
> 49	824.93000	-.21930	-1.25732	-2.07069	-1.28531
> 50	825.45000	-.08218	-16.58630	-13.62276	-6.64426

Output for Hazen & Sawyer Run

> Location: Downstream Location latitude: 37 39'27" long: 77 deg 11'09"
 > columns 1-6 as follows: 1-counter, 2-model time (hrs), 3-tidal height (m),
 > 4-surface current (cm/sec), 5-midwater current (cm/sec),
 > 6-bottom current (cm/sec)

> 1	800.09000	-.13550	-24.87435	-21.50349	-13.64534
> 2	800.61000	-.02395	-25.20786	-21.96587	-14.06392
> 3	801.13000	.07644	-26.09922	-22.79225	-14.64331
> 4	801.65000	.16830	-27.34417	-23.88751	-15.38462
> 5	802.16000	.25700	-28.26929	-24.71462	-15.97442
> 6	802.68000	.34270	-29.00660	-25.37908	-16.44721
> 7	803.20000	.42330	-28.88027	-25.28288	-16.42603
> 8	803.72000	.49150	-27.42960	-24.01566	-15.63196
> 9	804.23000	.53740	-23.86634	-20.88175	-13.61230
> 10	804.75000	.53930	-15.83550	-13.76345	-8.90531
> 11	805.27000	.45380	2.46812	3.04476	3.39147
> 12	805.79000	.32770	22.94303	19.88268	12.75362
> 13	806.30000	.22650	27.60083	24.12373	15.57739
> 14	806.82000	.14660	28.23407	24.64964	15.86708
> 15	807.34000	.07702	28.20249	24.60692	15.79170
> 16	807.86000	.01225	28.07616	24.47841	15.66355
> 17	808.37000	-.05036	28.04094	24.43533	15.58889
> 18	808.89000	-.11230	28.30088	24.64927	15.67468
> 19	809.41000	-.17420	28.74099	25.01400	15.85741
> 20	809.93000	-.23300	28.63329	24.89662	15.73894
> 21	810.44000	-.28690	28.22476	24.52112	15.44924
> 22	810.96000	-.33510	27.45078	23.83294	14.96605
> 23	811.48000	-.37220	25.36868	21.99709	13.75304
> 24	812.00000	-.34110	10.54041	8.67894	4.82582
> 25	812.51000	-.13520	-24.96124	-21.57852	-13.68878
> 26	813.03000	-.02370	-25.25021	-21.99818	-14.08509
> 27	813.55000	.07728	-26.17424	-22.85651	-14.67635
> 28	814.07000	.16900	-27.33340	-23.87711	-15.38389
> 29	814.58000	.25710	-28.19318	-24.64927	-15.92203
> 30	815.10000	.34270	-28.96570	-25.33710	-16.42530
> 31	815.62000	.42210	-28.70941	-25.13283	-16.32947
> 32	816.14000	.49020	-27.34453	-23.94136	-15.58889
> 33	816.65000	.53640	-23.84480	-20.86021	-13.59186
> 34	817.17000	.53850	-15.82437	-13.75231	-8.89454
> 35	817.69000	.45240	2.59696	3.16825	3.47949
> 36	818.21000	.32660	22.97425	19.90459	12.76548
> 37	818.72000	.22560	27.60083	24.11332	15.56771
> 38	819.24000	.14570	28.22476	24.63923	15.85704
> 39	819.76000	.07614	28.20249	24.60692	15.78238
> 40	820.28000	.01182	28.00936	24.41415	15.62083
> 41	820.79000	-.05065	28.01867	24.41379	15.57739
> 42	821.31000	-.11240	28.24703	24.59542	15.64237
> 43	821.83000	-.17410	28.68714	24.97128	15.83550
> 44	822.35000	-.23290	28.57944	24.85354	15.70735
> 45	822.86000	-.28650	28.15796	24.46655	15.41656
> 46	823.38000	-.33470	27.39729	23.78018	14.93410
> 47	823.90000	-.37150	25.29402	21.93320	13.72000
> 48	824.42000	-.33850	10.11646	8.29361	4.55098
> 49	824.93000	-.13330	-25.00432	-21.62196	-13.73077

$$\bar{u} = 10.41 \quad Q = 28.37 \text{ m}^3/\text{s}$$

$$\bar{u} = 22.74 \quad Q = 31.61 \text{ m}^3/\text{s}$$

$$\bar{u} = 20.15$$

$$\bar{u} = 22.68$$

$$Q = 14.29$$

Appendix B

CORMIX Model Runs

0. 440

???????????

Subsystem CORMIX2:

Emergent Multiport Diffuser Discharges CORMIX v.3.10 June 1995

```
Site name/label:      Pamunkey River
Design case:          b5mgd
FILE NAME:             cormix\sim\bmgd      .cx2
Time of Fortran run:   03/24/98--16:42:09
```

Site B

$$Q_{eff} = \sigma mgd$$
$$H = 20 \text{ m}$$
$$u_d = 0.119 \text{ m/s}$$

```

Bounded section
BS      =      69.50 AS      =      139.00 QA      =      16.54 ICHREG = 1
ZA      =      2.00 KD      =      2.00
UA      =      .119 F      =      .039 USTAR = .8301E-02
UW      =      .000 UWSTAR=.0000E+00
Uniform density environment
STRCNO= U      RHQAM = 1002.0000

```

```

Diffuser type:      DITYPE= unidirectional perpendicular
BANK  = LEFT      DISTB = 16.90  YB1  = 5.00  YB2  = 28.80
LD    = 23.80     NOPEN = 14     SPAC = 1.83
BO    = .152  AO   = .018  HO   = .30
Nozzle/port arrangement: unidirectional without fanning
GAMMA = 90.00  THETA = .00  SIGMA = .00  BETA = 90.00
      = .858  GO    = .219      = .2190E+00
      J = 998.0000  DRHOO = .4000E+01  GP0  = .3915E-01
CO    = .1000E+03  CUNITS= ppm
IPOLL = 1          KS    = .0000E+00  KD    = .0000E+00

```

```

q0      = .9202E-02  m0      = .7891E-02  j0      = .3602E-03  SIGNJ0=      1.0
Associated 2-d length scales (meters)
lq=8    =      .011  lm      =      1.56  lm      =      .56
lmp     = 99999.00  lbp     = 99999.00  la      = 99999.00

```

[illegible]

```
FR0 = 41.83 FR00 = 11.10 R = 7.20
(slot) (port/nozzle)
```

```

*****
! Flow class (CORMIX2)      = MU2 2
< Applicable layer depth HS = 2.00 2
- *****

```

C. 141

CO = .1000E+03 CUNITS= ppm
TOX = 0

NSTD = 0
 REGM2 = 0
 XINT = 5000.00 XMAX = 5000.00

X-Y-Z COORDINATE SYSTEM:

ORIGIN is located at the bottom and the diffuser mid-point:

16.90 m from the LEFT bank/shore.

X-axis points downstream, Y-axis points to left, Z-axis points upward.

NSTEP = 30 display intervals per module

BEGIN MOD201: DIFFUSER DISCHARGE MODULE

Due to complex near-field motions: EQUIVALENT SLOT DIFFUSER (2-D) GEOMETRY

Profile definitions:

BV = Gaussian 1/e (37%) half-width, in vertical plane normal to trajectory

BH = top-hat half-width, in horizontal plane normal to trajectory

S = hydrodynamic centerline dilution

C = centerline concentration (includes reaction effects, if any)

X	Y	Z	S	C	BV	BH
.00	.00	.30	1.0	.100E+03	.01	11.90

END OF MOD201: DIFFUSER DISCHARGE MODULE

BEGIN MOD271: ACCELERATION ZONE OF UNIDIRECTIONAL CO-FLOWING DIFFUSER

In this laterally contracting zone the diffuser plume becomes VERTICALLY FULLY

MIXED over the entire layer depth (HS = 2.00m).

Full mixing is achieved after a plume distance of about five layer depths from the diffuser.

Profile definitions:

BV = layer depth (vertically mixed)

BH = top-hat half-width, in horizontal plane normal to trajectory

S = hydrodynamic average (bulk) dilution

C = average (bulk) concentration (includes reaction effects, if any)

X	Y	Z	S	C	BV	BH
.00	.00	.30	1.0	.100E+03	.00	11.90
.40	.00	.32	6.1	.163E+02	.08	11.79
.79	.00	.35	8.2	.121E+02	.16	11.69
1.19	.00	.37	9.9	.101E+02	.24	11.59
1.59	.00	.39	11.2	.889E+01	.32	11.51
1.98	.00	.42	12.5	.803E+01	.40	11.43
2.38	.00	.44	13.6	.738E+01	.48	11.36
2.78	.00	.46	14.6	.687E+01	.56	11.30
3.17	.00	.49	15.5	.645E+01	.63	11.24
3.57	.00	.51	16.4	.611E+01	.71	11.19
3.97	.00	.53	17.2	.581E+01	.79	11.14
4.36	.00	.56	18.0	.556E+01	.87	11.09
4.76	.00	.58	18.8	.533E+01	.95	11.05
5.16	.00	.60	19.5	.513E+01	1.03	11.01
5.55	.00	.63	20.2	.496E+01	1.11	10.97
5.95	.00	.65	20.8	.480E+01	1.19	10.94
6.35	.00	.67	21.5	.465E+01	1.27	10.91
6.74	.00	.70	22.1	.452E+01	1.35	10.88
7.14	.00	.72	22.7	.440E+01	1.43	10.85

7.54	.00	.74	23.3	. -01	1.51	10.83
7.93	.00	.77	23.9	.41eE+01	1.59	10.81
8.33	.00	.79	24.5	.408E+01	1.67	10.79
8.73	.00	.81	25.0	.399E+01	1.75	10.77
9.12	.00	.84	25.6	.391E+01	1.82	10.76
9.52	.00	.86	26.1	.383E+01	1.90	10.75
9.92	.00	.88	26.6	.376E+01	1.98	10.74
10.31	.00	.91	27.1	.369E+01	2.00	10.73
10.71	.00	.93	27.6	.362E+01	2.00	10.73
11.11	.00	.95	28.1	.356E+01	2.00	10.73
11.50	.00	.98	28.6	.350E+01	2.00	10.72
11.90	.00	1.00	29.1	.344E+01	2.00	10.72

Cumulative travel time = 80. sec

END OF MOD271: ACCELERATION ZONE OF UNIDIRECTIONAL CO-FLOWING DIFFUSER

BEGIN MOD251: DIFFUSER PLUME IN CO-FLOW

Phase 1: Vertically mixed, Phase 2: Re-stratified

Phase 2: The flow has RESTRATIFIED at the beginning of this zone.

This flow region is INSIGNIFICANT in spatial extent and will be by-passed.

END OF MOD251: DIFFUSER PLUME IN CO-FLOW

** End of NEAR-FIELD REGION (NFR) **

The initial plume WIDTH values in the next far-field module will be
CORRECTED by a factor 1.23 to conserve the mass flux in the far-field!

BEGIN MOD241: BUOYANT AMBIENT SPREADING

Profile definitions:

BV = top-hat thickness, measured vertically
BH = top-hat half-width, measured horizontally in y-direction
ZU = upper plume boundary (Z-coordinate)
ZL = lower plume boundary (Z-coordinate)
S = hydrodynamic average (bulk) dilution
C = average (bulk) concentration (includes reaction effects, if any)

Plume Stage 1 (not bank attached):

X	Y	Z	S	C	BV	BH	ZU	ZL
11.90	.00	2.00	29.1	.344E+01	2.00	13.20	2.00	.00
12.33	.00	2.00	29.1	.343E+01	1.99	13.33	2.00	.01
12.77	.00	2.00	29.2	.342E+01	1.97	13.46	2.00	.03
13.20	.00	2.00	29.3	.341E+01	1.96	13.59	2.00	.04
13.64	.00	2.00	29.4	.341E+01	1.94	13.72	2.00	.06
14.07	.00	2.00	29.4	.340E+01	1.93	13.85	2.00	.07
14.51	.00	2.00	29.5	.339E+01	1.92	13.98	2.00	.08
14.94	.00	2.00	29.6	.338E+01	1.90	14.11	2.00	.10
15.37	.00	2.00	29.6	.337E+01	1.89	14.23	2.00	.11
15.81	.00	2.00	29.7	.337E+01	1.88	14.36	2.00	.12
16.24	.00	2.00	29.8	.336E+01	1.87	14.49	2.00	.13
16.68	.00	2.00	29.9	.335E+01	1.86	14.61	2.00	.14
17.11	.00	2.00	29.9	.334E+01	1.84	14.74	2.00	.16
17.55	.00	2.00	30.0	.334E+01	1.83	14.86	2.00	.17
17.98	.00	2.00	30.1	.333E+01	1.82	14.99	2.00	.18

0.142

18.41	.00	2.00	30.1	.331E+01	1.81	15.11	2.00	.19
18.85	.00	2.00	30.2	.331E+01	1.80	15.23	2.00	.20
19.28	.00	2.00	30.2	.331E+01	1.79	15.36	2.00	.21
19.72	.00	2.00	30.3	.330E+01	1.78	15.48	2.00	.22
20.15	.00	2.00	30.4	.329E+01	1.77	15.60	2.00	.23
20.59	.00	2.00	30.4	.329E+01	1.76	15.72	2.00	.24
21.02	.00	2.00	30.5	.328E+01	1.75	15.84	2.00	.25
21.45	.00	2.00	30.6	.327E+01	1.74	15.96	2.00	.26
21.89	.00	2.00	30.6	.327E+01	1.73	16.08	2.00	.27
22.32	.00	2.00	30.7	.326E+01	1.72	16.20	2.00	.28
22.76	.00	2.00	30.7	.325E+01	1.71	16.32	2.00	.29
23.19	.00	2.00	30.8	.325E+01	1.70	16.44	2.00	.30
23.63	.00	2.00	30.9	.324E+01	1.69	16.55	2.00	.31
24.06	.00	2.00	30.9	.323E+01	1.68	16.67	2.00	.32
24.49	.00	2.00	31.0	.323E+01	1.68	16.79	2.00	.32
24.93	.00	2.00	31.0	.322E+01	1.67	16.90	2.00	.33

Cumulative travel time = 188. sec

Plume is ATTACHED to LEFT bank/shore.

Plume width is now determined from LEFT bank/shore.

Plume Stage 2 (bank attached):

X	Y	Z	S	C	BV	BH	ZU	ZL
24.93	16.90	2.00	31.0	.322E+01	1.67	33.80	2.00	.33
30.45	16.90	2.00	31.4	.318E+01	1.62	35.26	2.00	.38
35.97	16.90	2.00	31.8	.315E+01	1.57	36.69	2.00	.43
41.49	16.90	2.00	32.2	.311E+01	1.53	38.09	2.00	.47
47.02	16.90	2.00	32.5	.307E+01	1.50	39.46	2.00	.50
52.54	16.90	2.00	32.9	.304E+01	1.46	40.81	2.00	.54
58.06	16.90	2.00	33.2	.301E+01	1.43	42.14	2.00	.57
63.58	16.90	2.00	33.6	.298E+01	1.40	43.45	2.00	.60
69.10	16.90	2.00	33.9	.295E+01	1.38	44.74	2.00	.62
74.62	16.90	2.00	34.2	.292E+01	1.35	46.00	2.00	.65
80.15	16.90	2.00	34.6	.289E+01	1.33	47.25	2.00	.67
85.67	16.90	2.00	34.9	.287E+01	1.31	48.49	2.00	.69
91.19	16.90	2.00	35.2	.284E+01	1.29	49.70	2.00	.71
96.71	16.90	2.00	35.6	.281E+01	1.27	50.90	2.00	.73
102.23	16.90	2.00	35.9	.279E+01	1.25	52.09	2.00	.75
107.75	16.90	2.00	36.2	.276E+01	1.24	53.26	2.00	.76
113.28	16.90	2.00	36.6	.273E+01	1.22	54.42	2.00	.78
118.80	16.90	2.00	36.9	.271E+01	1.21	55.57	2.00	.79
124.32	16.90	2.00	37.2	.269E+01	1.19	56.71	2.00	.81
129.84	16.90	2.00	37.6	.266E+01	1.18	57.83	2.00	.82
135.36	16.90	2.00	37.9	.264E+01	1.17	58.94	2.00	.83
140.88	16.90	2.00	38.3	.261E+01	1.16	60.04	2.00	.84
146.41	16.90	2.00	38.6	.259E+01	1.15	61.13	2.00	.85
151.93	16.90	2.00	39.0	.257E+01	1.14	62.21	2.00	.86
157.45	16.90	2.00	39.3	.254E+01	1.13	63.28	2.00	.87
162.97	16.90	2.00	39.7	.252E+01	1.12	64.34	2.00	.88
168.49	16.90	2.00	40.0	.250E+01	1.11	65.39	2.00	.89
174.01	16.90	2.00	40.4	.248E+01	1.10	66.44	2.00	.90
179.54	16.90	2.00	40.8	.245E+01	1.10	67.47	2.00	.90
185.06	16.90	2.00	41.1	.243E+01	1.09	68.50	2.00	.91
190.58	16.90	2.00	41.5	.241E+01	1.08	69.50	2.00	.92

Cumulative travel time = 1562. sec

Plume is laterally FULLY MIXED at the end of the buoyant spreading regime.

END OF MOD241: BUOYANT AMBIENT SPREADING

 BEGIN M00261: PASSIVE AMBIENT MIXING IN UNIFORM AMBIENT

Vertical diffusivity (initial value) = .332E-02 m²/s

Horizontal diffusivity (initial value) = .415E-02 m²/s

.file definitions:

BV = Gaussian s.d.*sqrt(pi/2) (46%) thickness, measured vertically
 = or equal to layer depth, if fully mixed

BH = Gaussian s.d.*sqrt(pi/2) (46%) half-width,
 measured horizontally in Y-direction

ZU = upper plume boundary (Z-coordinate)

ZL = lower plume boundary (Z-coordinate)

S = hydrodynamic centerline dilution

C = centerline concentration (includes reaction effects, if any)

Plume Stage 2 (bank attached):

X	Y	Z	S	C	BV	BH	ZU	ZL
190.58	16.90	2.00	41.5	.241E+01	1.08	69.50	2.00	.92
350.89	16.90	2.00	43.2	.231E+01	1.13	69.50	2.00	.87
511.21	16.90	2.00	45.1	.222E+01	1.18	69.50	2.00	.82
671.52	16.90	2.00	47.1	.212E+01	1.23	69.50	2.00	.77
831.84	16.90	2.00	49.3	.203E+01	1.29	69.50	2.00	.71
992.15	16.90	2.00	51.7	.193E+01	1.35	69.50	2.00	.65
1152.46	16.90	2.00	54.4	.184E+01	1.42	69.50	2.00	.58
1312.78	16.90	2.00	57.3	.175E+01	1.50	69.50	2.00	.50
1473.09	16.90	2.00	60.4	.165E+01	1.58	69.50	2.00	.42
1633.41	16.90	2.00	63.9	.156E+01	1.67	69.50	2.00	.33
1793.72	16.90	2.00	67.8	.148E+01	1.77	69.50	2.00	.23
1954.03	16.90	2.00	72.1	.139E+01	1.88	69.50	2.00	.12

no interacts with BOTTOM.

passive diffusion plume becomes VERTICALLY FULLY MIXED within this prediction interval.

2114.35	16.90	2.00	76.6	.131E+01	2.00	69.50	2.00	.00
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Effluent is FULLY MIXED over the entire channel cross-section.

Except for possible far-field decay or reaction processes, there are

NO FURTHER CHANGES with downstream direction.

2274.66	16.90	2.00	76.6	.131E+01	2.00	69.50	2.00	.00
2434.98	16.90	2.00	76.6	.131E+01	2.00	69.50	2.00	.00
2595.29	16.90	2.00	76.6	.131E+01	2.00	69.50	2.00	.00
2755.60	16.90	2.00	76.6	.131E+01	2.00	69.50	2.00	.00
2915.92	16.90	2.00	76.6	.131E+01	2.00	69.50	2.00	.00
3076.23	16.90	2.00	76.6	.131E+01	2.00	69.50	2.00	.00
3236.55	16.90	2.00	76.6	.131E+01	2.00	69.50	2.00	.00
3396.86	16.90	2.00	76.6	.131E+01	2.00	69.50	2.00	.00
3557.17	16.90	2.00	76.6	.131E+01	2.00	69.50	2.00	.00
3717.49	16.90	2.00	76.6	.131E+01	2.00	69.50	2.00	.00
3877.80	16.90	2.00	76.6	.131E+01	2.00	69.50	2.00	.00
4038.12	16.90	2.00	76.6	.131E+01	2.00	69.50	2.00	.00
4198.43	16.90	2.00	76.6	.131E+01	2.00	69.50	2.00	.00
4358.74	16.90	2.00	76.6	.131E+01	2.00	69.50	2.00	.00
4519.06	16.90	2.00	76.6	.131E+01	2.00	69.50	2.00	.00
4679.37	16.90	2.00	76.6	.131E+01	2.00	69.50	2.00	.00
4839.69	16.90	2.00	76.6	.131E+01	2.00	69.50	2.00	.00
5000.00	16.90	2.00	76.6	.131E+01	2.00	69.50	2.00	.00

active travel time = 41449. sec

..mulation limit based on maximum specified distance = 5000.00 m.

This is the REGION OF INTEREST limitation.

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[illegible]

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CORMIX SESSION REPORT:

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CORMIX: CORNELL MIXING ZONE EXPERT SYSTEM

CORMIX v.3.10.

June 1995

NAME/LABEL: Pamunkey River
 ORIGINAL design case: a5mgd
 ORIGINAL file name: a5mgd
 Start of main session: 03/24/98--16:10:55

DESIGN ITERATION number: 1
 NEW DESIGN CASE: b5mgd
 NEW FILE NAME: bmgd
 Design subsystem CORMIX2: Submerged Multiport Diffuser Discharges
 Start of iteration session: 03/24/98--16:41:03

SUMMARY OF INPUT DATA:

AMBIENT PARAMETERS:

Cross-section = bounded
 Width BS = 69.5 m
 Channel regularity ICHREG = 1
 Ambient flowrate QA = 16.54 m³/s
 Average depth HA = 2 m
 Depth at discharge HD = 2 m
 Ambient velocity UA = 0.119 m/s
 Darcy-Weisbach friction factor F = 0.0389
 Calculated from Manning's n = 0.025
 Wind velocity UW = 0 m/s
 Stratification Type STRCND = U
 Surface density RHOAS = 1002 kg/m³
 Bottom density RHOAB = 1002 kg/m³

DISCHARGE PARAMETERS:

Submerged Multiport Diffuser Discharge

Diffuser type DITYPE = unidirectional perpendicular
 Diffuser length LD = 23.8 m
 Nearest bank = left
 Diffuser endpoints YB1 = 5 m; YB2 = 28.8 m
 Number of openings NOPEN = 14
 Spacing between risers/openings SPAC = 1.83 m
 Port/Nozzle diameter DO = 0.1524 m
 Equivalent slot width BO = 0.0107 m
 Total area of openings AO = 0.0182 m²
 Discharge velocity UO = 0.85 m/s
 Total discharge flowrate QO = 0.219 m³/s
 Discharge port height HO = 0.3 m
 Nozzle arrangement BETYPE = unidirectional without fanning
 Diffuser alignment angle GAMMA = 90 deg
 Vertical discharge angle THETA = 0 deg
 Horizontal discharge angle SIGMA = 0 deg
 Relative orientation angle BETA = 90 deg
 Discharge density RHO0 = 998 kg/m³
 Density difference DRHO = 4 kg/m³
 Buoyant acceleration GPO = 0.0391 m/s²
 Discharge concentration CO = 100 ppm
 Surface heat exchange coeff. KS = 0 m/s
 Coefficient of decay KD = 0 /s

FLUX VARIABLES PER UNIT DIFFUSER LENGTH:

Discharge (volume flux) qO = 0.009202 m²/s

0.146

Momentum flux m0 0.007891 m³/s²
Buoyancy flux j0 = 0.000360 m³/s³

DISCHARGE/ENVIRONMENT LENGTH SCALES :

lq = 0.01 m lm = 0.55 m lM = 1.55 m
lq' = 99999.0 m lb' = 99999.0 m la = 99999.0 m

(these refer to the actual discharge/environment length scales.)

NON-DIMENSIONAL PARAMETERS:

Slot Froude number FRO = 41.83
Port/nozzle Froude number FRDO = 11.10
Velocity ratio R = 7.20

MIXING ZONE / TOXIC DILUTION ZONE / AREA OF INTEREST PARAMETERS:

Toxic discharge = no
Water quality standard specified = no
Regulatory mixing zone = no
Region of interest = 5000.00 m downstream

HYDRODYNAMIC CLASSIFICATION:

| FLOW CLASS = MU2 |

This flow configuration applies to a layer corresponding to the full water depth at the discharge site.

Applicable layer depth = water depth = 2 m

MIXING ZONE EVALUATION (hydrodynamic and regulatory summary):

-Y-Z Coordinate system:

Origin is located at the bottom below the port center:
16.90 m from the left bank/shore.

Number of display steps NISTEP = 30 per module.

NEAR-FIELD REGION (NFR) CONDITIONS :

Note: The NFR is the zone of strong initial mixing. It has no regulatory implication. However, this information may be useful for the discharge designer because the mixing in the NFR is usually sensitive to the discharge design conditions.

Pollutant concentration at edge of NFR = 3.4400 ppm

Dilution at edge of NFR = 29.0

NFR Location: x = 11.90 m

(centerline coordinates) y = .00 m

z = 2.00 m

NFR plume dimensions: half-width = 10.72 m

thickness = 2.00 m

Buoyancy assessment:

The effluent density is less than the surrounding ambient water density at the discharge level.

Therefore, the effluent is POSITIVELY BUOYANT and will tend to rise towards the surface.

Near-field instability behavior:

The diffuser flow will experience instabilities with full vertical mixing in the near-field.

may be benthic impact of high pollutant concentrations.

FAR-FIELD MIXING SUMMARY:

Plume is vertically fully mixed WITHIN NEAR-FIELD (or a fraction thereof),

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but RE-STRATIFIES LATER.

Plume becomes vertically fully mixed again at 2116.34 m downstream.

***** TOXIC DILUTION ZONE SUMMARY *****

> TOZ was specified for this simulation.

***** REGULATORY MIXING ZONE SUMMARY *****

" "42 and no ambient water quality standard have been specified.

***** FINAL DESIGN ADVICE AND COMMENTS *****

CORMIX2 uses the TWO-DIMENSIONAL SLOT DIFFUSER CONCEPT to represent the actual three-dimensional diffuser geometry. Thus, it approximates the details of the merging process of the individual jets from each port/nozzle.

In the present design, the spacing between adjacent ports/nozzles (or riser assemblies) is of the order of, or less than, the local water depth so that the slot diffuser approximation holds well. Nevertheless, if this is a final design, the user is advised to use a final CORMIX1 (single port discharge) analysis, with discharge data for an individual diffuser jet/plume, in order to compare to the present near-field prediction.

MINDER: The user must take note that HYDRODYNAMIC MODELING by any known technique is NOT AN EXACT SCIENCE.

Extensive comparison with field and laboratory data has shown that the CORMIX predictions on dilutions and concentrations (with associated plume geometries) are reliable for the majority of cases and are accurate to within about $\pm 50\%$ (standard deviation).

As a further safeguard, CORMIX will not give predictions whenever it judges the design configuration as highly complex and uncertain for prediction.

DESIGN CASE: b5mgd
FILE NAME: bmgd
Item CORMIX2: Submerged Multiport Diffuser Discharges
: SESSION/ITERATION: 03/24/98--16:42:22

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Subsystem CORMIX2: Submerged Multiport Diffuser Discharges CORMIX v.3.10 Subsystem version: June 1995

```
Site name/label:      Pamunkey River
Design case:          b10mgd
FILE NAME:            cormix\sim\b10mgd .ex2
Time of Fortran run:  03/25/98--09:14:56
```

Site B
 $Q_{eff} = 10 \text{ mgd}$
 $H = 2 \text{ m}$
 $U_a = 0.119 \text{ m/s}$

```

Bounded section
BS      =      69.50  AS      =      139.00  QA      =      16.54  ICHREG= 1
HA      =      2.00  HD      =      2.00
UA      =      .119  F      =      .039  USTAR = .8301E-02
UW      =      .000  UWSTAR=.0000E+00
Uniform density environment
STRCND=  U          RHOAM = 1002.0000

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Diffuser type:      DITYPE= unidirectional perpendicular
BANK  =  LEFT      DISTB =      16.90  YB1  =      5.00  YB2  =      28.80
LD    =      23.80  NOPEX =      14      SPAC  =      1.83
BO    =      .152  AO    =      .018  HO    =      .30
Nozzle/port arrangement: unidirectional without fanning
GAMMA =      90.00  THETA =      .00  SIGMA =      .00  BETA  =      90.00
UO    =      1.715  GO    =      .438      = .4380E+00
RHOO  =  998.0000  DRHOO = .4000E+01  GP0   = .3915E-01
      = .1000E+03  CUNITS= ppm
JLL   =  1        KS    = .0000E+00  XD    = .0000E+00

```

```
q0      = .1840E-01  m0      = .3156E-01  j0      = .7205E-03  SIGNJ0=      1.0
Associated 2-d length scales (meters)
.0=8    =      .011  lM      =      3.92  lM      =      2.23
lmp      = 99999.00  lbp      = 99999.00  la      = 99999.00
```

[illegible]

RO = 83.67 FRDO = 22.20 R = 14.41
(slot) (port/nozzle)

[illegible]

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REGM2 = 0
XINT = 5000.00 XMAX = 5000.00

X-Y-Z COORDINATE SYSTEM:

ORIGIN is located at the bottom and the diffuser mid-point:
16.90 m from the LEFT bank/shore.

X-axis points downstream, Y-axis points to left, Z-axis points upward.

NSTEP = 30 display intervals per module

BEGIN MOD201: DIFFUSER DISCHARGE MODULE

Due to complex near-field motions: EQUIVALENT SLOT DIFFUSER (2-D) GEOMETRY

Profile definitions:

BV = Gaussian 1/e (37%) half-width, in vertical plane normal to trajectory

BH = top-hat half-width, in horizontal plane normal to trajectory

S = hydrodynamic centerline dilution

C = centerline concentration (includes reaction effects, if any)

X	Y	Z	S	C	BV	BH
.00	.00	.30	1.0	.100E+03	.01	11.90

END OF MOD201: DIFFUSER DISCHARGE MODULE

BEGIN MOD271: ACCELERATION ZONE OF UNIDIRECTIONAL CO-FLOWING DIFFUSER

In this laterally contracting zone the diffuser plume becomes VERTICALLY FULLY MIXED over the entire layer depth (HS = 2.00m).

Full mixing is achieved after a plume distance of about five layer depths from the diffuser.

Profile definitions:

BV = layer depth (vertically mixed)

BH = top-hat half-width, in horizontal plane normal to trajectory

S = hydrodynamic average (bulk) dilution

C = average (bulk) concentration (includes reaction effects, if any)

X	Y	Z	S	C	BV	BH
.00	.00	.30	1.0	.100E+03	.00	11.90
.40	.00	.32	4.1	.243E+02	.08	11.65
.79	.00	.35	5.4	.185E+02	.16	11.42
1.19	.00	.37	6.4	.156E+02	.24	11.22
1.59	.00	.39	7.2	.138E+02	.32	11.03
1.98	.00	.42	8.0	.125E+02	.40	10.86
2.38	.00	.44	8.6	.116E+02	.48	10.70
2.78	.00	.46	9.3	.108E+02	.56	10.56
3.17	.00	.49	9.8	.102E+02	.63	10.43
3.57	.00	.51	10.4	.965E+01	.71	10.31
3.97	.00	.53	10.9	.920E+01	.79	10.20
4.36	.00	.56	11.3	.881E+01	.87	10.09
4.76	.00	.58	11.8	.847E+01	.95	10.00
5.16	.00	.60	12.2	.817E+01	1.03	9.91
5.55	.00	.63	12.7	.789E+01	1.11	9.83
5.95	.00	.65	13.1	.764E+01	1.19	9.75
6.35	.00	.67	13.5	.742E+01	1.27	9.68
6.74	.00	.70	13.9	.721E+01	1.35	9.62
7.14	.00	.72	14.2	.703E+01	1.43	9.56
7.54	.00	.74	14.6	.685E+01	1.51	9.51

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7.93	.00	.77	15.0	.4	.01	1.59	9.46
8.33	.00	.79	15.3	.654E+01		1.67	9.42
8.73	.00	.81	15.6	.640E+01		1.75	9.38
9.12	.00	.84	16.0	.627E+01		1.82	9.36
9.52	.00	.86	16.3	.614E+01		1.90	9.33
9.92	.00	.88	16.6	.603E+01		1.98	9.31
10.31	.00	.91	16.9	.592E+01		2.00	9.30
10.71	.00	.93	17.2	.581E+01		2.00	9.29
11.11	.00	.95	17.5	.571E+01		2.00	9.28
11.50	.00	.98	17.8	.562E+01		2.00	9.27
11.90	.00	1.00	18.1	.553E+01		2.00	9.27

Cumulative travel time = 56. sec

END OF MOD271: ACCELERATION ZONE OF UNIDIRECTIONAL CO-FLOWING DIFFUSER

BEGIN MOD251: DIFFUSER PLUME IN CO-FLOW

Phase 1: Vertically mixed, Phase 2: Re-stratified

Phase 2: The flow has RESTRATIFIED at the beginning of this zone.

This flow region is INSIGNIFICANT in spatial extent and will be by-passed.

END OF MOD251: DIFFUSER PLUME IN CO-FLOW

*** End of NEAR-FIELD REGION (NFR) ***

The initial plume WIDTH values in the next far-field module will be

CORRECTED by a factor 1.75 to conserve the mass flux in the far-field!

correction factor is quite large because of the small ambient velocity relative to the strong mixing characteristics of the discharge!

This indicates localized RECIRCULATION REGIONS and internal hydraulic JUMPS.

BEGIN MOD241: BUOYANT AMBIENT SPREADING

Profile definitions:

BV = top-hat thickness, measured vertically

BH = top-hat half-width, measured horizontally in y-direction

ZU = upper plume boundary (Z-coordinate)

ZL = lower plume boundary (Z-coordinate)

S = hydrodynamic average (bulk) dilution

C = average (bulk) concentration (includes reaction effects, if any)

Plume Stage 1 (not bank attached):

X	Y	Z	S	C	BV	BH	ZU	ZL
11.90	.00	2.00	18.1	.553E+01	2.00	16.21	2.00	.00
11.96	.00	2.00	18.1	.553E+01	2.00	16.24	2.00	.00
12.02	.00	2.00	18.1	.553E+01	2.00	16.26	2.00	.00
12.08	.00	2.00	18.1	.552E+01	1.99	16.28	2.00	.01
12.14	.00	2.00	18.1	.552E+01	1.99	16.31	2.00	.01
12.21	.00	2.00	18.1	.552E+01	1.99	16.33	2.00	.01
12.27	.00	2.00	18.1	.552E+01	1.99	16.35	2.00	.01
12.33	.00	2.00	18.1	.552E+01	1.99	16.38	2.00	.01
12.39	.00	2.00	18.1	.551E+01	1.98	16.40	2.00	.02
12.45	.00	2.00	18.1	.551E+01	1.98	16.42	2.00	.02
12.51	.00	2.00	18.2	.551E+01	1.98	16.44	2.00	.02
12.57	.00	2.00	18.2	.551E+01	1.98	16.47	2.00	.02
12.63	.00	2.00	18.2	.551E+01	1.97	16.49	2.00	.03

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12.70	.00	2.00	18.2	.551	1.97	16.51	2.00	.03
12.76	.00	2.00	18.2	.550E+01	1.97	16.54	2.00	.03
12.82	.00	2.00	18.2	.550E+01	1.97	16.56	2.00	.03
12.88	.00	2.00	18.2	.550E+01	1.97	16.58	2.00	.03
12.94	.00	2.00	18.2	.550E+01	1.96	16.61	2.00	.04
13.00	.00	2.00	18.2	.549E+01	1.96	16.63	2.00	.04
13.06	.00	2.00	18.2	.549E+01	1.96	16.65	2.00	.04
13.12	.00	2.00	18.2	.549E+01	1.96	16.67	2.00	.04
13.19	.00	2.00	18.2	.549E+01	1.96	16.70	2.00	.04
13.25	.00	2.00	18.2	.549E+01	1.95	16.72	2.00	.05
13.31	.00	2.00	18.2	.548E+01	1.95	16.74	2.00	.05
13.37	.00	2.00	18.2	.548E+01	1.95	16.77	2.00	.05
13.43	.00	2.00	18.2	.548E+01	1.95	16.79	2.00	.05
13.49	.00	2.00	18.3	.548E+01	1.95	16.81	2.00	.05
13.55	.00	2.00	18.3	.548E+01	1.94	16.83	2.00	.06
13.61	.00	2.00	18.3	.547E+01	1.94	16.86	2.00	.06
13.68	.00	2.00	18.3	.547E+01	1.94	16.88	2.00	.06
13.74	.00	2.00	18.3	.547E+01	1.94	16.90	2.00	.06

Cumulative travel time = 71. sec

Plume is ATTACHED to LEFT bank/shore.

Plume width is now determined from LEFT bank/shore.

Plume Stage 2 (bank attached):

X	Y	Z	S	C	BV	BH	ZU	ZL
13.74	16.90	2.00	18.3	.547E+01	1.94	33.80	2.00	.06
17.71	16.90	2.00	18.5	.541E+01	1.88	35.26	2.00	.12
21.69	16.90	2.00	18.7	.535E+01	1.83	36.69	2.00	.17
25.67	16.90	2.00	18.9	.530E+01	1.78	38.09	2.00	.22
29.65	16.90	2.00	19.1	.525E+01	1.73	39.46	2.00	.27
33.62	16.90	2.00	19.2	.520E+01	1.69	40.82	2.00	.31
37.60	16.90	2.00	19.4	.516E+01	1.65	42.14	2.00	.35
41.58	16.90	2.00	19.6	.511E+01	1.61	43.45	2.00	.39
45.56	16.90	2.00	19.7	.507E+01	1.58	44.74	2.00	.42
49.54	16.90	2.00	19.9	.503E+01	1.55	46.01	2.00	.45
53.51	16.90	2.00	20.0	.499E+01	1.52	47.26	2.00	.48
57.49	16.90	2.00	20.2	.495E+01	1.49	48.49	2.00	.51
61.47	16.90	2.00	20.3	.492E+01	1.47	49.71	2.00	.53
65.45	16.90	2.00	20.5	.488E+01	1.44	50.91	2.00	.56
69.42	16.90	2.00	20.6	.485E+01	1.42	52.10	2.00	.58
73.40	16.90	2.00	20.8	.482E+01	1.40	53.27	2.00	.60
77.38	16.90	2.00	20.9	.479E+01	1.38	54.43	2.00	.62
81.36	16.90	2.00	21.0	.475E+01	1.36	55.58	2.00	.64
85.33	16.90	2.00	21.2	.472E+01	1.34	56.72	2.00	.66
89.31	16.90	2.00	21.3	.469E+01	1.32	57.84	2.00	.68
93.29	16.90	2.00	21.4	.467E+01	1.30	58.95	2.00	.70
97.27	16.90	2.00	21.6	.464E+01	1.29	60.05	2.00	.71
101.24	16.90	2.00	21.7	.461E+01	1.27	61.15	2.00	.73
105.22	16.90	2.00	21.8	.458E+01	1.26	62.23	2.00	.74
109.20	16.90	2.00	22.0	.456E+01	1.24	63.30	2.00	.76
113.18	16.90	2.00	22.1	.453E+01	1.23	64.36	2.00	.77
117.15	16.90	2.00	22.2	.450E+01	1.22	65.41	2.00	.78
121.13	16.90	2.00	22.3	.448E+01	1.20	66.45	2.00	.80
125.11	16.90	2.00	22.5	.445E+01	1.19	67.49	2.00	.81
129.09	16.90	2.00	22.6	.443E+01	1.18	68.52	2.00	.82
1.06	16.90	2.00	22.7	.440E+01	1.17	69.50	2.00	.83

Cumulative travel time = 1048. sec

Plume is LATERALLY FULLY MIXED at the end of the buoyant spreading regime.

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END OF MOD261: BUOYANT AMBIENT SPREADIN

BEGIN MOD261: PASSIVE AMBIENT MIXING IN UNIFORM AMBIENT

Vertical diffusivity (initial value) = .332E-02 m²/s
Horizontal diffusivity (initial value) = .415E-02 m²/s

Profile definitions:

BV = Gaussian s.d.*sqrt(pi/2) (46%) thickness, measured vertically
= or equal to layer depth, if fully mixed
BH = Gaussian s.d.*sqrt(pi/2) (46%) half-width,
measured horizontally in Y-direction
ZU = upper plume boundary (Z-coordinate)
ZL = lower plume boundary (Z-coordinate)
S = hydrodynamic centerline dilution
C = centerline concentration (includes reaction effects, if any)

Plume Stage 2 (bank attached):

X	Y	Z	S	C	BV	BH	ZU	ZL
133.06	16.90	2.00	22.7	.440E+01	1.17	.69.50	2.00	.83
295.30	16.90	2.00	23.1	.433E+01	1.19	.69.50	2.00	.81
457.53	16.90	2.00	23.5	.426E+01	1.21	.69.50	2.00	.79
619.76	16.90	2.00	23.8	.419E+01	1.23	.69.50	2.00	.77
781.99	16.90	2.00	24.3	.412E+01	1.25	.69.50	2.00	.75
944.22	16.90	2.00	24.7	.405E+01	1.27	.69.50	2.00	.73
1106.45	16.90	2.00	25.1	.398E+01	1.29	.69.50	2.00	.71
1268.68	16.90	2.00	25.5	.391E+01	1.32	.69.50	2.00	.68
1430.91	16.90	2.00	26.0	.384E+01	1.34	.69.50	2.00	.66
1593.15	16.90	2.00	26.5	.378E+01	1.37	.69.50	2.00	.63
1755.38	16.90	2.00	27.0	.371E+01	1.39	.69.50	2.00	.61
1917.61	16.90	2.00	27.5	.364E+01	1.42	.69.50	2.00	.58
2079.84	16.90	2.00	28.0	.357E+01	1.45	.69.50	2.00	.55
2242.07	16.90	2.00	28.6	.350E+01	1.47	.69.50	2.00	.53
2404.30	16.90	2.00	29.2	.343E+01	1.50	.69.50	2.00	.50
2566.53	16.90	2.00	29.8	.336E+01	1.53	.69.50	2.00	.47
2728.76	16.90	2.00	30.4	.329E+01	1.57	.69.50	2.00	.43
2890.99	16.90	2.00	31.0	.322E+01	1.60	.69.50	2.00	.40
3053.23	16.90	2.00	31.7	.316E+01	1.63	.69.50	2.00	.37
3215.46	16.90	2.00	32.4	.309E+01	1.67	.69.50	2.00	.33
3377.69	16.90	2.00	33.1	.302E+01	1.71	.69.50	2.00	.29
3539.92	16.90	2.00	33.9	.295E+01	1.75	.69.50	2.00	.25
3702.15	16.90	2.00	34.7	.288E+01	1.79	.69.50	2.00	.21
3864.38	16.90	2.00	35.5	.282E+01	1.83	.69.50	2.00	.17
4026.61	16.90	2.00	36.4	.275E+01	1.87	.69.50	2.00	.13
4188.84	16.90	2.00	37.3	.268E+01	1.92	.69.50	2.00	.08
4351.08	16.90	2.00	38.2	.262E+01	1.97	.69.50	2.00	.03

Plume interacts with BOTTOM.

The passive diffusion plume becomes VERTICALLY FULLY MIXED within this prediction interval.

4513.31	16.90	2.00	38.8	.258E+01	2.00	.69.50	2.00	.00
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Effluent is FULLY MIXED over the entire channel cross-section.

Except for possible far-field decay or reaction processes, there are NO FURTHER CHANGES with downstream direction.

4675.54	16.90	2.00	38.8	.258E+01	2.00	.69.50	2.00	.00
4837.77	16.90	2.00	38.8	.258E+01	2.00	.69.50	2.00	.00
5000.00	16.90	2.00	38.8	.258E+01	2.00	.69.50	2.00	.00

Cumulative travel time = 40891. sec

Simulation limit based on maximum specified distance = 5000.00 m.

END OF MOD261: PASSIVE AMBIENT MIXING IN UNIFORM AMBIENT

C. 454

CORNIX SESSION REPORT:

XX

CORNIX: CORNELL MIXING ZONE EXPERT SYSTEM

CORNIX v.3.10

June 1995

SITE NAME/LABEL: Pamunkey River
 ORIGINAL design case: b5mgd
 ORIGINAL file name: bmgd
 Start of main session: 03/24/98--16:41:03

DESIGN ITERATION number: 1
 NEW DESIGN CASE: b10mgd
 NEW FILE NAME: b10mgd
 Using subsystem CORNIX2: Submerged Multiport Diffuser Discharges
 Start of iteration session: 03/25/98--09:12:07

SUMMARY OF INPUT DATA:

AMBIENT PARAMETERS:

Cross-section = bounded
 Width BS = 69.5 m
 Channel regularity ICHREG = 1
 Ambient flowrate QA = 16.54 m³/s
 Average depth HA = 2 m
 Depth at discharge HD = 2 m
 Ambient velocity UA = 0.119 m/s
 Darcy-Weisbach friction factor F = 0.0389
 Calculated from Manning's n = 0.025
 Wind velocity UW = 0 m/s
 Stratification Type STRCND = U
 Surface density RHOAS = 1002 kg/m³
 Bottom density RHOAB = 1002 kg/m³

DISCHARGE PARAMETERS:

Submerged Multiport Diffuser Discharge

Diffuser type DITYPE = unidirectional perpendicular
 Diffuser length LD = 23.8 m
 Nearest bank = left
 Diffuser endpoints YB1 = 5 m; YB2 = 28.8 m
 Number of openings NOPEN = 14
 Spacing between risers/openings SPAC = 1.83 m
 Port/Nozzle diameter DO = 0.1524 m
 Equivalent slot width BO = 0.0107 m
 Total area of openings AO = 0.0182 m²
 Discharge velocity UO = 1.71 m/s
 Total discharge flowrate QO = 0.438 m³/s
 Discharge port height HO = 0.3 m
 Nozzle arrangement BETYPE = unidirectional without fanning
 Diffuser alignment angle GAMMA = 90 deg
 Vertical discharge angle THETA = 0 deg
 Horizontal discharge angle SIGMA = 0 deg
 Relative orientation angle BETA = 90 deg
 Discharge density RHOD = 998 kg/m³
 Density difference DRHO = 4 kg/m³
 Buoyant acceleration GPO = 0.0391 m/s²
 Discharge concentration CD = 100 ppm
 Surface heat exchange coeff. KS = 0 m/s
 Coefficient of decay KD = 0 /s

FLUX VARIABLES PER UNIT DIFFUSER LENGTH:

Discharge (volume flux) qD = 0.018403 m²/s

0.155

Momentum flux m0 0.031562 m³/s²
Buoyancy flux j0 0.000720 m³/s³

DISCHARGE/ENVIRONMENT LENGTH SCALES :

lq = 0.01 m lm = 2.22 m lM = 3.92 m
lb' = 99999.0 m lb' = 99999.0 m la = 99999.0 m

(these refer to the actual discharge/environment length scales.)

NON-DIMENSIONAL PARAMETERS:

Slot Froude number FRO = 83.67
Port/nozzle Froude number FRDO = 22.20
Velocity ratio R = 14.41

MIXING ZONE / TOXIC DILUTION ZONE / AREA OF INTEREST PARAMETERS:

Toxic discharge = no
Water quality standard specified = no
Regulatory mixing zone = no
Region of interest = 5000.00 m downstream

HYDRODYNAMIC CLASSIFICATION:

| FLOW CLASS = MJ2 |

This flow configuration applies to a layer corresponding to the full water depth at the discharge site.

Applicable layer depth = water depth = 2 m

MIXING ZONE EVALUATION (hydrodynamic and regulatory summary):

V-Y-Z Coordinate system:

Origin is located at the bottom below the port center:

16.90 m from the left bank/shore.

Number of display steps NSTEP = 30 per module.

NEAR-FIELD REGION (NFR) CONDITIONS :

Note: The NFR is the zone of strong initial mixing. It has no regulatory implication. However, this information may be useful for the discharge designer because the mixing in the NFR is usually sensitive to the discharge design conditions.

Pollutant concentration at edge of NFR = 5.5292 ppm

Dilution at edge of NFR = 18.0

NFR Location: x = 11.90 m

(centerline coordinates) y = .00 m

z = 2.00 m

NFR plume dimensions: half-width = 9.26 m

thickness = 2.00 m

BUOYANCY assessment:

The effluent density is less than the surrounding ambient water density at the discharge level.

Therefore, the effluent is POSITIVELY BUOYANT and will tend to rise towards the surface.

NEAR-FIELD instability behavior:

The diffuser flow will experience instabilities with full vertical mixing in the near-field.

There may be benthic impact of high pollutant concentrations.

FAR-FIELD MIXING SUMMARY:

Plume is vertically fully mixed WITHIN NEAR-FIELD (or a fraction thereof),

0. 256

but RE-STRATIFIES LATER.

Plume becomes vertically fully mixed again at 4513.30 m downstream.

***** TOXIC DILUTION ZONE SUMMARY *****

No TDZ was specified for this simulation.

***** REGULATORY MIXING ZONE SUMMARY *****

No RMZ and no ambient water quality standard have been specified.

***** FINAL DESIGN ADVICE AND COMMENTS *****

CORMIX2 uses the TWO-DIMENSIONAL SLOT DIFFUSER CONCEPT to represent the actual three-dimensional diffuser geometry. Thus, it approximates the details of the merging process of the individual jets from each port/nozzle.

In the present design, the spacing between adjacent ports/nozzles (or riser assemblies) is of the order of, or less than, the local water depth so that the slot diffuser approximation holds well. Nevertheless, if this is a final design, the user is advised to use a final CORMIX1 (single port discharge) analysis, with discharge data for an individual diffuser jet/plume, in order to compare to the present near-field prediction.

REMINDER: The user must take note that HYDRODYNAMIC MODELING by any known technique is NOT AN EXACT SCIENCE.

Extensive comparison with field and laboratory data has shown that the CORMIX predictions on dilutions and concentrations (with associated plume geometries) are reliable for the majority of cases and are accurate to within about +-50% (standard deviation).

As a further safeguard, CORMIX will not give predictions whenever it judges the design configuration as highly complex and uncertain for prediction.

DESIGN CASE: b10mgd
FILE NAME: b10mgd
System CORMIX2: Submerged Multiport Diffuser Discharges
IF SESSION/ITERATION: 03/25/98--09:15:16

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C. 1457

Attachment F
Calculation of Quantification Levels

Quantification levels for the metals monitoring performed in accordance with Part I.E. of the VPDES permit were calculated as follows:

Water quality criteria for each metal were determined using a stream hardness value of 35.6 mg/l (based on the average of 18 samples taken on the Pamunkey River at the Rt. 360 bridge between 7/7/92 and 8/11/97) and an assumed effluent hardness of 50 mg/l. A mass balance was performed with the receiving stream at critical flow and the discharge at a flow of 5 MGD. Background concentrations in the receiving stream were assumed to be zero. Due to the stream being designated as a Tier II water, only 25% of the acute and chronic water quality criteria and 10% of the human health water quality criteria were allocated in accordance with agency guidance for antidegradation.

<u>Criteria</u>	<u>River Flow</u>	<u>IWC</u>	<u>Wasteload Allocation</u>
Acute	38.1 MGD (1Q10)	0.116	$WQC_a(0.25)/(0.116) = 2.155 * WQC_a$
Chronic	42.1 MGD (7Q10)	0.106	$WQC_c(0.25)/(0.106) = 2.355 * WQC_c$
Human Health	50.9 MGD (30Q5)	0.089	$WQC_h(0.10)/(0.089) = 1.123 * WQC_h$

Parameter	Acute WQC	Acute WLA	Chronic WQC	Chronic WLA	Human Health WQC	Human Health WLA	Target QL
Arsenic	360	776	190	409	--	--	409
Cadmium	1.3	2.8	0.52	1.2	--	--	1.2
Chromium	774	1668	92	217	--	--	217
Chromium VI	16	34.5	11	26	--	--	26
Copper	7	15.1	5.1	12	--	--	12
Lead	33.9	73.1	3.8	9	--	--	9
Mercury	2.4	5.2	0.012	0.037	0.053	0.059	0.037
Nickel	79.3	171	8.8	21	4,600	5,143	21
Selenium	20	43.1	5	12	11,000	12,300	12
Silver	0.74	1.6	--	--	--	--	1.6
Zinc	51	109	46	108	--	--	108

MEMORANDUM

DEPARTMENT OF ENVIRONMENTAL QUALITY
Piedmont Regional Office

4949-A Cox Road

Glen Allen, VA 23060

804/527-5020

SUBJECT: Tidal Pamunkey River Dissolved Oxygen Study, Performed
June 1 - October 31, 1995

TO: Curt Linderman

FROM: Mark Alling *Mal A.*

DATE: March 19, 1996

COPIES: Jon Van Soestbergen, File

The purpose of this memo is to describe results from the Tidal Pamunkey River Dissolved Oxygen (DO) Study performed by PRO Water Division staff during the period of June 1 - October 31, 1995. Refer to the attached figures for data graphics. The consulting firm Hazen and Sawyer received these data and graphics via an FOI request in March 1996. These data are in STORET from stations 8-PMK056.87 downstream to 8-PMK032.84.

Mean Daily DO Standard Violations Occurred on 40 Days (26 Percent) During the Five Month Study Period.

Figure 1 describes mean daily DO values derived from hourly Datasonde readings at one meter depth at Carters Landing, river mile 48.80, from June 1 to October 30, 1995. Datasondes were always deployed for periods of seven days, except for eleven and nine days deployments in August, to minimize probe fouling. PRO obtained QAQC grab DO readings at the start and end of each deployment using a Hydrolab H20/Surveyor 3 monitoring device. This was pre- and post-calibrated within two hours of use. PRO graduated DO corrections into raw Datasonde data using the QAQC grab DO values.

A total of 40 days with mean daily DO < 5.0 mg/l occurred during the five month study period. These dates totaled 26 percent of the study period, or 11 percent of calendar year 1995. The lowest mean daily DO occurred July 5 at 4.21 mg/l. The first mean daily DO violation occurred on June 24 and the last violation occurred October 8. The majority of violations occurred from early July through mid-September.

The violations in late June, early July and October coincided with turbid flood runoff from the upstream tributaries. Sediments are deposited in the Carters Landing river segment because this is the first reach of greater depth and decreasing velocity downstream of the head of tide near Totopotomoy Creek.

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Instantaneous DO Violations Occurred on 10 Days, with Minimum DO of 3.25 mg/l.

Ten days of instantaneous DO violations ($DO < 4.0$ mg/l) occurred July 5, 7, 21, 31, August 1-3, September 10, 11, and 17. The minimum DO during this period was 3.25 mg/l. The longest duration of DO below 4.0 mg/l was four hours. PRO also detected instantaneous DO violations as low as 3.49 mg/l at the Pamunkey River Whitehouse CBP station at river mile 34.17, 14.6 miles below Carters Landing, on July 6 and August 15, 1995, during scheduled CBP monitoring.

Mean Daily DO Violations Occurred Concurrently at RM48.80 and RM40.74 in August and October.

PRO deployed three Datasondes concurrently at RM51.11 at Horseshoe, RM48.80 at Carters Landing, and at RM40.74 at Montague Landing during the period of August 24 to October 10, 1995. The purpose was to define the length and severity of DO violations. Figures 2 and 3 describe these results. At no time did DO at Horseshoe, the upstream station, violate the DO standard. However in late August and in early October mean daily DO violations occurred concurrently at Carters and Montague Landings, 8.0 miles apart (Figure 2).

DO Minima Occurred Near Both Low and High Slack Tides.

Figure 3 shows the period of August 24 - 30, during which both Carters Landing and Montague Landing violated the standard. Figure 3 appears to show a tidal fluctuation in DO at all three stations. DO minima seemed to coincide with High Slack tide in this August dataset. However, PRO observed the opposite relationship during the June deployment when mean daily DO violations first occurred. Figure 4 depicts DO minima occurring close to Low Slack tide in this late June dataset. Reasons for these alternating tidal DO fluctuations were unclear.

DO Minima Occurred Longitudinally near RM46-49 and RM34-38.

Late in the season, from mid-September to early October, Mr. Willie Weber, a Hanover County Utilities staff member, obtained longitudinal DO surveys at 24 stations from the Rt 360 bridge downstream to Whitehouse RR bridge, a distance of 22.7 miles. Two surveys were collected on both Low and High slack tides at 2 meter depth, using a pre- and post-calibrated H2O/Surveyor unit supplied by PRO. DO depth profiles obtained at Datasonde sites by Mr. Weber showed that DO was uniform throughout the water column. Figure 5 shows the longitudinal DO minima near rivermiles 46-49 and 34-38. These occurred on both tides, and the low water slack DO minima occurred approximately 3 miles downstream of the high water slack DO minima in Figure 5. The low water slack DO minima shown in Figure 5 were repeated in the September 27 survey. However in the October 4 high water slack survey, the DO minima were less pronounced and were located at rivermiles 44 and 38.

DO Minima Occurred Below Large Swampy Tributaries, and Where
Turbid Flood Runoff Deposits Sediments.

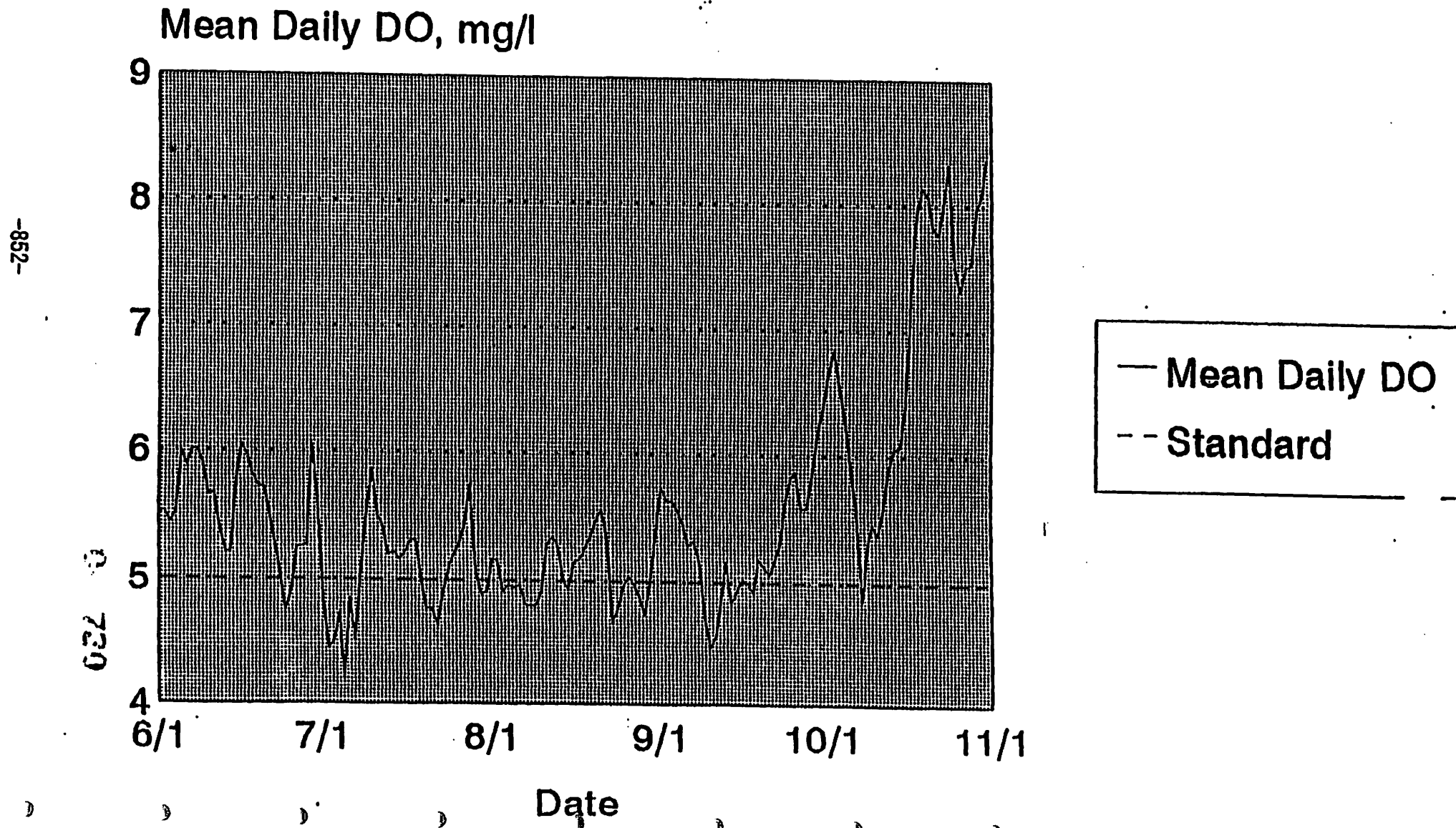
The DO minima occurred in river segments just downstream of large swampy tributaries. Manquin Creek enters the Pamunkey at river mile 50 through a large wetland named The Island, just above the upper DO sag area. Black Creek enters the Pamunkey at river mile 37.5 at the head of the lower sag area, and large expanses of wetland border the river from above Black Creek down to Whitehouse at river mile 34.17. Vegetative decomposition from large wetland areas may contribute to DO minima in these segments. In addition, the upstream DO sag area occurred in a deep curved river segment where sediment from turbid flood runoff may settle out and exert demand on oxygen, as stated previously.

Recommendations for Further Study.

PRO can deploy a Datasonde at Carters Landing beginning May 1, 1996 to check whether mean daily DO violations occur prior to June 1, the start date of this study. PRO can continue Datasonde deployments through the summer to confirm the results of the 1995 deployments. PRO can also perform more longitudinal DO surveys to confirm DO sag areas.

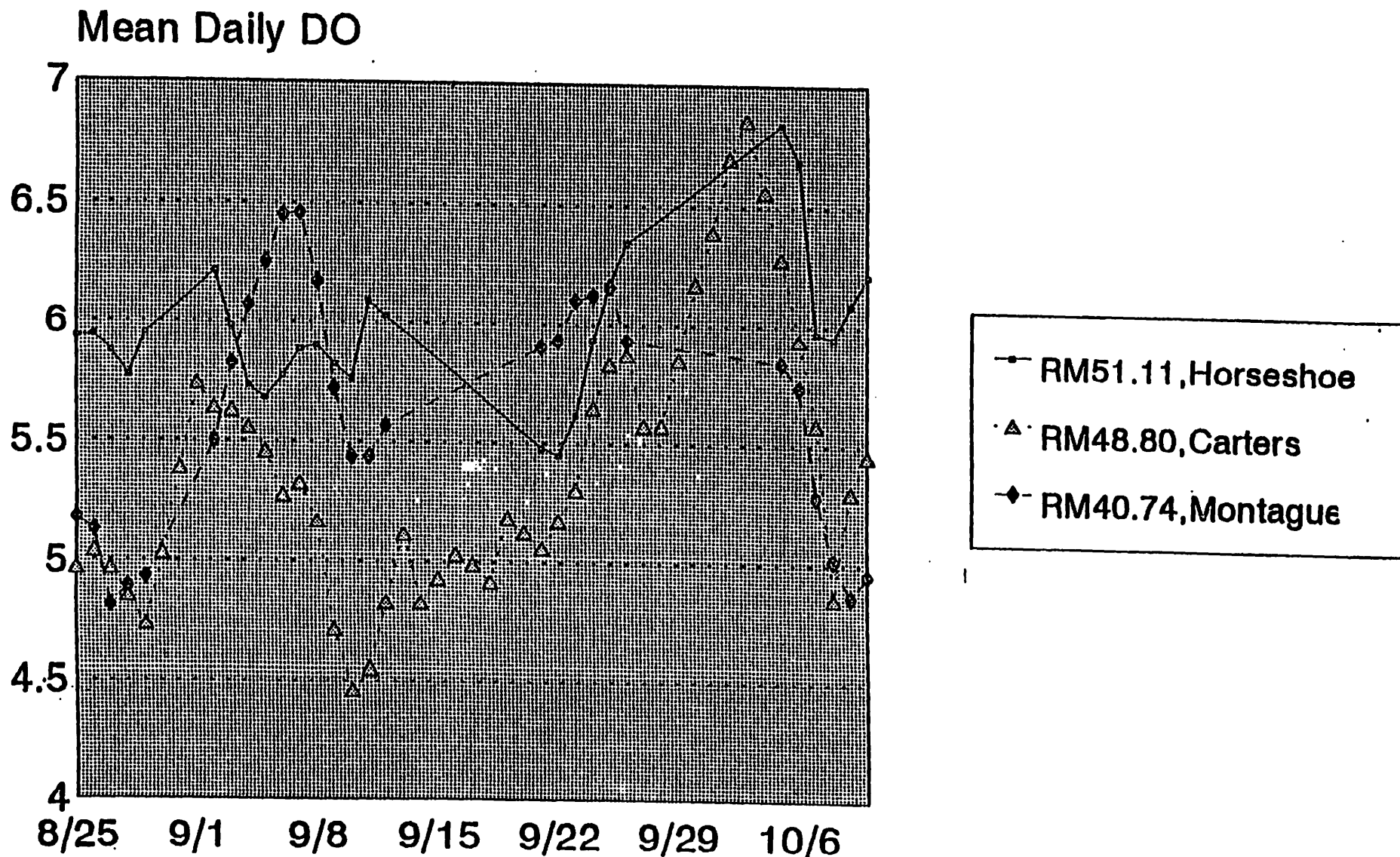
MEAN DAILY DISSOLVED OXYGEN

Pamunkey River at Carters Landing, June 1 - Oct. 31, 1995



PAMUNKEY RIVER MEAN DAILY DO

RM 51.11 to RM 40.74, August 25-October 10, 1995.



PAMUNKEY RIVER DISSOLVED OXYGEN

RM 56.87 (Rt360) to RM 40.74 (Montague Landing)

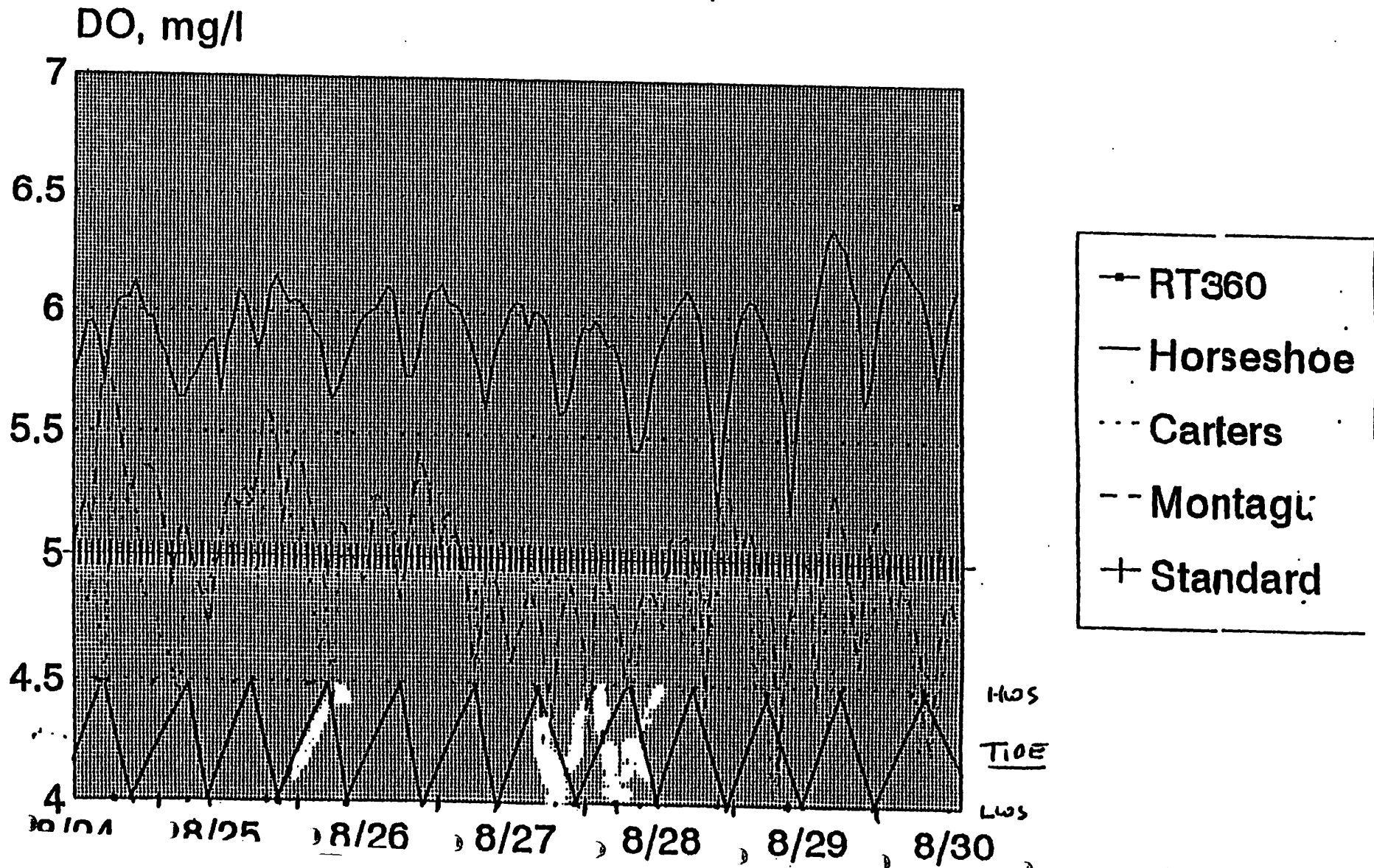
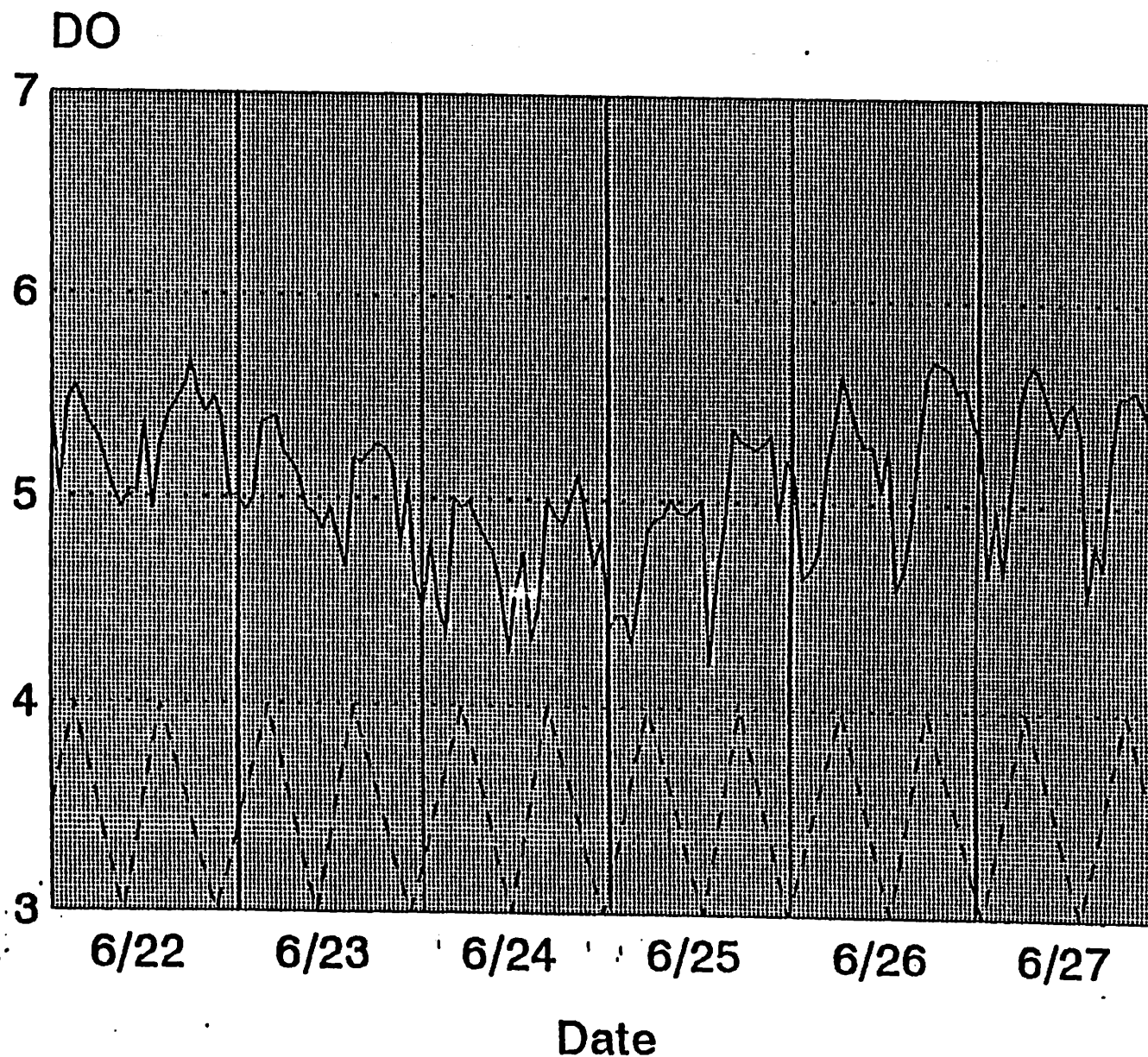


FIGURE .

HOURLY DISSOLVED OXYGEN, PAMUNKEY R., PMK048.80

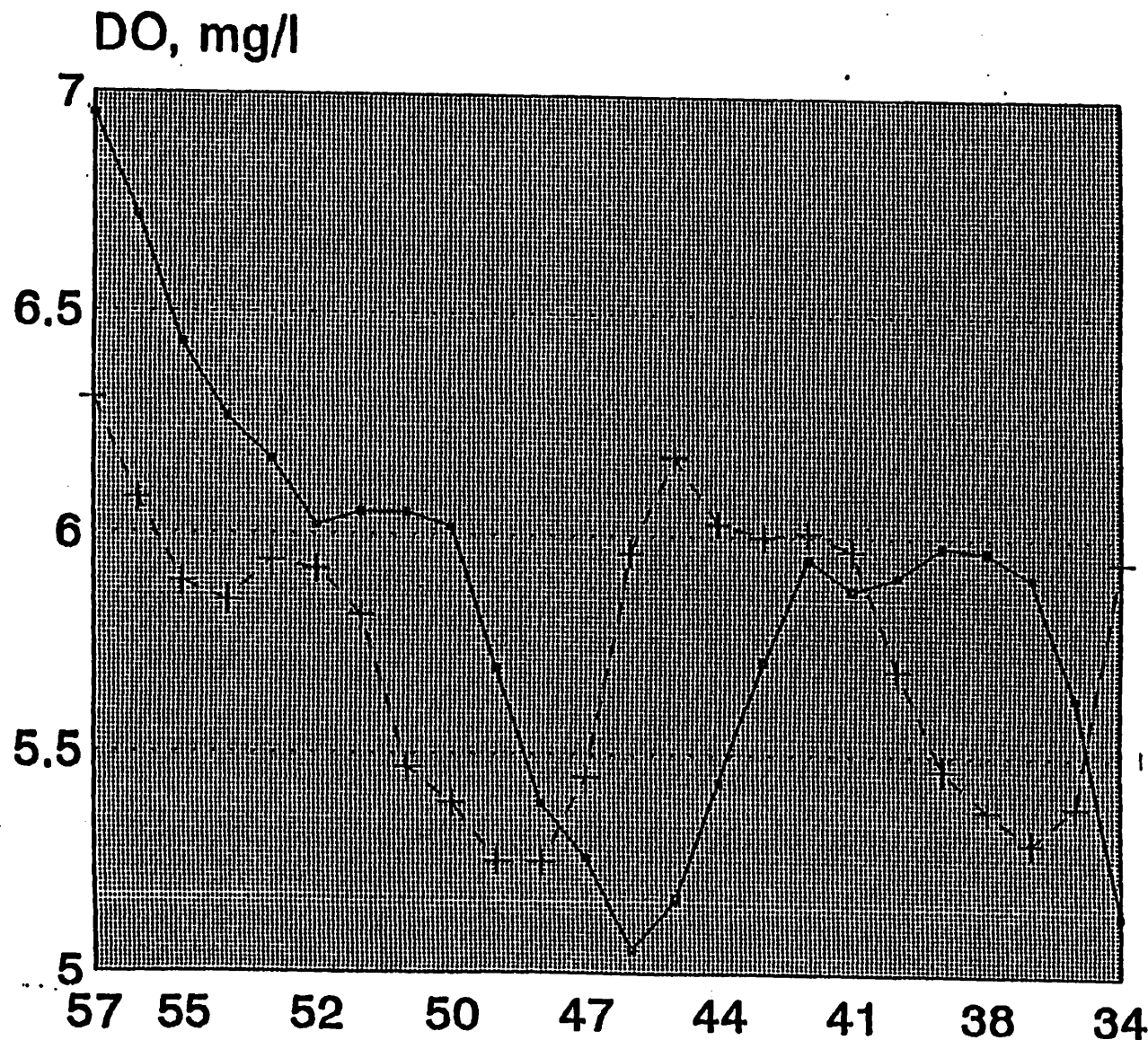
June 22 - 27, 1995



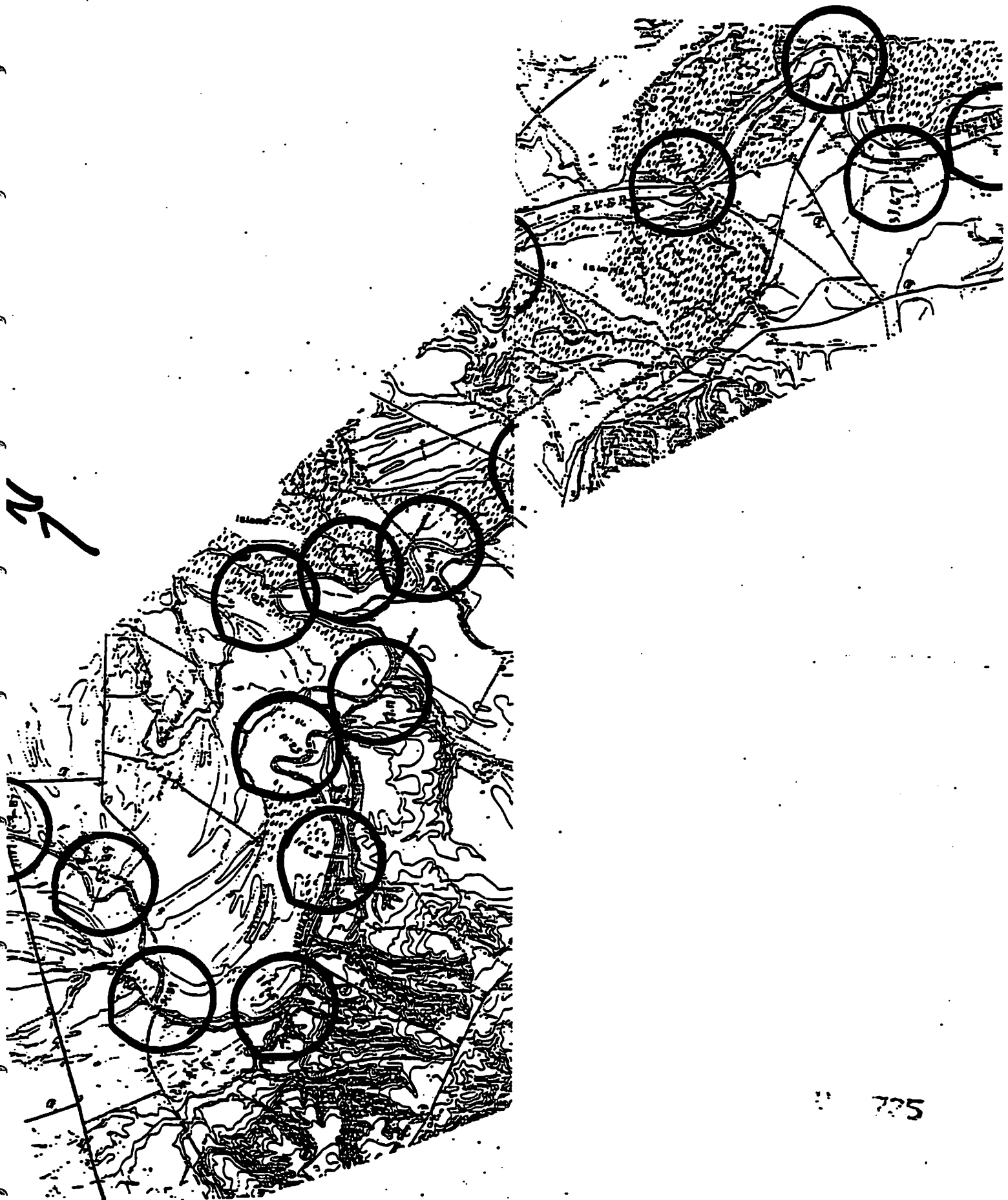
— DO, mg/l
- - Tide

TIDAL PAMUNKEY RIVER DISSOLVED OXYGEN SAG AREAS

Rt 360 to Whitehouse RR Bridge, LWS and HWS Tides



• LWS, 9/13/95
+ HWS, 9/20/95



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Mean Daily DO, mg/l, Pamunkey River, RM 48.80, June 1, 1995 to Oct. 31, 1995

Date	Mean Daily DO
6/1	5.51
6/2	5.53
6/3	5.44
6/4	5.51
6/5	5.99
6/6	5.88
6/7	6.01
6/8	6.01
6/9	5.89
6/10	5.66
6/11	5.67
6/12	5.39
6/13	5.21
6/14	5.21
6/15	5.78
6/16	6.05
6/17	5.97
6/18	5.82
6/19	5.73
6/20	5.72
6/21	5.57
6/22	5.31
6/23	5.07
6/24	4.75
6/25	4.9
6/26	5.25
6/27	5.26
6/28	5.27
6/29	6.07
6/30	5.66
7/1	4.84
7/2	4.45
7/3	4.5
7/4	4.73
7/5	4.21
7/6	4.85
7/7	4.51
7/8	5.1
7/9	5.54
7/10	5.87
7/11	5.5
7/12	5.43
7/13	5.2
7/14	5.22
7/15	5.16
7/16	5.22
7/17	5.31
7/18	5.31
7/19	5.02
7/20	4.77
7/21	4.77
7/22	4.64
7/23	4.91
7/24	5.1
7/25	5.2
7/26	5.29
7/27	5.44

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7/28	5 ;
7/29	5.06
7/30	4.88
7/31	4.92
8/1	5.17
8/2	5.15
8/3	4.91
8/4	4.96
8/5	4.94
8/6	4.96
8/7	4.8
8/8	4.8
8/9	4.8
8/10	4.92
8/11	5.29
8/12	5.34
8/13	5.28
8/14	4.99
8/15	4.93
8/16	5.15
8/17	5.17
8/18	5.25
8/19	5.35
8/20	5.48
8/21	5.56
8/22	5.37
8/23	4.66
8/24	4.79
8/25	4.97
8/26	5.04
8/27	4.97
8/28	4.85
8/29	4.73
8/30	5.03
8/31	5.39
9/1	5.74
9/2	5.64
9/3	5.63
9/4	5.56
9/5	5.46
9/6	5.28
9/7	5.33
9/8	5.17
9/9	4.71
9/10	4.46
9/11	4.55
9/12	4.83
9/13	5.16
9/14	4.83
9/15	4.93
9/16	5.03
9/17	4.99
9/18	4.92
9/19	5.19
9/20	5.12
9/21	5.06
9/22	5.18
9/23	5.31
9/24	5.65
9/25	5.83

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9/26	5
9/27	5.58
9/28	5.58
9/29	5.85
9/30	6.17
10/1	6.39
10/2	6.69
10/3	6.85
10/4	6.56
10/5	6.28
10/6	5.94
10/7	5.59
10/8	4.86
10/9	5.31
10/10	5.46
10/11	5.38
10/12	5.57
10/13	5.91
10/14	6.05
10/15	6.07
10/16	6.43
10/17	7.29
10/18	7.92
10/19	8.14
10/20	8.07
10/21	7.82
10/22	7.77
10/23	8.05
10/24	8.33
10/25	7.52
10/26	7.32
10/27	7.51
10/28	7.53
10/29	7.96
10/30	8.09
10/31	8.36
11/1	

000738

Pamunkey R., PMK048.80, Carters Landing below Monquin Cr., 5/31-6/7/95

Time	TempC	Sonde DO, mg/l	QAQC DO	Corr. DO, mg/l	Corr. DO, Value	Daily Mean DO
150000	23.06	8.04	not equil	0	5.38	5.38
160000	22.74	6.53	5.38	1	5.38	5.38
170000	22.4	6.43		2	5.3	5.3
180000	22.85	6.6	[Low flow	3	5.48	5.48
190000	22.89	6.71	Datasonde	4	5.6	5.6
200000	22.47	6.71	membrane	5	5.62	5.62
210000	22.44	6.65	reads DO	6	5.57	5.57
220000	22.35	6.64	2.5 %	7	5.57	5.57
230000	22.13	6.67	High!]	8	5.61	5.61
0	21.99	6.96	60195	9	5.91	5.91
10000	21.89	6.57		10	5.53	5.53
20000	21.85	6.51		11	5.48	5.48
30000	21.9	6.58		12	5.56	5.56
40000	21.97	6.52		13	5.52	5.52
50000	21.89	6.34		14	5.35	5.35
60000	21.85	6.26		15	5.28	5.28
70000	21.82	6.51		16	5.54	5.54
80000	21.67	6.57		17	5.61	5.61
90000	21.62	6.74		18	5.79	5.79
100000	21.64	6.64		19	5.7	5.7
110000	21.74	6.57		20	5.64	5.64
120000	22.17	6.53		21	5.61	5.61
130000	22.65	6.63		22	5.73	5.73
140000	22.74	6.3		23	5.41	5.41
150000	23.05	5.86		24	4.98	4.98
160000	23.63	5.75		25	4.88	4.88
170000	22.83	6.03		26	5.17	5.17
180000	22.69	6.11		27	5.26	5.26
190000	22.71	6.13		28	5.29	5.29
200000	22.9	6.47		29	5.64	5.64
210000	22.81	6.44		30	5.62	5.62
220000	22.76	6.66		31	5.86	5.86
230000	22.63	6.67		32	5.88	5.88
0	22.42	6.58	60295	33	5.8	5.8
10000	22.24	6.56		34	5.79	5.79
20000	22.22	6.47		35	5.71	5.71
30000	22.22	6.4		36	5.65	5.65
40000	22.29	6.32		37	5.58	5.58
50000	22.29	6.08		38	5.35	5.35
60000	22.33	5.99		39	5.28	5.28
70000	22.31	5.97		40	5.27	5.27
80000	22.28	6.17		41	5.48	5.48
90000	22.19	6.26		42	5.58	5.58
100000	22.19	6.37		43	5.7	5.7
110000	22.31	6.34		44	5.68	5.68
120000	22.6	6.37		45	5.72	5.72
130000	23.08	6.41		46	5.77	5.77
140000	22.83	6.39		47	5.76	5.76
150000	23.17	6.46		48	5.85	5.85
160000	23.77	6.11		49	5.51	5.51
170000	23.39	5.82		50	5.23	5.23

180000	23.43	5.7		51	.12	5.12
190000	23.26	5.65		52	5.08	5.08

200000	23.06	5.83		53	5.27	5.27
210000	23.06	5.87		54	5.32	5.32
220000	22.9	6.08		55	5.54	5.54
230000	22.89	6.21		56	5.68	5.68
0	22.72	6.16	60395	57	5.65	5.65
10000	22.58	6.23		58	5.73	5.73
20000	22.53	6.17		59	5.68	5.68
30000	22.51	6		60	5.52	5.52
40000	22.54	5.51		61	5.04	5.04
50000	22.56	5.59		62	5.13	5.13
60000	22.54	5.31		63	4.86	4.86
70000	22.56	5.38		64	4.94	4.94
80000	22.54	5.57		65	5.15	5.15
90000	22.53	5.75		66	5.34	5.34
100000	22.4	6		67	5.6	5.6
110000	22.4	6.07		68	5.68	5.68
120000	22.51	5.95		69	5.57	5.57
130000	22.83	6.13		70	5.76	5.76
140000	23.5	6.09		71	5.73	5.73
150000	23.39	6.14		72	5.79	5.79
160000	23.55	5.84		73	5.5	5.5
170000	23.66	5.79		74	5.47	5.47
180000	23.81	5.96		75	5.65	5.65
190000	23.63	5.4		76	5.1	5.1
200000	23.55	5.45		77	5.16	5.16
210000	23.44	5.73		78	5.45	5.45
220000	23.3	5.72		79	5.45	5.45
230000	23.3	5.85		80	5.59	5.59
0	23.26	5.84	60495	81	5.59	5.59
10000	23.08	5.78		82	5.54	5.54
20000	23.03	5.88		83	5.66	5.66
30000	23.1	5.7		84	5.49	5.49
40000	23.16	5.64		85	5.44	5.44
50000	23.1	5.39		86	5.2	5.2
60000	23.1	5.38		87	5.2	5.2
70000	23.1	5.25		88	5.08	5.08
80000	23.05	5.1		89	4.94	4.94
90000	23.19	5.53		90	5.38	5.38
100000	23.21	5.59		91	5.46	5.46
110000	23.28	5.76		92	5.64	5.64
120000	23.46	5.63		93	5.52	5.52
130000	23.81	5.58		94	5.48	5.48
140000	24.32	5.82		95	5.73	5.73
150000	24.26	5.69	000740	96	5.61	5.61
160000	24.12	5.52		97	5.45	5.45
170000	24.01	5.36		98	5.3	5.3
180000	24.13	5.46		99	5.41	5.41
190000	24.13	5.62		100	5.59	5.59

200000	23.82	5.5		101	.48	5.48	
210000	24.06	5.95		102	5.94	5.94	
220000	23.97	5.98	5.98	103	5.98	5.98	
230000	23.97	6.04	assumed	1	6.05	6.05	
0	23.9	6.04	60595	2	6.06	6.06	5.99
10000	23.88	5.98		3	6.01	6.01	
20000	23.79	6.04		4	6.08	6.08	
30000	23.64	6.1		5	6.16	6.16	

40000	23.57	5.95		6	6.02	6.02	
50000	23.46	5.86		7	5.94	5.94	
60000	23.44	5.66		8	5.75	5.75	
70000	23.46	5.61		9	5.71	5.71	
80000	23.44	5.81		10	5.92	5.92	
90000	23.52	6.06		11	6.18	6.18	
100000	23.59	6.11		12	6.24	6.24	
110000	23.7	6.14		13	6.28	6.28	
120000	23.75	6.12		14	6.28	6.28	
130000	23.75	6.04		15	6.21	6.21	
140000	23.68	6.04		16	6.22	6.22	
150000	23.79	5.98		17	6.17	6.17	
160000	23.77	5.78		18	5.98	5.98	
170000	23.72	5.77		19	5.98	5.98	
180000	23.92	5.72		20	5.94	5.94	
190000	24.04	5.61		21	5.84	5.84	
200000	23.77	4.93		22	5.18	5.18	
210000	23.73	5.51		23	5.77	5.77	
220000	23.64	5.67		24	5.94	5.94	
230000	23.52	5.63		25	5.91	5.91	
0	23.19	5.88	60695	26	6.17	6.17	5.88
10000	23.08	6.01		27	6.31	6.31	
20000	22.99	5.95		28	6.26	6.26	
30000	22.9	5.85		29	6.17	6.17	
40000	22.76	5.76		30	6.09	6.09	
50000	22.69	5.63		31	5.98	5.98	
60000	22.69	5.54		32	5.9	5.9	
70000	22.71	5.35		33	5.72	5.72	
80000	22.74	5.23		34	5.61	5.61	
90000	22.74	5.2		35	5.59	5.59	
100000	22.76	5.43		36	5.83	5.83	
110000	22.76	5.49		37	5.9	5.9	
120000	22.69	5.54		38	5.96	5.96	
130000	22.71	5.66		39	6.09	6.09	
140000	22.8	5.74		40	6.19	6.19	
150000	22.87	5.6	000741	41	6.06	6.06	
160000	22.89	5.5		42	5.97	5.97	
170000	22.89	5.27		43	5.75	5.75	
180000	22.87	5.24		44	5.73	5.73	
190000	22.85	5.22		45	5.72	5.72	
200000	22.85	5.05		46	5.56	5.56	
210000	22.85	4.92		47	5.44	5.44	

220000	22.83	4.92		48	5.46	5.46
230000	22.83	5.15		49	5.7	5.7
0	22.78	5.25	60795	50	5.81	5.81
10000	22.67	5.41		51	5.98	5.98
20000	22.63	5.64		52	6.22	6.22
30000	22.62	5.69		53	6.28	6.28
40000	22.54	5.55		54	6.15	6.15
50000	22.47	5.36		55	5.97	5.97
60000	22.44	5.33		56	5.95	5.95
70000	22.44	5.28		57	5.92	5.92
80000	22.44	4.94		58	5.59	5.59
90000	22.46	4.69		59	5.35	5.35
100000	22.54	4.64		60	5.31	5.31
110000	22.58	5.13	5.81	61	5.81	5.81

6/7/95 Total Mean Daily DO = 6.01

Pamunkey R., PMK048.80, Carters Landing below Monquin Cr., 5/31-6/7/95							
Time	TempC	Sonde DO, mg/l	QAQC DO	Corr. DO, mg/l	Corr. DO, Value	Daily Mean DO	
150000	23.06	8.04	not equil	0	5.38	5.38	
160000	22.74	6.53	5.38	1	5.38	5.38	
170000	22.4	6.43		2	5.3	5.3	
180000	22.85	6.6	[Low flow	3	5.48	5.48	
190000	22.89	6.71	Datasonde	4	5.6	5.6	
200000	22.47	6.71	membrane	5	5.62	5.62	
210000	22.44	6.65	reads DO	6	5.57	5.57	
220000	22.35	6.64	2.5 %	7	5.57	5.57	
230000	22.13	6.67	High!]	8	5.61	5.61	
0	21.99	6.86	60195	9	5.91	5.91	5.51
10000	21.89	6.57		10	5.53	5.53	
20000	21.85	6.51		11	5.48	5.48	
30000	21.9	6.58		12	5.56	5.56	
40000	21.97	6.52		13	5.52	5.52	
50000	21.89	6.34		14	5.35	5.35	
60000	21.85	6.26		15	5.28	5.28	
70000	21.82	6.51		16	5.54	5.54	
80000	21.67	6.57		17	5.61	5.61	
90000	21.62	6.74		18	5.79	5.79	
100000	21.64	6.64		19	5.7	5.7	
110000	21.74	6.57		20	5.64	5.64	
120000	22.17	6.53		21	5.61	5.61	
130000	22.65	6.63		22	5.73	5.73	
140000	22.74	6.3		23	5.41	5.41	
150000	23.05	5.86		24	4.98	4.98	
160000	23.63	5.75		25	4.88	4.88	
170000	22.83	6.03		26	5.17	5.17	
180000	22.69	6.11		27	5.26	5.26	
190000	22.71	6.13		28	5.29	5.29	
200000	22.9	6.47		29	5.64	5.64	
210000	22.81	6.44		30	5.62	5.62	
220000	22.76	6.66		31	5.86	5.86	
230000	22.63	6.67		32	5.88	5.88	

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PMK048.80, Pamunkey R. at Carters Landing, 6/7/95 - 6/14/95

Time	Temp	Cond	Salin	Sonde DO, mg/l	Date/ QAQC DO	Mean Daily DO
110000	22.62	0.0761	0	5.96	60795	6.16
120000	23.65	0.0756	0	6.12	5.81@1100	Partial
130000	23.11	0.0748	0	6.3		Day
140000	23.43	0.0746	0	6.35		
150000	23.65	0.0747	0	6.31		
160000	23.87	0.0749	0	6.28		
170000	23.96	0.0752	0	6.28		
180000	23.85	0.0751	0	6.16		
190000	23.85	0.075	0	6.12		
200000	23.83	0.0751	0	6.12		
210000	23.81	0.075	0	6.15		
220000	23.85	0.0751	0	6.11		
230000	23.91	0.075	0	5.84		
0	23.87	0.0757	0	6.01	60895	6.01
10000	23.78	0.0754	0	5.98		
20000	23.63	0.0756	0	6.08		
30000	23.43	0.0758	0	6.17		
40000	23.34	0.076	0	6.12		
50000	23.23	0.0765	0	6.04		
60000	23.11	0.0769	0	6.02		
70000	23.07	0.077	0	6.06		
80000	23.09	0.0769	0	5.93		
90000	23.14	0.077	0	5.76		
100000	23.41	0.0771	0	5.84		
110000	23.47	0.077	0	5.7		
120000	23.41	0.077	0	5.74		
130000	24.11	0.0773	0	5.94		
140000	24.13	0.0773	0	6.13		
150000	24	0.0776	0	6.13		
160000	24.24	0.0781	0	6.34		
170000	24.62	0.0787	0	6.3		
180000	24.66	0.0792	0	6.23		
190000	24.57	0.079	0	6.07		
200000	24.57	0.0788	0	5.73		
210000	24.53	0.0784	0	6.13		
220000	24.53	0.0787	0	6.05		
230000	24.58	0.0786	0	5.84		
0	24.57	0.0786	0	5.81	60995	5.89
10000	24.57	0.0786	0	5.88		
20000	24.46	0.0785	0	6		
30000	24.46	0.0778	0	6.05	3 DOs lost,	
40000	24.33	0.0783	0	6.1	interpo-	
50000	24.22	0.0777	0	6.15	lated to	
60000	24.11	0.0779	0	6.22	HERE!!	
70000	24.03	0.0777	0	6.05		

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80000	24.11	0.0778	0	5.93
90000	24.07	0.0777	0	5.81
100000	24.27	0.0775	0	5.76
110000	24.46	0.0775	0	5.76
120000	24.86	0.0775	0	5.77
130000	24.68	0.0775	0	5.47
140000	24.81	0.0777	0	5.73

150000	25.1	0.0777	0	5.78
160000	24.75	0.0779	0	5.74
170000	24.86	0.0782	0	5.91
180000	25.01	0.0789	0	6.02
190000	24.92	0.08	0	5.99
200000	24.81	0.0804	0	5.92
210000	24.82	0.0803	0	5.79
220000	24.9	0.08	0	5.82
230000	24.84	0.0789	0	5.84
0	24.82	0.0788	0	5.58
10000	24.79	0.0788	0	5.39
20000	24.75	0.0784	0	5.07
30000	24.7	0.0785	0	5.62
40000	24.51	0.0788	0	5.66
50000	24.49	0.0797	0	5.83
60000	24.33	0.0807	0	5.79
70000	24.25	0.0818	0	5.76
80000	24.2	0.0827	0	5.65
90000	24.27	0.0836	0	5.58
100000	24.49	0.0838	0	5.61
110000	24.55	0.0834	0	5.54
120000	24.62	0.0828	0	5.38
130000	25.29	0.0823	0	5.73
140000	24.9	0.0823	0	5.44
150000	25.29	0.0826	0	5.6
160000	24.92	0.083	0	5.6
170000	25.1	0.0841	0	5.83
180000	25.23	0.0841	0	5.98
190000	25.2	0.0835	0	5.94
200000	25.14	0.0827	0	5.99
210000	25.12	0.0819	0	5.9
220000	25.08	0.082	0	5.6
230000	25.12	0.0828	0	5.84
0	25.1	0.0834	0	5.81
10000	25.08	0.0838	0	5.7
20000	25.05	0.0839	0	5.62
30000	25.03	0.0839	0	5.29
40000	24.95	0.0839	0	5.5
50000	24.86	0.0836	0	5.65
60000	24.81	0.0825	0	5.76
70000	24.75	0.0831	0	5.82
80000	24.7	0.086	0	5.72
90000	24.64	0.0897	0	5.64

61095 5.66

61195 5.67

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100000	24.84	0.0933	0	5.66
110000	25.1	0.0939	0	5.51
120000	25.29	0.0911	0	5.55
130000	25.72	0.0881	0	5.67
140000	25.91	0.0864	0	5.34
150000	25.68	0.0861	0	5.36
160000	27.08	0.087	0	5.79
170000	25.83	0.09	0	5.55
180000	26.11	0.0951	0	5.85
190000	26.15	0.097	0	5.94
200000	26.09	0.0989	0	5.94
210000	25.98	0.1007	0	5.86
220000	25.92	0.1017	0	5.8

230000	25.87	0.1016	0	5.71		
0	25.87	0.1003	0	5.62	61295	5.39
10000	25.98	0.0983	0	5.17		
20000	25.96	0.0969	0	5.33		
30000	25.94	0.0951	0	5.32		
40000	25.89	0.0948	0	4.82		
50000	25.7	0.0937	0	5.33		
60000	25.76	0.0968	0	5.63		
70000	25.61	0.0999	0	5.64		
80000	25.47	0.1025	0	5.59		
90000	25.33	0.1024	0	5.51		
100000	25.42	0.1004	0	5.54		
110000	25.64	0.0987	0	5.3		
120000	25.55	0.0988	0	5.09		
130000	25.55	0.1005	0	5.24		
140000	25.59	0.102	0	5.2		
150000	25.62	0.1023	0	4.96		
160000	25.66	0.1024	0	5.11		
170000	25.61	0.1023	0	5.33		
180000	25.51	0.1013	0	5.34		
190000	25.44	0.0986	0	5.47		
200000	25.18	0.0962	0	5.74		
210000	25.03	0.0957	0	5.72		
220000	24.82	0.0741	0	5.81		
230000	24.94	0.0967	0	5.47		
0	24.9	0.0966	0	5.16	61395	5.21
10000	24.92	0.0964	0	5.5		
20000	24.88	0.0964	0	5.34		
30000	24.84	0.0968	0	4.95		
40000	24.82	0.0977	0	5.27		
50000	24.79	0.0988	0	4.76		
60000	24.75	0.0998	0	4.92		
70000	24.29	0.0989	0	5.23		
80000	24.46	0.097	0	5.46		
90000	24.25	0.0962	0	5.5		
100000	23.96	0.0951	0	5.38		
110000	23.81	0.0954	0	5.35		

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120000	23.96	0.096	0	5.21		
130000	23.98	0.0958	0	5.07		
140000	24	0.0958	0	5.22		
150000	24.05	0.0956	0	5.22		
160000	24.16	0.0957	0	4.88		
170000	24.24	0.0958	0	4.81		
180000	24.18	0.0958	0	5.09		
190000	23.96	0.0956	0	5.24		
200000	23.98	0.096	0	5.33		
210000	23.96	0.0955	0	5.39		
220000	23.71	0.0956	0	5.42		
230000	23.54	0.0956	0	5.36		
0	23.6	0.0955	0	5.09	61495	4.98
10000	23.63	0.0956	0	5.06		
20000	23.58	0.0959	0	5.21	(6/13@1200 -	
30000	23.51	0.0959	0	4.81	6/14@1100	
40000	23.45	0.0957	0	4.66	Mean DO =	5.09
50000	23.4	0.0956	0	4.74		
60000	23.4	0.0955	0	4.48		

70000	23.27	0.0957	0	4.84		
80000	23.14	0.0954	0	5.08		
90000	23.14	0.0954	0	5.25		
100000	23.05	0.095	0	5.27		
110000	23.03	0.0948	0	5.32	5.44	

DO within Sonde specs at start and end; NO CORRECTION MADE.

6/14/95 Total Mean Daily DO = 5.21 ✓

000746

PMK048.80, Pamunkey R. at Carters Landing, June 14 - 21, 1995

Time	Temp	Cond	Sonde DO, mg/l	Date/ QAQC DO	Corr. DO Formula	Corr. DO Value	Mean Daily DO
110000	22.95	0.095	5.56	61495	5.41	5.41	5.43
120000	23.05	0.0957	5.62	5.44	5.47	5.47	Partial
130000	23.28	0.0969	5.68		5.53	5.53	Day
140000	23.41	0.097	5.65		5.5	5.5	
150000	23.64	0.0969	5.53		5.38	5.38	
160000	23.77	0.0965	5.43		5.28	5.28	
170000	23.73	0.0961	5.56		5.41	5.41	
180000	23.77	0.096	5.18		5.03	5.03	
190000	23.66	0.096	5.42		5.27	5.27	
200000	23.64	0.0967	5.56		5.41	5.41	
210000	23.52	0.0973	5.75		5.6	5.6	
220000	23.48	0.0976	5.84		5.69	5.69	
230000	23.23	0.0977	5.78		5.63	5.63	
0	22.99	0.0988	5.82	61595	5.67	5.67	5.78
10000	22.9	0.1007	5.82		5.67	5.67	
20000	22.94	0.1002	5.6		5.45	5.45	
30000	22.92	0.0997	5.56		5.41	5.41	
40000	22.92	0.0991	5.52		5.37	5.37	
50000	22.92	0.0985	5.44		5.29	5.29	
60000	22.9	0.0981	5.37		5.22	5.22	
70000	22.87	0.0981	5.37		5.22	5.22	
80000	22.6	0.0984	5.54		5.39	5.39	
90000	22.54	0.101	5.71		5.56	5.56	
100000	22.4	0.106	6.09		5.94	5.94	
110000	22.4	0.106	6.09		5.94	5.94	
120000	22.49	0.1059	6.16		6.01	6.01	
130000	22.69	0.107	6.34		6.19	6.19	
140000	22.81	0.1097	6.41		6.26	6.26	
150000	23.25	0.1099	6.27		6.12	6.12	
160000	23.55	0.1089	6.33		6.18	6.18	
170000	23.43	0.1089	5.9		5.75	5.75	
180000	23.25	0.1079	5.44		5.29	5.29	
190000	23.46	0.1077	5.93		5.78	5.78	
200000	23.37	0.1078	6.31		6.16	6.16	
210000	23.05	0.1103	6.38		6.23	6.23	
220000	22.98	0.1114	6.5		6.35	6.35	
230000	22.9	0.1068	6.43		6.28	6.28	
0	22.76	0.1	6.35	61695	6.2	6.2	6.05
10000	22.54	0.0952	6.34		6.19	6.19	
20000	22.47	0.0922	6.31		6.16	6.16	
30000	22.51	0.093	6.05		5.9	5.9	
40000	22.42	0.0941	6.07		5.92	5.92	
50000	22.46	0.097	5.6		5.45	5.45	
60000	22.4	0.1	5.75		5.6	5.6	
70000	22.38	0.1019	5.69		5.54	5.54	
80000	22.33	0.1017	6.06	000747	5.91	5.91	
90000	22.37	0.0965	6.17		6.02	6.02	
100000	22.24	0.09	6.32		6.17	6.17	
110000	22.24	0.0887	6.37		6.22	6.22	
120000	22.26	0.0875	6.38		6.23	6.23	
130000	22.56	0.0867	6.57		6.42	6.42	

140000	22.85	0.0859	6.7	5.55	6.55
150000	23.17	0.0855	6.37	6.22	6.22
160000	23.44	0.086	5.92	5.77	5.77
170000	23.14	0.0862	5.97	5.82	5.82
180000	23.16	0.0868	6.3	6.15	6.15
190000	23.19	0.0872	6.21	6.06	6.06
200000	23.17	0.0875	6.02	5.87	5.87
210000	22.99	0.0871	6.31	6.16	6.16
220000	22.83	0.0861	6.42	6.27	6.27
230000	22.85	0.0856	6.45	6.3	6.3
0	22.71	0.0859	6.35	6.2	6.2
10000	22.47	0.0862	6.31	6.16	6.16
20000	22.29	0.0866	6.49	6.34	6.34
30000	22.26	0.086	6.09	5.94	5.94
40000	22.37	0.0861	5.95	5.8	5.8
50000	22.31	0.0862	6.09	5.94	5.94
60000	22.24	0.0862	5.64	5.49	5.49
70000	22.28	0.0862	6.01	5.86	5.86
80000	22.26	0.0862	5.76	5.61	5.61
90000	22.28	0.0862	6.16	6.01	6.01
100000	22.33	0.0863	6.19	6.04	6.04
110000	22.35	0.0862	6.35	6.2	6.2
120000	22.42	0.0864	6.35	6.2	6.2
130000	22.58	0.0865	6.43	6.28	6.28
140000	22.99	0.0862	6.54	6.39	6.39
150000	23.37	0.0856	6.03	5.88	5.88
160000	23.5	0.0855	5.94	5.79	5.79
170000	23.46	0.0858	6.1	5.95	5.95
180000	23.32	0.0861	6	5.85	5.85
190000	23.34	0.0865	5.82	5.67	5.67
200000	23.32	0.0866	6.21	6.06	6.06
210000	23.32	0.0866	5.49	5.34	5.34
220000	23.17	0.0865	6.23	6.08	6.08
230000	22.99	0.0858	6.29	6.14	6.14
0	22.83	0.0855	6.23	6.08	6.08
10000	22.8	0.0857	6.18	6.03	6.03
20000	22.65	0.0859	6.15	6	6
30000	22.62	0.0861	6.32	6.17	6.17
40000	22.58	0.0859	5.84	5.69	5.69
50000	22.62	0.0858	5.32	5.17	5.17
60000	22.6	0.0858	5.8	5.65	5.65
70000	22.56	0.0858	5.42	5.27	5.27
80000	22.56	0.0859	5.49	5.34	5.34
90000	22.54	0.0859	5.69	5.54	5.54
100000	22.67	0.0859	6.04	5.89	5.89
110000	22.8	0.0858	6.05	5.9	5.9
120000	22.98	0.086	6.04	5.89	5.89
130000	23.19	0.0869	6.15	6	6
140000	23.57	0.088	6.25	6.1	6.1
150000	23.63	0.0873	6.18	6.03	6.03

160000	23.81	0.0902	6.33	.18	6.18
170000	23.92	0.0901	6.03	5.88	5.88
180000	23.84	0.0895	5.95	5.8	5.8
190000	23.86	0.0884	6.15	6	6
200000	23.9	0.088	5.91	5.76	5.76
210000	23.92	0.0875	5.96	5.81	5.81
220000	23.88	0.0872	5.72	5.57	5.57
230000	23.79	0.0876	6.07	5.92	5.92

0	23.64	0.0887	6.13	61995	5.98	5.98	5.73
10000	23.41	0.0898	6.04		5.89	5.89	
20000	23.26	0.091	6		5.85	5.85	
30000	23.1	0.0916	6.02		5.87	5.87	
40000	22.94	0.0924	6.13		5.98	5.98	
50000	22.89	0.0925	5.89		5.74	5.74	
60000	22.99	0.0923	5.08		4.93	4.93	
70000	22.94	0.0922	5.76		5.61	5.61	
80000	22.9	0.0919	5.59		5.44	5.44	
90000	22.94	0.0912	5.57		5.42	5.42	
100000	23.16	0.0907	5.56		5.41	5.41	
110000	23.19	0.0915	5.94		5.79	5.79	
120000	23.34	0.0922	6		5.85	5.85	
130000	23.64	0.0928	6.06		5.91	5.91	
140000	23.86	0.0933	6.19		6.04	6.04	
150000	24.06	0.0938	6.24		6.09	6.09	
160000	24.12	0.0938	6.27		6.12	6.12	
170000	24.13	0.0938	6.14		5.99	5.99	
180000	24.17	0.0936	6.18		6.03	6.03	
190000	24.12	0.0938	6.07		5.92	5.92	
200000	24.21	0.0937	6.01		5.86	5.86	
210000	24.28	0.0936	5.55		5.4	5.4	
220000	24.28	0.0933	5.19		5.04	5.04	
230000	24.28	0.0928	5.52		5.37	5.37	
0	24.21	0.0933	5.9	62095	5.75	5.75	5.72
10000	24.08	0.0937	5.9		5.75	5.75	
20000	23.93	0.0936	5.79		5.64	5.64	
30000	23.88	0.0942	5.73		5.58	5.58	
40000	23.81	0.0954	5.9		5.75	5.75	
50000	23.72	0.0964	6.04		5.89	5.89	
60000	23.66	0.0968	5.73	000749	5.58	5.58	
70000	23.68	0.0966	5.75		5.6	5.6	
80000	23.75	0.096	5.74		5.59	5.59	
90000	23.81	0.0951	5.75		5.6	5.6	
100000	23.92	0.0943	5.82		5.67	5.67	
110000	23.95	0.0943	5.72		5.57	5.57	
120000	24.06	0.0948	5.82		5.67	5.67	
130000	24.23	0.0959	5.88		5.73	5.73	
140000	24.45	0.097	6		5.85	5.85	
150000	24.68	0.0976	6.08		5.93	5.93	
160000	24.89	0.0979	6.17		6.02	6.02	
170000	25.15	0.0007	6.68		6.53	6.53	

180000	24.92	0.0978	5.92		5.77	5.77
190000	24.85	0.0978	5.7		5.55	5.55
200000	24.81	0.098	5.82		5.67	5.67
210000	24.92	0.098	5.8		5.65	5.65
220000	24.96	0.0977	5.59		5.44	5.44
230000	24.94	0.097	5.66		5.51	5.51
0	24.92	0.0969	5.82	62195	5.67	5.67
10000	24.87	0.0975	5.88		5.73	5.73
20000	24.7	0.0979	5.8		5.65	5.65
30000	24.52	0.0979	5.75		5.6	5.6
40000	24.39	0.0979	5.75		5.6	5.6
50000	24.24	0.0979	5.91		5.76	5.76
60000	24.12	0.0982	5.86		5.71	5.71
70000	24.28	0.0983	5.61		5.46	5.46

80000	24.34	0.0982	5.41		5.26	5.26
90000	24.26	0.0981	5.59		5.44	5.44
100000	24.43	0.0983	5.6	5.42	5.45	5.45

62195 Total Mean Daily DO =

5.57 ✓

000750

6/24+25 < 5.0 ✓
C/24+25 ✓ STOKET 3/8/96

PMK048.80, Pamunkey R. at Carters Landing, 6/21-28/95, Batts 17.4v							
Time	Temp	Sonde DO,mg/l	Date/ QAQC DO	Number	Corr.DO Formula	Corr.DO Value	Daily Mean DO
100000	24.44	6.15	62195	81	5.42	5.42	5.57
110000	24.81	6.25	5.42	80	5.53	5.53	partial day
120000	24.68	6.09		79	5.38	5.38	
130000	24.82	6.25		78	5.55	5.55	
140000	25.03	6.35		77	5.66	5.66	
150000	25.21	6.47		76	5.79	5.79	
160000	25.23	6.53		75	5.86	5.86	
170000	25.1	6.53		74	5.86	5.86	
180000	25.16	6.26		73	5.6	5.6	
190000	25.05	5.78		72	5.13	5.13	
200000	25.03	6.14		71	5.5	5.5	
210000	25.07	6.32		70	5.69	5.69	
220000	25.21	6.2		69	5.58	5.58	
230000	25.23	5.97		68	5.36	5.36	
0	25.21	6.03	62295	67	5.43	5.43	5.31
10000	25.2	5.62		66	5.03	5.03	
20000	25.14	6.05		65	5.47	5.47	
30000	25.1	6.13		64	5.55	5.55	
40000	24.94	6.04		63	5.47	5.47	
50000	24.77	5.92		62	5.36	5.36	
60000	24.79	5.86		61	5.31	5.31	
70000	24.84	5.71		60	5.17	5.17	
80000	24.86	5.57		59	5.04	5.04	
90000	24.86	5.47		58	4.95	4.95	
100000	24.9	5.54		57	5.03	5.03	
110000	24.99	5.53		56	5.03	5.03	
120000	25.4	5.86		55	5.37	5.37	
130000	25.51	5.43		54	4.94	4.94	
140000	25.27	5.75		53	5.27	5.27	
150000	25.34	5.88		52	5.41	5.41	
160000	25.46	5.93		51	5.47	5.47	
170000	25.7	5.99		50	5.54	5.54	
180000	25.79	6.1		49	5.66	5.66	
190000	25.74	5.94		48	5.51	5.51	
200000	25.68	5.84		47	5.42	5.42	
210000	25.64	5.91		46	5.5	5.5	
220000	25.68	5.79		45	5.39	5.39	
230000	25.64	5.4		44	5	5	
0	25.55	5.4	62395	43	5.01	5.01	5.07
10000	25.51	5.32		42	4.94	4.94	
20000	25.46	5.37		41	5	5	
30000	25.38	5.73		40	5.37	5.37	
40000	25.44	5.74		39	5.39	5.39	
50000	25.38	5.75		38	5.41	5.41	
60000	25.21	5.55		37	5.22	5.22	
70000	24.99	5.49		36	5.17	5.17	
80000	24.97	5.42		35	5.11	5.11	
90000	24.99	5.26		34	4.95	4.95	
100000	24.99	5.23		33	4.93	4.93	
110000	25.08	5.14		32	4.85	4.85	
120000	25.33	5.24		31	4.96	4.96	
130000	25.46	5.08		30	4.81	4.81	

000751

140000	25.62	.94		29	.68	4.68
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150000	25.42	5.45		28	5.2	5.2
160000	25.36	5.41		27	5.17	5.17
170000	25.23	5.46		26	5.23	5.23
180000	25.23	5.49		25	5.27	5.27
190000	25.27	5.47		24	5.25	5.25
200000	25.29	5.39		23	5.18	5.18
210000	25.27	4.98		22	4.78	4.78
220000	25.25	5.28		21	5.09	5.09
230000	25.21	4.79		20	4.61	4.61

0	25.16	4.66	62495	19	4.49	4.49	4.75
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10000	25.18	4.96		18	4.8	4.8
20000	25.2	4.64		17	4.49	4.49
30000	25.25	4.5		16	4.36	4.36
40000	25.14	5.14		15	5.01	5.01
50000	25.05	5.09		14	4.96	4.96
60000	25.01	5.11		13	4.99	4.99
70000	24.92	5		12	4.89	4.89
80000	24.84	4.91		11	4.81	4.81
90000	24.88	4.84		10	4.75	4.75
100000	24.94	4.65		9	4.57	4.57
110000	24.99	4.34		8	4.27	4.27
120000	24.99	4.62		7	4.56	4.56
130000	25.18	4.8		6	4.75	4.75
140000	25.49	4.37		5	4.33	4.33
150000	25.33	4.54		4	4.5	4.5
160000	25.61	5.04	graduated	3	5.01	5.01
170000	25.57	4.95	corr.	2	4.93	4.93
180000	25.61	4.9	assumed	1	4.89	4.89
190000	25.76	5	= 0 here	0	5	5
200000	25.79	5.12		1	5.13	5.13
210000	25.7	4.9		2	4.92	4.92
220000	25.7	4.66		3	4.69	4.69
230000	25.74	4.78		4	4.82	4.82

0	25.64	4.35	62595	5	4.39	4.39	4.9
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10000	25.55	4.4		6	4.45	4.45
20000	25.53	4.39		7	4.45	4.45
30000	25.53	4.25		8	4.32	4.32
40000	25.49	4.48		9	4.56	4.56
50000	25.44	4.77		10	4.86	4.86
60000	25.44	4.81		11	4.91	4.91
70000	25.34	4.82		12	4.93	4.93
80000	25.27	4.89		13	5.01	5.01
90000	25.31	4.82		14	4.95	4.95
100000	25.46	4.81		15	4.94	4.94
110000	25.66	4.83		16	4.97	4.97
120000	26.47	4.86		17	5.01	5.01
130000	25.72	4.06		18	4.22	4.22
140000	25.79	4.49		19	4.66	4.66
150000	25.89	4.73		20	4.91	4.91

000752

160000	26.55	1.18	21	.37	5.37
170000	26.23	5.11	22	5.31	5.31
180000	26.09	5.08	23	5.29	5.29
190000	26.04	5.04	24	5.26	5.26
200000	25.96	5.07	25	5.29	5.29
210000	25.87	5.11	26	5.34	5.34
220000	25.79	4.68	27	4.92	4.92

230000	25.77	4.96	28	5.21	5.21	
0	25.79	4.87	29	5.13	5.13	5.25
10000	25.81	4.37	30	4.64	4.64	
20000	25.76	4.4	31	4.68	4.68	
30000	25.72	4.48	32	4.77	4.77	
40000	25.62	4.88	33	5.18	5.18	
50000	25.44	5.08	34	5.39	5.39	
60000	25.36	5.31	35	5.62	5.62	
70000	25.18	5.19	36	5.51	5.51	
80000	24.95	5.04	37	5.37	5.37	
90000	24.82	4.94	38	5.28	5.28	
100000	24.97	4.94	39	5.29	5.29	
110000	25.25	4.7	40	5.06	5.06	
120000	25.7	4.91	41	5.28	5.28	
130000	25.34	4.21	42	4.59	4.59	
140000	25.33	4.29	43	4.68	4.68	
150000	25.49	4.52	44	4.92	4.92	
160000	26.13	4.95	45	5.35	5.35	
170000	25.66	5.22	46	5.63	5.63	
180000	25.72	5.27	47	5.69	5.69	
190000	25.66	5.24	48	5.67	5.67	
200000	25.64	5.21	49	5.65	5.65	
210000	25.61	5.1	50	5.55	5.55	
220000	25.55	5.11	51	5.57	5.57	
230000	25.53	4.94	52	5.41	5.41	
0	25.49	4.83	53	5.31	5.31	5.26
10000	25.51	4.17	54	4.66	4.66	
20000	25.49	4.49	55	4.98	4.98	
30000	25.49	4.16	56	4.66	4.66	
40000	25.47	4.59	57	5.1	5.1	
50000	25.42	4.97	58	5.49	5.49	
60000	25.36	5.09	59	5.62	5.62	
70000	25.36	5.14	60	5.68	5.68	
80000	25.23	5.03	61	5.58	5.58	
90000	25.2	4.9	62	5.46	5.46	
100000	25.2	4.78	63	5.35	5.35	
110000	25.29	4.88	64	5.46	5.46	
120000	25.44	4.93	65	5.51	5.51	
130000	26.24	4.77	66	5.36	5.36	
140000	25.7	3.95	67	4.55	4.55	
150000	26.13	4.22	68	4.83	4.83	
160000	25.72	4.08	69	4.7	4.7	
170000	25.68	4.64	70	5.27	5.27	

000753

180000	25.94	4.9		71	.54	5.54
190000	25.4	4.89		72	5.54	5.54
200000	25.18	4.91		73	5.57	5.57
210000	25.12	4.82		74	5.49	5.49
220000	25.03	4.72		75	5.39	5.39
230000	24.82	4.57		76	5.25	5.25
0	24.73	4.46	62895	77	5.15	5.15
10000	24.7	4.21		78	4.91	4.91
20000	24.73	4.05		79	4.76	4.76
30000	24.71	4.24		80	4.96	4.96
40000	24.7	4.15		81	4.88	4.88
50000	24.64	4.3		82	5.04	5.04
60000	24.55	4.43		83	5.18	5.18
						5.08
						partial
						day

70000	24.42	4.45		84	5.2	5.2
80000	24.42	4.45		85	5.21	5.21
90000	24.4	4.49		86	5.26	5.26
100000	24.4	4.59	5.37	87	5.37	5.37

Total Mean Daily DO, 6/28/95 = 5.27

000754

7/1-5 < 5.0 ✓

SECRET
3/8/9

PMK048.80, Pamunkey R. at Carters Landing, June 28 - July 5, 1995

Time	Temp	Sonde DO, mg/l	Date/ QAQC DO	Number	Corr.DO Formula	Corr.DO Value	Mean Daily DO
100000	24.32	5.48	62895	24	5.38	5.38	5.79
110000	24.32	5.47	5.37	23	5.37	5.37	Partial
120000	24.3	5.48		22	5.39	5.39	Day
130000	24.3	5.53		21	5.44	5.44	
140000	24.37	5.57		20	5.49	5.49	
150000	24.41	5.64		19	5.56	5.56	
160000	24.45	5.89		18	5.82	5.82	
170000	24.46	6.04		17	5.97	5.97	
180000	24.39	6.14		16	6.07	6.07	
190000	24.34	6.18		15	6.12	6.12	
200000	24.34	6.18		14	6.12	6.12	
210000	24.5	6.18		13	6.13	6.13	
220000	24.5	6.15		12	6.1	6.1	
230000	24.5	6.15		11	6.1	6.1	
0	24.63	6.06	62995	10	6.02	6.02	6.07
10000	24.8	6.02		9	5.98	5.98	
20000	24.94	6.07		8	6.04	6.04	
30000	25.09	6.22		7	6.19	6.19	
40000	25.13	6.22		6	6.2	6.2	
50000	25.11	6.23		5	6.21	6.21	
60000	25.09	6.16	Graduated	4	6.14	6.14	
70000	25.05	6.26	Corr.	3	6.25	6.25	
80000	24.94	6.22	Assumed	2	6.21	6.21	
90000	24.81	6.11	OK Here!	1	6.11	6.11	
100000	24.8	6.05		1	6.05	6.05	
110000	24.59	6.03		2	6.04	6.04	
120000	24.52	6.07		3	6.08	6.08	
130000	24.5	6.01		4	6.03	6.03	
140000	24.52	5.93		5	5.95	5.95	
150000	24.56	5.93		6	5.95	5.95	
160000	24.54	6.09		7	6.12	6.12	
170000	24.54	6.07		8	6.1	6.1	
180000	24.54	6.04		9	6.08	6.08	
190000	24.5	6.05		10	6.09	6.09	
200000	24.45	6.02		11	6.07	6.07	
210000	24.41	5.93		12	5.98	5.98	
220000	24.32	5.89		13	5.94	5.94	
230000	24.24	5.89		14	5.95	5.95	
0	24.21	5.8	63095	15	5.86	5.86	5.66
10000	24.15	5.73		16	5.8	5.8	
20000	24.08	5.79		17	5.86	5.86	
30000	24.04	5.9		18	5.97	5.97	
40000	23.99	5.91		19	5.99	5.99	
50000	23.95	5.93		20	6.01	6.01	
60000	23.9	5.91		21	6	6	
70000	23.86	5.88		22	5.97	5.97	
80000	23.84	5.82		23	5.92	5.92	
90000	23.77	5.7		24	5.8	5.8	
100000	23.75	5.6		25	5.7	5.7	000755
110000	23.75	5.53		26	5.64	5.64	
120000	23.84	5.5		27	5.61	5.61	
130000	24.03	5.44		28	5.56	5.56	

140000	24.1	5.39		29	5.51	5.51	
150000	24.17	5.41		30	5.53	5.53	
160000	24.15	5.47		31	5.6	5.6	
170000	24.21	5.44		32	5.57	5.57	
180000	24.24	5.39		33	5.53	5.53	
190000	24.23	5.33		34	5.47	5.47	
200000	24.23	5.25		35	5.39	5.39	
210000	24.17	5.18		36	5.33	5.33	
220000	24.13	5.02		37	5.17	5.17	
230000	24.08	4.98		38	5.14	5.14	
0	24.08	4.92	70195	39	5.08	5.08	4.84
10000	24.08	4.93		40	5.1	5.1	
20000	24.1	4.85		41	5.02	5.02	
30000	24.08	4.84		42	5.01	5.01	
40000	24.06	4.83		43	5.01	5.01	
50000	24.03	4.82		44	5	5	
60000	23.99	4.77		45	4.96	4.96	
70000	23.95	4.74		46	4.93	4.93	
80000	23.93	4.69		47	4.88	4.88	
90000	23.93	4.66		48	4.86	4.86	
100000	23.99	4.64		49	4.84	4.84	
110000	24.06	4.56		50	4.77	4.77	
120000	24.17	4.52		51	4.73	4.73	
130000	24.3	4.48		52	4.7	4.7	
140000	24.45	4.42		53	4.64	4.64	
150000	24.52	4.41		54	4.63	4.63	
160000	24.54	4.43		55	4.66	4.66	
170000	24.54	4.45		56	4.68	4.68	
180000	24.46	4.6		57	4.84	4.84	
190000	24.46	4.61		58	4.85	4.85	
200000	24.48	4.56		59	4.8	4.8	
210000	24.45	4.56		60	4.81	4.81	
220000	24.41	4.51		61	4.76	4.76	
230000	24.39	4.45		62	4.71	4.71	
0	24.41	4.42	70295	63	4.68	4.68	4.45
10000	24.39	4.37		64	4.64	4.64	
20000	24.39	4.3		65	4.57	4.57	
30000	24.39	4.33		66	4.6	4.6	
40000	24.39	4.31		67	4.59	4.59	
50000	24.37	4.26		68	4.54	4.54	
60000	24.32	4.17	000756	69	4.46	4.46	
70000	24.26	4.13		70	4.42	4.42	
80000	24.21	4.1		71	4.39	4.39	
90000	24.17	4.07		72	4.37	4.37	
100000	24.12	4.04		73	4.34	4.34	
110000	24.08	4.03		74	4.34	4.34	
120000	24.23	4.03		75	4.34	4.34	
130000	24.32	3.98		76	4.29	4.29	
140000	24.39	3.99		77	4.31	4.31	
150000	24.48	4.07		78	4.39	4.39	

160000	24.56	4.1	79	4.43	4.43
170000	24.61	4.12	80	4.45	4.45
180000	24.59	4.12	81	4.46	4.46
190000	24.57	4.12	82	4.46	4.46
200000	24.54	4.12	83	4.46	4.46
210000	24.48	4.12	84	4.47	4.47
220000	24.41	4.06	85	4.41	4.41

230000	24.32	4.01	86	4.37	4.37
0	24.32	4.06	87	4.42	4.42
10000	24.23	4.08	88	4.44	4.44
20000	24.15	4.05	89	4.42	4.42
30000	24.15	4.11	90	4.48	4.48
40000	24.13	4.1	91	4.48	4.48
50000	24.08	4.12	92	4.5	4.5
60000	23.99	4.06	93	4.45	4.45
70000	23.92	4.08	94	4.47	4.47
80000	23.82	4.05	95	4.44	4.44
90000	23.73	4	96	4.4	4.4
100000	23.75	4	97	4.4	4.4
110000	23.75	3.99	98	4.4	4.4
120000	23.72	3.99	99	4.4	4.4
130000	23.81	4.09	100	4.5	4.5
140000	23.88	4.08	101	4.5	4.5
150000	23.95	4.07	102	4.49	4.49
160000	24.03	4.14	103	4.57	4.57
170000	24.04	4.15	104	4.58	4.58
180000	24.06	4.19	105	4.62	4.62
190000	24.06	4.17	106	4.61	4.61
200000	24.03	4.23	107	4.67	4.67
210000	23.99	4.16	108	4.61	4.61
220000	23.97	4.12	109	4.57	4.57
230000	23.95	4.05	110	4.51	4.51
0	23.95	4.11	111	4.57	4.57
10000	23.9	4.13	112	4.59	4.59
20000	23.92	4.08	113	4.55	4.55
30000	23.9	4.11	114	4.58	4.58
40000	23.9	4.12	115	4.6	4.6
50000	23.92	4.12	116	4.6	4.6
60000	23.92	4.08	117	4.56	4.56
70000	23.92	4.08	118	4.57	4.57
80000	23.9	4.04	119	4.53	4.53
90000	23.93	4.04	120	4.54	4.54
100000	23.99	4.01	121	4.51	4.51
110000	23.99	4	122	4.51	4.51
120000	24.12	3.98	123	4.49	4.49
130000	24.24	3.95	124	4.46	4.46
140000	24.3	3.93	125	4.45	4.45
150000	24.37	3.96	126	4.48	4.48
160000	24.45	3.84	127	4.37	4.37
170000	24.43	3.9	128	4.43	4.43

180000	24.32	4.48		129	.01	5.01
190000	24.21	4.84		130	5.38	5.38
200000	24.08	4.96		131	5.5	5.5
210000	23.9	4.97		132	5.52	5.52
220000	23.79	4.89		133	5.44	5.44
230000	23.79	4.62		134	5.18	5.18
0	23.79	4.42	70595	135	4.98	4.98
10000	23.82	4.22		136	4.78	4.78
20000	23.77	3.95		137	4.52	4.52
30000	23.77	3.66		138	4.23	4.23
40000	23.73	3.57		139	4.15	4.15
50000	23.66	3.47		140	4.05	4.05
60000	23.59	3.46		141	4.04	4.04
						4.27

70000	23.55	3.46		142	4.05	4.05
80000	23.55	3.51		143	4.1	4.1
90000	23.57	3.44		144	4.04	4.04
100000	23.63	3.47	4.07	145	4.07	4.07

Total Mean Daily DO 7/5/95 =

4.21

000758

7/5-7 < 5.0 ✓

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3/8/96

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PMK 048.80, Pamunkey R. at Carters Landing, 7/5 - 7/12/95

Time	Temp	Sonde DO, mg/l	Date/ QAQC DO	Number	Corr.DO Formula	Corr.DO Value	Mean Daily DO
100000	23.67	4.07	70595	0	4.07	4.07	4.16
110000	23.74	4.1	4.07	1	4.11	4.11	Partial
120000	23.8	4.09		2	4.11	4.11	Day
130000	23.89	3.9		3	3.92	3.92	
140000	24.07	3.95		4	3.98	3.98	
150000	24.2	4.06		5	4.1	4.1	
160000	24.29	4.03		6	4.08	4.08	
170000	24.38	3.83		7	3.89	3.89	
180000	24.46	3.84		8	3.9	3.9	
190000	24.49	3.87		9	3.94	3.94	
200000	24.49	4.29		10	4.37	4.37	
210000	24.49	4.41		11	4.5	4.5	
220000	24.49	4.5		12	4.59	4.59	
230000	24.49	4.59		13	4.69	4.69	
0	24.49	4.65	70695	14	4.76	4.76	4.85
10000	24.49	4.6		15	4.72	4.72	
20000	24.47	4.57		16	4.7	4.7	
30000	24.4	4.75		17	4.88	4.88	
40000	24.36	7.55		18	7.69	7.69	4.88
50000	24.31	4.74		19	4.89	4.89	
60000	24.31	4.57		20	4.73	4.73	
70000	24.29	4.29		21	4.46	4.46	
80000	24.29	4.28		22	4.45	4.45	
90000	24.55	4.48		23	4.66	4.66	
100000	24.84	4.85		24	5.04	5.04	
110000	24.71	4.97		25	5.17	5.17	
120000	24.73	4.77		26	4.98	4.98	
130000	24.92	4.93		27	5.14	5.14	
140000	25.14	4.67		28	4.89	4.89	
150000	25.29	4.5		29	4.73	4.73	
160000	25.44	4.48		30	4.72	4.72	
170000	25.49	4.59		31	4.84	4.84	
180000	25.4	4.58		32	4.83	4.83	
190000	25.38	3.96		33	4.22	4.22	
200000	25.34	4.41		34	4.68	4.68	
210000	25.34	4.24		35	4.52	4.52	
220000	25.36	4.07		36	4.35	4.35	
230000	25.33	3.97		37	4.26	4.26	
0	25.31	4.32	70795	38	4.62	4.62	4.51
10000	25.21	4.46		39	4.77	4.77	
20000	25.05	4.59		40	4.91	4.91	
30000	24.95	4.6		41	4.92	4.92	
40000	24.86	4.38		42	4.71	4.71	
50000	24.81	4.33		43	4.67	4.67	
60000	24.79	4.4		44	4.75	4.75	
70000	24.75	4		45	4.36	4.36	
80000	24.75	4.09		46	4.45	4.45	
90000	24.77	3.69		47	4.06	4.06	
100000	24.88	3.93		48	4.31	4.31	
110000	24.82	3.42		49	3.81	3.81	
120000	25.36	4.19		50	4.59	4.59	

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130000	25.2	4.65		51	5.05	5.05
140000	25.38	4.61		52	5.02	5.02
150000	25.62	4.54		53	4.96	4.96
160000	25.89	4.36		54	4.79	4.79
170000	26	4.43		55	4.87	4.87
180000	26	4.34		56	4.78	4.78
190000	26.04	3.64		57	4.09	4.09
200000	26.07	3.62		58	4.08	4.08
210000	25.98	2.96		59	3.43	3.43
220000	25.92	3.82		60	4.29	4.29
230000	25.91	3.48		61	3.96	3.96
0	25.91	3.83	70895	62	4.32	4.32
10000	25.83	3.81		63	4.31	4.31
20000	25.59	3.98		64	4.49	4.49
30000	25.57	4.57		65	5.08	5.08
40000	25.46	4.72		66	5.24	5.24
50000	25.31	4.59		67	5.12	5.12
60000	25.18	4.42		68	4.96	4.96
70000	24.99	4.56		69	5.11	5.11
80000	25.01	4.35		70	4.9	4.9
90000	25.12	4.22		71	4.78	4.78
100000	25.42	4.52		72	5.09	5.09
110000	26.06	4.48		73	5.06	5.06
120000	26.24	5.03		74	5.62	5.62
130000	26.04	5.02		75	5.61	5.61
140000	26.02	5.13		76	5.73	5.73
150000	26.04	5.01		77	5.62	5.62
160000	26.13	5.71		78	6.33	6.33
170000	26.23	5.04		79	5.67	5.67
180000	26.19	4.79		80	5.42	5.42
190000	26.04	4.91		81	5.55	5.55
200000	25.94	4.4		82	5.05	5.05
210000	25.85	3.63		83	4.29	4.29
220000	25.83	3.91		84	4.57	4.57
230000	25.76	3.79		85	4.46	4.46
0	25.72	4.33	70995	86	5.01	5.01
10000	25.61	4.28		87	4.97	4.97
20000	25.47	4.31		88	5.01	5.01
30000	25.01	4.56		89	5.26	5.26
40000	25.2	4.83		90	5.54	5.54
50000	25.2	4.88		91	5.6	5.6
60000	25.1	4.92	000760	92	5.65	5.65
70000	25.03	4.84		93	5.58	5.58
80000	25.03	4.8		94	5.54	5.54
90000	25.16	5.02		95	5.77	5.77
100000	25.4	4.54		96	5.3	5.3
110000	25.83	4.7		97	5.47	5.47
120000	26.15	4.77		98	5.55	5.55
130000	26.24	4.92		99	5.7	5.7
140000	26.15	5.19		100	5.98	5.98

5.1

5.54

150000	26.06	4.84		101	.64	5.64
160000	26.17	5.18		102	5.99	5.99
170000	26.17	5.08		103	5.9	5.9
180000	26.24	5.06		104	5.88	5.88
190000	26.15	4.93		105	5.76	5.76
200000	25.98	5.12		106	5.96	5.96
210000	25.85	4.71		107	5.56	5.56
220000	25.76	4.38		108	5.23	5.23

230000	25.72	4.28		109	5.14	5.14
0	25.68	4.75	71095	110	5.62	5.62
10000	25.61	4.55		111	5.43	5.43
20000	25.49	4.68		112	5.57	5.57
30000	25.4	4.75		113	5.64	5.64
40000	24.9	5.08		114	5.98	5.98
50000	24.99	5.17		115	6.08	6.08
60000	24.97	5.27		116	6.19	6.19
70000	24.75	5.2		117	6.13	6.13
80000	24.7	5.04		118	5.97	5.97
90000	24.62	5.08		119	6.02	6.02
100000	24.81	4.9		120	5.85	5.85
110000	25.46	4.79		121	5.75	5.75
120000	25.4	5.05		122	6.02	6.02
130000	25.25	4.66		123	5.63	5.63
140000	25.33	4.74		124	5.72	5.72
150000	25.57	4.71		125	5.7	5.7
160000	26.24	5.01		126	6.01	6.01
170000	25.98	5.01		127	6.02	6.02
180000	26.06	5.09		128	6.1	6.1
190000	26.07	4.98		129	6	6
200000	26.06	5.06		130	6.09	6.09
210000	25.91	4.8		131	5.84	5.84
220000	25.96	4.82		132	5.86	5.86
230000	25.94	4.61		133	5.66	5.66
0	25.98	4.51	71195	134	5.57	5.57
10000	26	4.67		135	5.74	5.74
20000	25.98	4.3		136	5.38	5.38
30000	25.98	4.38		137	5.46	5.46
40000	25.92	4.46		138	5.55	5.55
50000	25.55	4.37		139	5.47	5.47
60000	25.62	4.57		140	5.68	5.68
70000	25.55	4.8		141	5.92	5.92
80000	25.4	4.74		142	5.86	5.86
90000	25.29	4.6	000761	143	5.73	5.73
100000	25.21	4.58		144	5.72	5.72
110000	25.66	4.48		145	5.63	5.63
120000	26.04	3.91		146	5.07	5.07
130000	26.19	4.07		147	5.23	5.23
140000	26.38	4.23		148	5.4	5.4
150000	26.23	3.3		149	4.48	4.48
160000	26.23	3.47		150	4.66	4.66

170000	27	1.23		151	.43	5.43	
180000	26.26	4.24		152	5.44	5.44	
190000	26.24	4.44		153	5.65	5.65	
200000	26.49	4.61		154	5.83	5.83	
210000	26.26	4.56		155	5.79	5.79	
220000	25.87	4.4		156	5.63	5.63	
230000	25.94	4.4		157	5.64	5.64	
0	25.98	4.28	71295	158	5.53	5.53	5.45
10000	26	3.94		159	5.2	5.2	
20000	26.15	4.29		160	5.56	5.56	
30000	26.11	4		161	5.27	5.27	
40000	26.09	3.69		162	4.97	4.97	
50000	25.98	4.11		163	5.4	5.4	
60000	25.51	4.34		164	5.64	5.64	

70000	25.81	4.26		165	5.57	5.57	
80000	25.59	4.4		166	5.71	5.71	
90000	25.36	4.33		167	5.65	5.65	
100000	25.23	4.11	5.44	168	5.44	5.44	

Total Mean Daily DO for 71295 = 5.43

000762

PMK048.80, Pamunkey R. at Carters Landing, 7/12/95 - 7/19/95

Time	Temp	Sonde DO, mg/l	Date/ QAQC DO	Number	Corr.DO Formula	Corr.DO Value	Mean Daily DO
100000	25.09	5.44	71295	0	5.44	5.44	5.41
110000	25.41	5.61	5.44	31	5.44	5.44	Partial
120000	25.67	5.72		30	5.56	5.56	Day
130000	25.93	5.52		29	5.36	5.36	
140000	25.91	5.44		28	5.29	5.29	
150000	26.48	5.45		27	5.3	5.3	
160000	26.49	5.39		26	5.25	5.25	
170000	26.36	5.4		25	5.26	5.26	
180000	26.97	5.53		24	5.4	5.4	
190000	26.31	5.41		23	5.28	5.28	
200000	26.25	5.59		22	5.47	5.47	
210000	26.32	5.71		21	5.6	5.6	
220000	26.19	5.63		20	5.52	5.52	
230000	26.04	5.7		19	5.6	5.6	
0	26.04	5.55	71395	18	5.45	5.45	5.2
10000	26.04	5.1		17	5.01	5.01	
20000	26.06	5.33		16	5.24	5.24	
30000	26.1	5.19		15	5.11	5.11	
40000	26.06	5.25		14	5.17	5.17	
50000	25.99	4.39		13	4.32	4.32	
60000	25.97	5.03		12	4.96	4.96	
70000	25.7	5.1		11	5.04	5.04	
80000	25.84	5.36		10	5.31	5.31	
90000	25.84	5.5		9	5.45	5.45	
100000	25.78	5.28		8	5.24	5.24	
110000	25.84	5.18		7	5.14	5.14	
120000	26.04	5.24		6	5.21	5.21	
130000	26.49	5.48		5	5.45	5.45	
140000	26.74	5.16		4	5.14	5.14	
150000	26.78	5.23	Sonde DO	3	5.21	5.21	
160000	27.03	5.35	Assumed	2	5.34	5.34	
170000	27.2	5.34	Correct	1	5.33	5.33	
180000	27.27	5.05	Here!	0	5.05	5.05	
190000	27.31	5.4	(by Grad.	1	5.41	5.41	
200000	26.78	5.13	Corr.)	2	5.14	5.14	
210000	26.74	5.33		3	5.35	5.35	
220000	26.72	5.41		4	5.43	5.43	
230000	26.61	5.31		5	5.34	5.34	
0	26.53	5.26	71495	6	5.29	5.29	5.22
10000	26.51	5.26		7	5.3	5.3	
20000	26.53	4.96		8	5	5	
30000	26.49	5.07		9	5.12	5.12	
40000	26.49	5.05		10	5.11	5.11	
50000	26.44	4.92		11	4.98	4.98	
60000	26.44	4.86		12	4.93	4.93	
70000	26.36	4.85		13	4.92	4.92	
80000	26.32	5.11		14	5.19	5.19	
90000	26.36	5.17		15	5.25	5.25	
100000	26.34	5.18		16	5.27	5.27	
110000	26.36	5.23		17	5.32	5.32	
120000	26.49	5.25		18	5.35	5.35	
130000	26.85	5.54		19	5.64	5.64	

000763

140000	26.95	..08	20	.19	5.19
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150000	27.29	5.17		21	5.29	5.29
160000	27.33	5.34		22	5.46	5.46
170000	27.5	5.17		23	5.3	5.3
180000	27.68	5.22		24	5.35	5.35
190000	27.5	4.87		25	5.01	5.01
200000	27.54	5.13		26	5.27	5.27
210000	27.39	5.12		27	5.27	5.27
220000	27.26	5.12		28	5.27	5.27
230000	27.24	5.14		29	5.3	5.3
0	27.2	5.15	71595	30	5.32	5.32
10000	27.03	5.22		31	5.39	5.39
20000	27.03	4.98		32	5.16	5.16
30000	27.03	5.11		33	5.29	5.29
40000	27.08	4.93		34	5.12	5.12
50000	27.04	4.82		35	5.01	5.01
60000	27.03	4.84		36	5.04	5.04
70000	27.03	4.84		37	5.04	5.04
80000	26.99	4.79		38	5	5
90000	27.03	5.02		39	5.24	5.24
100000	27.08	5.07		40	5.29	5.29
110000	27.12	5.03		41	5.26	5.26
120000	27.31	5.02		42	5.25	5.25
130000	27.97	5.08		43	5.32	5.32
140000	28.38	5		44	5.24	5.24
150000	28.63	4.92		45	5.17	5.17
160000	28.2	4.83		46	5.08	5.08
170000	28.34	4.7		47	4.96	4.96
180000	28.4	4.92		48	5.18	5.18
190000	28.42	4.63		49	4.9	4.9
200000	28.38	4.7		50	4.98	4.98
210000	28.36	4.83		51	5.11	5.11
220000	28.32	4.9		52	5.19	5.19
230000	28.24	4.92		53	5.21	5.21
0	28.26	4.89	71695	54	5.19	5.19
10000	28.24	4.95		55	5.25	5.25
20000	28.12	4.89		56	5.2	5.2
30000	28.06	4.58		57	4.89	4.89
40000	28.12	4.86		58	5.18	5.18
50000	28.14	4.59		59	4.92	4.92
60000	28.08	4.68		60	5.01	5.01
70000	28.05	4.65		61	4.99	4.99
80000	28.06	4.63		62	4.97	4.97
90000	28.08	4.73		63	5.08	5.08
100000	28.1	4.75		64	5.1	5.1
110000	28.22	4.89		65	5.25	5.25
120000	28.38	4.99		66	5.35	5.35
130000	28.75	5.07		67	5.44	5.44
140000	28.77	5.11		68	5.48	5.48
150000	28.95	4.81		69	5.19	5.19

000764

160000	29	4.97	70	.36	5.36
170000	28.98	5.12	71	5.51	5.51
180000	29.06	4.92	72	5.32	5.32
190000	29.08	4.9	73	5.3	5.3
200000	29.08	4.83	74	5.24	5.24
210000	28.97	4.79	75	5.2	5.2
220000	28.97	4.97	76	5.39	5.39

230000	28.83	5.01	77	5.43	5.43
0	28.67	4.99	78	5.42	5.42
10000	28.53	4.87	79	5.31	5.31
20000	28.4	4.82	80	5.26	5.26
30000	28.3	4.67	81	5.12	5.12
40000	28.32	4.62	82	5.07	5.07
50000	28.32	4.7	83	5.16	5.16
60000	28.28	4.57	84	5.03	5.03
70000	28.26	4.44	85	4.91	4.91
80000	28.26	4.39	86	4.86	4.86
90000	28.36	4.56	87	5.04	5.04
100000	28.49	4.88	88	5.37	5.37
110000	28.44	4.77	89	5.26	5.26
120000	28.57	4.84	90	5.34	5.34
130000	28.71	4.9	91	5.4	5.4
140000	28.97	5.08	92	5.59	5.59
150000	29.34	5.29	93	5.8	5.8
160000	29.4	5.3	94	5.82	5.82
170000	29.44	5.19	95	5.71	5.71
180000	29.38	5.17	96	5.7	5.7
190000	29.42	4.98	97	5.51	5.51
200000	29.42	4.93	98	5.47	5.47
210000	29.42	4.68	99	5.23	5.23
220000	29.36	4.22	100	4.77	4.77
230000	29.24	4.84	101	5.4	5.4
0	29.26	4.9	102	5.46	5.46
10000	29.16	4.92	103	5.49	5.49
20000	29.04	4.81	104	5.38	5.38
30000	28.97	4.63	105	5.21	5.21
40000	28.81	4.54	106	5.12	5.12
50000	28.83	4.52	107	5.11	5.11
60000	28.85	4.41	108	5.01	5.01
70000	28.79	4.41	109	5.01	5.01
80000	28.75	4.2	110	4.81	4.81
90000	28.77	4.38	111	4.99	4.99
100000	28.95	4.12	112	4.74	4.74
110000	29.04	4.76	113	5.38	5.38
120000	29.08	4.71	114	5.34	5.34
130000	29.26	4.75	115	5.38	5.38
140000	29.46	4.8	116	5.44	5.44
150000	29.7	5.01	117	5.66	5.66
160000	29.64	5.09	118	5.74	5.74
170000	29.74	4.8	119	5.46	5.46

180000	29.78	4.6		120	5.26	5.26	
190000	29.84	4.96		121	5.63	5.63	
200000	29.9	4.99		122	5.66	5.66	
210000	29.84	4.56		123	5.24	5.24	
220000	29.78	4.74		124	5.42	5.42	
230000	29.76	4.75		125	5.44	5.44	
0	29.64	4.86	71995	126	5.55	5.55	5.15
10000	29.64	4.76		127	5.46	5.46	
20000	29.42	4.68		128	5.39	5.39	Partial
30000	29.22	4.5		129	5.21	5.21	Day
40000	29.02	4.42		130	5.14	5.14	
50000	28.91	4.34		131	5.06	5.06	
60000	28.91	4.29		132	5.02	5.02	

70000	28.93	4.26		133	4.99	4.99
80000	28.87	3.98		134	4.72	4.72
90000	28.91	4.31		135	5.05	5.05
100000	29.12	4.3	5.05	136	5.05	5.05

7/19/95 Total Mean Daily DO =

5.02

000766

7/20-23 L.S.C.

570657
3/11/9

PMK048.80, Pamunkey R. at Carters Landing, 7/19 - 7/26/95.

Time	Temp	Sonde DO, mg/l	Date/ QAQC DO	Number	Corr.DO Formula	Corr.DO Value	Mean Daily DO
100000	28.95	5.47	71995	93	5.05	5.05	4.91
110000	29.29	4.79	5.05	92	4.37	4.37	
120000	29.4	5.1		91	4.69	4.69	
130000	29.52	5.18		90	4.77	4.77	
140000	29.68	5.25		89	4.85	4.85	
150000	29.91	5.43		88	5.03	5.03	
160000	29.95	5.42		87	5.03	5.03	
170000	30.01	5.53		86	5.14	5.14	
180000	29.99	5.31		85	4.93	4.93	
190000	29.91	5.45		84	5.07	5.07	
200000	29.97	5.53		83	5.15	5.15	
210000	29.95	5.48		82	5.11	5.11	
220000	29.84	5.24		81	4.87	4.87	
230000	29.78	5.06		80	4.7	4.7	
0	29.72	5.36	72095	79	5	5	4.77
10000	29.64	5.31		78	4.96	4.96	
20000	29.56	5.26		77	4.91	4.91	
30000	29.23	5.12		76	4.78	4.78	
40000	28.83	4.88		75	4.54	4.54	
50000	28.52	4.79		74	4.45	4.45	
60000	28.63	4.52		73	4.19	4.19	
70000	28.61	4.47		72	4.14	4.14	
80000	28.57	4.67		71	4.35	4.35	
90000	28.61	4.52		70	4.2	4.2	
100000	28.87	4.85		69	4.54	4.54	
110000	29.39	5.19		68	4.88	4.88	
120000	29.21	5.04		67	4.74	4.74	
130000	29.25	5.16		66	4.86	4.86	
140000	29.35	5.24		65	4.95	4.95	
150000	29.46	5.33		64	5.04	5.04	
160000	29.6	5.43		63	5.14	5.14	
170000	29.72	5.34		62	5.06	5.06	
180000	29.72	5.24		61	4.96	4.96	
190000	29.72	5.21		60	4.94	4.94	
200000	29.7	5.4		59	5.13	5.13	
210000	29.66	5		58	4.74	4.74	
220000	29.68	5.32		57	5.06	5.06	
230000	29.66	5.17		56	4.92	4.92	
0	29.62	5.16	72195	55	4.91	4.91	4.77
10000	29.62	5.24		54	5	5	
20000	29.52	5.26		53	5.02	5.02	
30000	29.42	5.2		52	4.96	4.96	
40000	29.19	4.96		51	4.73	4.73	
50000	28.95	4.78		50	4.55	4.55	
60000	28.77	4.66		49	4.44	4.44	
70000	28.77	4.2		48	3.98	3.98	
80000	28.79	4.49		47	4.28	4.28	
90000	28.85	4.39		46	4.18	4.18	
100000	28.93	4.64		45	4.44	4.44	
110000	29.15	4.86		44	4.66	4.66	
120000	29.62	4.87		43	4.68	4.68	

000767

130000	30.43	5.5	42	.31	5.31
140000	29.54	5.07	41	4.88	4.88

150000	29.66	5.15	40	4.97	4.97
160000	29.84	5.32	39	5.14	5.14
170000	29.76	5.33	38	5.16	5.16
180000	29.68	5.26	37	5.09	5.09
190000	29.56	5.15	36	4.99	4.99
200000	29.62	4.99	35	4.83	4.83
210000	29.56	5.13	34	4.98	4.98
220000	29.54	4.87	33	4.72	4.72
230000	29.48	4.67	32	4.53	4.53
0	29.58	4.89	31	4.75	4.75
10000	29.6	4.7	30	4.56	4.56
20000	29.54	5	29	4.87	4.87
30000	29.4	4.92	28	4.79	4.79
40000	29.27	4.9	27	4.78	4.78
50000	29.11	4.82	26	4.7	4.7
60000	28.93	4.71	25	4.6	4.6
70000	28.75	4.63	24	4.52	4.52
80000	28.69	4.5	23	4.4	4.4
90000	28.75	4.22	22	4.12	4.12
100000	28.77	4.38	21	4.28	4.28
110000	28.95	4.69	20	4.6	4.6
120000	29.09	4.58	19	4.49	4.49
130000	29.23	4.51	18	4.43	4.43
140000	29.31	4.81	17	4.73	4.73
150000	29.31	4.88	16	4.81	4.81
160000	29.46	4.9	15	4.83	4.83
170000	29.58	5.07	14	5.01	5.01
180000	29.42	4.89	13	4.83	4.83
190000	29.35	5.05	12	5	5
200000	29.31	4.61	11	4.56	4.56
210000	29.21	4.62	10	4.57	4.57
220000	29.33	4.58	9	4.54	4.54
230000	29.4	4.6	8	4.56	4.56
0	29.46	4.69	7	4.66	4.66
10000	29.46	4.59	6	4.56	4.56
20000	29.4	4.43	5	4.41	4.41
30000	29.35	4.74	4	4.72	4.72
40000	29.31	4.72	3	4.71	4.71
50000	29.09	4.68	2	4.67	4.67
60000	28.77	4.65	1	4.65	4.65
70000	28.48	4.64	2	4.65	4.65
80000	28.4	4.61	3	4.62	4.62
90000	28.4	4.66	4	4.68	4.68
100000	28.53	4.62	5	4.64	4.64
110000	28.83	4.68	6	4.71	4.71
120000	29.31	4.86	7	4.89	4.89
130000	29.68	5.09	8	5.13	5.13
140000	29.7	4.68	9	4.72	4.72

72295

72395

Grad. Corr
Assumed
Correct
Here!

000768

150000	30.88	.47	10	.52	5.52
160000	29.74	5.17	11	5.22	5.22
170000	29.68	5.19	12	5.24	5.24
180000	29.74	5.26	13	5.32	5.32
190000	29.7	5.22	14	5.28	5.28
200000	29.52	5.22	15	5.29	5.29
210000	29.48	5.02	16	5.09	5.09
220000	29.46	5.19	17	5.27	5.27

230000	29.54	5.14	18	5.22	5.22	
0	29.54	4.93	19	5.02	5.02	5.1
10000	29.6	4.94	20	5.03	5.03	
20000	29.64	4.72	21	4.82	4.82	
30000	29.6	4.84	22	4.94	4.94	
40000	29.42	4.91	23	5.01	5.01	
50000	29.31	4.98	24	5.09	5.09	
60000	29.11	4.96	25	5.07	5.07	
70000	28.79	4.77	26	4.89	4.89	
80000	28.61	4.68	27	4.8	4.8	
90000	28.73	4.73	28	4.86	4.86	
100000	28.87	4.8	29	4.93	4.93	
110000	29.52	5.01	30	5.15	5.15	
120000	29.7	5.08	31	5.22	5.22	
130000	29.93	5.14	32	5.28	5.28	
140000	29.93	4.78	33	4.93	4.93	
150000	29.76	5	34	5.15	5.15	
160000	29.87	5.24	35	5.4	5.4	
170000	29.68	5.11	36	5.27	5.27	
180000	29.68	5.17	37	5.34	5.34	
190000	29.54	5.27	38	5.44	5.44	
200000	29.31	5.21	39	5.39	5.39	
210000	29.19	4.82	40	5	5	
220000	29.19	4.97	41	5.16	5.16	
230000	29.23	4.92	42	5.11	5.11	5.
0	29.23	5.03	43	5.22	5.22	
10000	29.35	5.03	44	5.23	5.23	
20000	29.33	4.87	45	5.07	5.07	
30000	29.31	4.6	46	4.81	4.81	
40000	29.29	4.87	47	5.08	5.08	
50000	29.15	4.94	48	5.16	5.16	
60000	28.95	4.94	49	5.16	5.16	
70000	28.65	4.91	50	5.14	5.14	
80000	28.52	4.89	51	5.12	5.12	
90000	28.5	4.98	52	5.22	5.22	
100000	28.61	4.9	53	5.14	5.14	OC
110000	28.91	4.82	54	5.06	5.06	
120000	29.23	5.06	55	5.31	5.31	
130000	29.33	5.16	56	5.41	5.41	
140000	29.5	4.92	57	5.18	5.18	
150000	29.89	4.78	58	5.04	5.04	
160000	29.54	5.1	59	5.37	5.37	

170000	29.68	4.17		60	5.44	5.44
180000	29.74	5.22		61	5.5	5.5
190000	29.78	5.18		62	5.46	5.46
200000	29.7	5.06		63	5.35	5.35
210000	29.5	5.03		64	5.32	5.32
220000	29.27	4.93		65	5.22	5.22
230000	29.35	4.55		66	4.85	4.85
0	29.5	4.75	72695	67	5.05	5.05
10000	29.5	4.85		68	5.16	5.16
20000	29.54	4.64		69	4.95	4.95
30000	29.52	4.52		70	4.84	4.84
40000	29.5	4.83		71	5.15	5.15
50000	29.39	4.87		72	5.2	5.2
60000	29.25	4.86		73	5.19	5.19

70000	28.97	4.77		74	5.11	5.11
80000	28.73	4.73		75	5.07	5.07
90000	28.73	4.76		76	5.1	5.1
100000	28.73	4.85		77	5.2	5.2
110000	29.01	4.88	5.23	78	5.23	5.23

Total Mean Daily DO, 7/26/95 =

5.29

000770

PMK048.80, Pamunkey river at Carters Landing, 7, - 8/4/95
 Sonde Date/ Corr.DO Corr.DO Mean

7/30, 31, 8/3, 4 < 5.0 ✓

In Situ
 3/11/96

Time	Temp	DO, mg/l	QAQC DO	Number	Formula	Value	Daily DO
110000	29.3	5.25	72695	0	5.25	5.25	5.46
120000	29.46	5.32	5.23	1	5.33	5.33	
130000	29.68	5.51		2	5.53	5.53	
140000	29.82	5.43		3	5.46	5.46	
150000	29.98	5.42		4	5.45	5.45	
160000	29.72	5.02		5	5.06	5.06	
170000	30.2	5.68		6	5.73	5.73	
180000	29.74	5.36		7	5.42	5.42	
190000	29.62	5.38		8	5.45	5.45	
200000	29.56	5.46		9	5.54	5.54	
210000	29.44	5.44		10	5.53	5.53	
220000	29.3	5.6		11	5.69	5.69	
230000	29.32	5.38		12	5.48	5.48	
0	29.28	4.92	72795	13	5.03	5.03	5.44
10000	29.2	4.72		14	4.84	4.84	
20000	29.2	4.93		15	5.06	5.06	
30000	29.16	4.78		16	4.92	4.92	
40000	29.18	4.58		17	4.73	4.73	
50000	29.14	5.09		18	5.24	5.24	
60000	29	5.15		19	5.31	5.31	
70000	29.02	5.24		20	5.41	5.41	
80000	28.83	5.25		21	5.43	5.43	
90000	28.69	5.19		22	5.38	5.38	
100000	28.75	5.32		23	5.52	5.52	
110000	28.98	5.62		24	5.83	5.83	
120000	29.2	5.49		25	5.71	5.71	
130000	29.84	5.3		26	5.52	5.52	
140000	29.76	5.07		27	5.3	5.3	
150000	30.12	5.61		28	5.85	5.85	
160000	30.04	5.37		29	5.62	5.62	
170000	29.84	5.22		30	5.48	5.48	
180000	29.8	5.42		31	5.69	5.69	
190000	29.7	5.42		32	5.7	5.7	
200000	29.8	5.51		33	5.79	5.79	
210000	29.68	5.47		34	5.76	5.76	
220000	29.6	5.5		35	5.8	5.8	
230000	29.44	5.42		36	5.73	5.73	
0	29.28	5.36	72895	37	5.68	5.68	5.75
10000	29.36	5.32		38	5.65	5.65	
20000	29.38	5.21		39	5.55	5.55	
30000	29.34	5.09		40	5.43	5.43	
40000	29.3	4.99		41	5.34	5.34	
50000	29.26	5.08		42	5.44	5.44	
60000	29.16	5.29		43	5.66	5.66	
70000	29.14	5.3		44	5.68	5.68	
80000	28.93	5.33		45	5.72	5.72	
90000	28.65	5.24		46	5.64	5.64	

000771

100000	28.67	5.33	47	.73	5.73
110000	28.81	5.58	48	5.99	5.99
120000	28.81	5.5	49	5.92	5.92
130000	29.04	5.46	50	5.89	5.89
140000	29.52	5.48	51	5.92	5.92
150000	30.04	5.56	52	6.01	6.01
160000	29.82	5.5	53	5.96	5.96
170000	29.74	5.02	54	5.48	5.48

180000	29.78	5.27	55	5.74	5.74
190000	29.52	5.39	56	5.87	5.87
200000	29.42	5.48	57	5.97	5.97
210000	29.46	5.44	58	5.94	5.94
220000	29.44	5.3	59	5.81	5.81
230000	29.36	5.39	60	5.91	5.91
0	29.26	5.05	61	5.58	5.58
10000	29.16	4.86	62	5.39	5.39
20000	29.24	4.85	63	5.39	5.39
30000	29.22	4.75	64	5.3	5.3
40000	29.18	4.7	65	5.26	5.26
50000	29.12	4.69	66	5.26	5.26
60000	29.08	5.02	67	5.6	5.6
70000	29.04	5.04	68	5.63	5.63
80000	28.44	4.61	69	5.2	5.2
90000	27.76	4.09	70	4.69	4.69
100000	27.56	3.96	71	4.57	4.57
110000	27.54	4.27	72	4.89	4.89
120000	28.1	4.8	73	5.43	5.43
130000	28.57	4.9	74	5.54	5.54
140000	28.4	4.13	75	4.78	4.78
150000	28.75	4.36	76	5.01	5.01
160000	29.16	3.87	77	4.53	4.53
170000	29.14	3.88	78	4.55	4.55
180000	28.73	3.74	79	4.42	4.42
190000	29.22	4.21	80	4.9	4.9
200000	28.67	4.23	81	4.93	4.93
210000	28.69	4.33	82	5.04	5.04
220000	28.73	4.07	83	4.78	4.78
230000	28.67	4.1	84	4.82	4.82
0	28.53	4.29	85	5.02	5.02
10000	28.4	4.23	86	4.97	4.97
20000	28.42	3.94	87	4.69	4.69
30000	28.45	3.54	88	4.3	4.3
40000	28.47	3.99	89	4.76	4.76
50000	28.45	3.73	90	4.5	4.5
60000	28.44	3.36	91	4.14	4.14
70000	28.42	3.92	92	4.71	4.71
80000	28.36	3.98	93	4.78	4.78
90000	28.22	4.02	94	4.83	4.83
100000	28.06	3.87	95	4.69	4.69
110000	28.28	4.12	96	4.95	4.95

72995

5.06

73095

4.88

000772

120000	28.65	4.41		97	5.25	5.25
130000	31.22	4.03		98	4.87	4.87
140000	29.64	4.68		99	5.53	5.53
150000	29.34	4.34		100	5.2	5.2
160000	29.44	4.02		101	4.89	4.89
170000	29.36	3.96		102	4.84	4.84
180000	29.28	3.79		103	4.68	4.68
190000	29.24	4		104	4.9	4.9
200000	29.22	4.02		105	4.92	4.92
210000	29.14	4.22		106	5.13	5.13
220000	29.14	4.34		107	5.26	5.26
230000	29.2	4.3		108	5.23	5.23
0	29.18	4.69	73195	109	5.63	5.63
10000	29.16	4.52		110	5.47	5.47

4.92

20000	29.08	4.09		111	5.05	5.05
30000	29.1	3.44		112	4.4	4.4
40000	29	3.69		113	4.66	4.66
50000	28.93	3.62		114	4.6	4.6
60000	28.83	3.66		115	4.65	4.65
70000	28.79	3.47		116	4.47	4.47
80000	28.75	4.04		117	5.05	5.05
90000	28.87	4.13		118	5.15	5.15
100000	28.89	4.23		119	5.25	5.25
110000	28.89	4.26		120	5.29	5.29
120000	29.06	4.55		121	5.59	5.59
130000	29.5	4.73		122	5.78	5.78
140000	29.56	4.36		123	5.42	5.42
150000	30.14	3.77		124	4.84	4.84
160000	29.9	2.82		125	3.9	3.9
170000	29.9	3.67		126	4.75	4.75
180000	29.94	2.9		127	3.99	3.99
190000	29.9	3.5		128	4.6	4.6
200000	29.9	3.17		129	4.28	4.28
210000	29.76	3.93		130	5.05	5.05
220000	29.62	3.94		131	5.07	5.07
230000	29.46	4.02		132	5.16	5.16
0	29.38	4.01	80195	133	5.16	5.16
10000	29.24	4.05		134	5.2	5.2
20000	29.16	4.29		135	5.45	5.45
30000	29.06	3.83		136	5	5
40000	29.12	3.01		137	4.19	4.19
50000	29	3.86		138	5.05	5.05
60000	28.98	3.59		139	4.79	4.79
70000	28.93	3.08		140	4.29	4.29
80000	28.93	3.12		141	4.33	4.33
90000	28.89	3.81		142	5.03	5.03
100000	28.97	4.02		143	5.25	5.25
110000	28.98	4.17		144	5.41	5.41
120000	29.06	4.55		145	5.8	5.8
130000	29.34	4.93		146	6.19	6.19

5.17

000773

140000	29.48	3.98		147	5.25	6.25
150000	29.56	4.24		148	5.51	5.51
160000	29.9	3.89		149	5.17	5.17
170000	29.84	4.04		150	5.33	5.33
180000	29.86	4.04		151	5.34	5.34
190000	29.9	3.95		152	5.26	5.26
200000	29.9	2.43		153	3.75	3.75
210000	29.9	3.71		154	5.04	5.04
220000	29.76	4.31		155	5.64	5.64
230000	29.72	4.33		156	5.67	5.67
0	29.52	4.34	80295	157	5.69	5.69
10000	29.32	4.2		158	5.56	5.56
20000	29.16	4.05		159	5.42	5.42
30000	29.14	4		160	5.38	5.38
40000	29.04	3.76		161	5.15	5.15
50000	29.12	3.51		162	4.9	4.9
60000	29.02	2.69		163	4.09	4.09
70000	29.02	3.91		164	5.32	5.32
80000	29.04	3.66		165	5.08	5.08
90000	29.08	3.68		166	5.11	5.11

100000	29.12	3.99		167	5.43	5.43
110000	29.22	4.15		168	5.6	5.6
120000	29.38	4.12		169	5.58	5.58
130000	29.44	4.34		170	5.8	5.8
140000	29.72	4.35		171	5.82	5.82
150000	29.86	3.53		172	5.01	5.01
160000	30.1	3.96		173	5.45	5.45
170000	30.06	3.62		174	5.12	5.12
180000	30	3.75		175	5.26	5.26
190000	30	3.39		176	4.91	4.91
200000	30.04	2.87		177	4.39	4.39
210000	30.06	2.84		178	4.37	4.37
220000	30.06	2.45		179	3.99	3.99
230000	29.94	3.72		180	5.27	5.27
0	29.88	3.62	80395	181	5.18	5.18
10000	29.66	3.6		182	5.17	5.17
20000	29.46	3.42		183	5	5
30000	29.26	3.27		184	4.85	4.85
40000	29.06	3.44		185	5.03	5.03
50000	29.04	3.36		186	4.96	4.96
60000	29.06	2.86		187	4.47	4.47
70000	29.04	2.9		188	4.52	4.52
80000	29.14	3.05		189	4.68	4.68
90000	29.2	2.39		190	4.03	4.03
100000	29.4	3.18		191	4.82	4.82
110000	29.36	3.39		192	5.04	5.04
120000	29.46	3.55		193	5.21	5.21
130000	29.68	3.85		194	5.52	5.52
140000	29.74	3.89		195	5.57	5.57
150000	29.96	4.46		196	6.15	6.15

160000	30.24	.15		197	.85	5.85	
170000	30.14	3.86		198	5.56	5.56	
180000	30.04	3.39		199	5.1	5.1	
190000	30.06	3.49		200	5.21	5.21	
200000	30.2	3.55		201	5.28	5.28	
210000	30.18	1.62		202	3.36	3.36	
220000	30.16	1.5		203	3.25	3.25	
230000	30.12	2.17		204	3.93	3.93	
0	30	3.58	.80495	205	5.35	5.35	4.91
10000	29.98	3.62		206	5.39	5.39	
20000	29.72	3.6		207	5.38	5.38	
30000	29.44	3.18		208	4.97	4.97	
40000	29.28	3.37		209	5.17	5.17	
50000	29.2	3.22		210	5.03	5.03	
60000	29.14	2.89		211	4.71	4.71	
70000	29.2	2.44		212	4.27	4.27	
80000	29.2	2.38		213	4.21	4.21	
90000	29.18	2.77		214	4.61	4.61	
100000	29.5	3.06		215	4.91	4.91	
110000	29.68	3.01	4.87	216	4.87	4.87	

8/4/95 Total Mean Daily DO =

4.96

000775

8/5-10+LS.O ✓
8/14
IN
STREET
3/11/96

PMK048.80, Pamunkey River at Carters Landing, 8/4 - 8/14/95

Time	Temp	Sonde DO, mg/l	Date/ QAQC DO	Number	Corr.DO Formula	Corr.DO Value	Mean Daily DO
110000	29.82	5.14	80495	66	4.87	4.87	5
120000	29.72	4.95	4.87	65	4.68	4.68	
130000	29.93	5.07		64	4.81	4.81	
140000	30.17	5.22		63	4.96	4.96	
150000	30.29	5.44		62	5.19	5.19	
160000	30.49	5.67		61	5.42	5.42	
170000	30.53	5.49		60	5.24	5.24	
180000	30.41	5.44		59	5.2	5.2	
190000	30.35	5.25		58	5.01	5.01	
200000	30.47	5.34		57	5.11	5.11	
210000	30.45	5.14		56	4.91	4.91	
220000	30.41	5.15		55	4.92	4.92	
230000	30.37	4.9		54	4.68	4.68	
0	30.37	5.1	80595	53	4.88	4.88	4.94
10000	30.27	5.15		52	4.94	4.94	
20000	30.17	5.12		51	4.91	4.91	
30000	29.95	5		50	4.8	4.8	
40000	29.64	4.87		49	4.67	4.67	
50000	29.46	4.85		48	4.65	4.65	
60000	29.4	4.83		47	4.64	4.64	
70000	29.31	4.8		46	4.61	4.61	
80000	29.36	4.55		45	4.37	4.37	
90000	29.36	4.59		44	4.41	4.41	
100000	29.5	4.73		43	4.55	4.55	
110000	30.05	5.1		42	4.93	4.93	
120000	30.47	5.45		41	5.28	5.28	
130000	30.01	5.11		40	4.95	4.95	
140000	30.23	5.31		39	5.15	5.15	
150000	30.49	5.46		38	5.3	5.3	
160000	30.7	5.39		37	5.24	5.24	
170000	30.6	5.45		36	5.3	5.3	
180000	30.51	5.5		35	5.36	5.36	
190000	30.39	5.3		34	5.16	5.16	
200000	30.49	5.25		33	5.11	5.11	
210000	30.57	5.45		32	5.32	5.32	
220000	30.49	5.05		31	4.92	4.92	
230000	30.49	5.31		30	5.19	5.19	
0	30.49	4.97	80695	29	4.85	4.85	4.96
10000	30.53	5.3		28	5.19	5.19	
20000	30.37	5.22		27	5.11	5.11	
30000	30.29	5.08		26	4.97	4.97	
40000	30.07	4.98		25	4.88	4.88	
50000	29.76	4.88		24	4.78	4.78	
60000	29.23	5.06		23	4.97	4.97	
70000	29.42	4.95		22	4.86	4.86	
80000	29.64	4.78		21	4.69	4.69	
90000	29.72	4.83		20	4.75	4.75	
100000	29.76	4.91		19	4.83	4.83	
110000	29.95	4.9		18	4.83	4.83	
120000	30.03	4.9		17	4.83	4.83	
130000	30.09	5.07		16	5	5	

IN STREET
3/11/96

000776

140000	30.03	5.12	15	.06	5.06
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150000	29.93	5.08	14	5.02	5.02
160000	29.76	5.08	13	5.03	5.03
170000	29.62	5.31	12	5.26	5.26
180000	29.5	5.2	11	5.15	5.15
190000	29.4	5.1	10	5.06	5.06
200000	29.29	5.06	9	5.02	5.02
210000	29.35	5.05	8	5.02	5.02
220000	29.46	4.97	7	4.94	4.94
230000	29.54	4.97	6	4.95	4.95
0	29.62	4.98	5	4.96	4.96
10000	29.6	4.93	4	4.91	4.91
20000	29.6	4.95	3	4.94	4.94
30000	29.54	4.93	2	4.92	4.92
40000	29.35	5	1	5	5
50000	29.23	4.94	2	4.95	4.95
60000	28.91	4.77	3	4.79	4.79
70000	28.5	4.61	4	4.63	4.63
80000	28.42	4.36	5	4.39	4.39
90000	28.4	4.41	6	4.44	4.44
100000	28.48	4.65	7	4.69	4.69
110000	28.63	4.66	8	4.7	4.7
120000	28.79	4.51	9	4.56	4.56
130000	28.89	4.71	10	4.76	4.76
140000	28.93	4.81	11	4.87	4.87
150000	29.03	4.87	12	4.93	4.93
160000	29.05	5.06	13	5.13	5.13
170000	28.69	4.85	14	4.92	4.92
180000	28.59	4.93	15	5.01	5.01
190000	28.3	4.76	16	4.84	4.84
200000	28.03	4.69	17	4.78	4.78
210000	27.83	4.55	18	4.64	4.64
220000	27.87	4.61	19	4.71	4.71
230000	27.91	4.67	20	4.77	4.77
0	27.95	4.52	21	4.63	4.63
10000	28.09	4.57	22	4.68	4.68
20000	28.12	4.64	23	4.76	4.76
30000	28.26	4.77	24	4.89	4.89
40000	28.28	4.81	25	4.94	4.94
50000	28.09	4.71	26	4.84	4.84
60000	27.85	4.71	27	4.85	4.85
70000	27.35	4.5	28	4.64	4.64
80000	27	4.44	29	4.59	4.59
90000	26.72	4.41	30	4.56	4.56
100000	26.72	4.38	31	4.54	4.54
110000	26.76	4.49	32	4.65	4.65
120000	26.93	4.46	33	4.63	4.63
130000	27.06	4.54	34	4.71	4.71
140000	27.43	4.78	35	4.96	4.96
150000	27.43	4.6	36	4.78	4.78

80795

Grad.

Corr.

Assumed

5 OK Here!!

80895

000777

160000	27.56	.68	37	.87	4.87
170000	27.14	4.66	38	4.85	4.85
180000	26.91	4.6	39	4.8	4.8
190000	26.97	4.69	40	4.89	4.89
200000	27.14	4.96	41	5.17	5.17
210000	26.97	4.93	42	5.14	5.14
220000	26.89	4.6	43	4.82	4.82

230000	26.83	4.75	80995	44	4.97	4.97	
0	26.87	4.79		45	5.02	5.02	4.8
10000	26.85	4.64		46	4.87	4.87	
20000	26.83	4.51		47	4.75	4.75	
30000	26.78	4.57		48	4.81	4.81	
40000	26.7	4.48		49	4.73	4.73	
50000	26.38	4.3		50	4.55	4.55	
60000	26.4	4.4		51	4.66	4.66	
70000	26.28	4.48		52	4.74	4.74	
80000	26.24	4.59		53	4.86	4.86	
90000	26.06	4.48		54	4.75	4.75	
100000	26.04	4.47		55	4.75	4.75	
110000	26.07	4.45		56	4.73	4.73	
120000	26.13	4.47		57	4.76	4.76	
130000	26.13	4.52		58	4.81	4.81	
140000	26.21	4.42		59	4.72	4.72	
150000	26.23	4.43		60	4.73	4.73	
160000	26.23	4.3		61	4.61	4.61	
170000	26.19	4.31		62	4.62	4.62	
180000	25.91	4.42		63	4.74	4.74	
190000	25.92	4.5		64	4.82	4.82	
200000	25.79	4.5		65	4.83	4.83	
210000	25.64	4.75		66	5.08	5.08	
220000	25.44	4.8		67	5.14	5.14	
230000	25.4	4.89	81095	68	5.23	5.23	
0	25.42	4.62		69	4.97	4.97	4.92
10000	25.46	4.65		70	5	5	
20000	25.49	4.42		71	4.78	4.78	
30000	25.55	4.3		72	4.66	4.66	
40000	25.53	4.14		73	4.51	4.51	
50000	25.61	4.13		74	4.5	4.5	
60000	25.44	4.22		75	4.6	4.6	
70000	25.33	4.2		76	4.58	4.58	
80000	25.21	4.46		77	4.85	4.85	
90000	25.05	4.52		78	4.91	4.91	
100000	24.95	4.49		79	4.89	4.89	
110000	25.07	4.75		80	5.15	5.15	
120000	25.12	4.78		81	5.19	5.19	
130000	25.14	4.72		82	5.13	5.13	
140000	25.2	4.61		83	5.03	5.03	
150000	25.36	4.55		84	4.97	4.97	
160000	25.53	4.56		85	4.99	4.99	
170000	25.87	4.01		86	4.44	4.44	

000778

180000	25.59	1.28		87	.72	4.72
190000	25.38	4.49		88	4.93	4.93
200000	25.31	4.68		89	5.13	5.13
210000	25.14	4.82		90	5.27	5.27
220000	25.03	4.87		91	5.33	5.33
230000	24.94	5.08		92	5.54	5.54
0	24.94	5.07	81195	93	5.54	5.54
10000	24.99	4.94		94	5.41	5.41
20000	25.01	4.8		95	5.28	5.28
30000	24.94	4.61		96	5.09	5.09
40000	24.99	4.51		97	5	5
50000	24.99	4.49		98	4.98	4.98
60000	25.01	4.33		99	4.83	4.83

70000	24.73	4.48		100	4.98	4.98
80000	24.77	4.69		101	5.2	5.2
90000	24.64	4.74		102	5.25	5.25
100000	24.51	4.75		103	5.27	5.27
110000	24.68	4.94		104	5.46	5.46
120000	25.25	5.01		105	5.54	5.54
130000	25.55	5.02		106	5.55	5.55
140000	25.33	5.05		107	5.59	5.59
150000	25.66	4.94		108	5.48	5.48
160000	25.68	4.92		109	5.47	5.47
170000	25.92	4.8		110	5.35	5.35
180000	25.89	4.68		111	5.24	5.24
190000	25.79	4.55		112	5.11	5.11
200000	25.7	4.62		113	5.19	5.19
210000	25.57	4.69		114	5.26	5.26
220000	25.57	4.76		115	5.34	5.34
230000	25.61	4.94		116	5.52	5.52
0	25.44	4.94	81295	117	5.53	5.53
10000	25.46	4.93		118	5.52	5.52
20000	25.49	4.9		119	5.5	5.5
30000	25.47	4.6		120	5.2	5.2
40000	25.46	4.58		121	5.19	5.19
50000	25.42	4.15		122	4.76	4.76
60000	25.38	4.44		123	5.06	5.06
70000	25.34	4.36		124	4.98	4.98
80000	25.18	4.3		125	4.93	4.93
90000	25.33	4.57		126	5.2	5.2
100000	25.23	4.66		127	5.3	5.3
110000	25.31	4.84		128	5.48	5.48
120000	25.61	5.04		129	5.69	5.69
130000	26.23	5.31		130	5.96	5.96
140000	26.09	5.01		131	5.67	5.67
150000	26.34	5.08		132	5.74	5.74
160000	26.4	4.9		133	5.57	5.57
170000	26.6	4.74		134	5.41	5.41
180000	26.66	4.54		135	5.22	5.22
190000	26.64	4.45		136	5.13	5.13

200000	26.6	4.54		137	.23	5.23
210000	26.47	4.55		138	5.24	5.24
220000	26.34	4.61		139	5.31	5.31
230000	26.43	4.72		140	5.42	5.42
0	26.38	4.72	81395	141	5.43	5.43
10000	26.15	4.53		142	5.24	5.24
20000	26.19	4.52		143	5.24	5.24
30000	26.3	4.59		144	5.31	5.31
40000	26.34	4.61		145	5.34	5.34
50000	26.3	4.19		146	4.92	4.92
60000	26.26	4.26		147	5	5
70000	26.26	4.19		148	4.93	4.93
80000	26.24	4.14		149	4.89	4.89
90000	26.26	4.31		150	5.06	5.06
100000	26.3	4.47		151	5.23	5.23
110000	26.38	4.58		152	5.34	5.34
120000	26.49	4.76		153	5.53	5.53
130000	26.76	5		154	5.77	5.77
140000	26.74	4.96		155	5.74	5.74

150000	26.89	4.89		156	5.67	5.67
160000	27.16	4.83		157	5.62	5.62
170000	27.41	4.69		158	5.48	5.48
180000	27.39	4.21		159	5.01	5.01
190000	27.41	4.36		160	5.16	5.16
200000	27.43	4.29		161	5.1	5.1
210000	27.31	4.32		162	5.13	5.13
220000	27.27	4.52		163	5.34	5.34
230000	27.08	4.38		164	5.2	5.2
0	27	4.41	81495	165	5.24	5.24
10000	26.93	4.22		166	5.05	5.05
20000	26.83	4.44		167	5.28	5.28
30000	26.87	4.18		168	5.02	5.02
40000	26.91	4.15		169	5	5
50000	26.91	4.02		170	4.87	4.87
60000	26.95	3.9		171	4.76	4.76
70000	27.02	3.9		172	4.76	4.76
80000	27.1	3.74		173	4.61	4.61
90000	26.99	4.01		174	4.88	4.88
100000	26.97	4.17		175	5.05	5.05
110000	27.04	4.25		176	5.13	5.13
120000	27.16	4.13		177	5.02	5.02
130000	27.48	4.21	5.1	178	5.1	5.1

8/14/95 Total Mean Daily DO =

4.99

000780

7/15 L5.0 ✓

IN STORET
3/11/96

PMK 048.80, Pamunkey River at Carters Landing, 8/14 - 22, 1995

Time	Temp	Sonde DO, mg/l	Date/ QAQC DO	Number	Corr.DO Formula	Corr.DO Value	Mean Daily DO
130000	27.39	5.22	81495	12	5.1	5.1	5.01
140000	27.33	5.17	5.1	11	5.06	5.06	
150000	27.68	5.09		10	4.99	4.99	
160000	27.64	5.18		9	5.09	5.09	
170000	27.91	5.03		8	4.95	4.95	
180000	28.01	5.18		7	5.11	5.11	
190000	28.05	5.18		6	5.12	5.12	
200000	28.06	4.84		5	4.79	4.79	
210000	28.08	4.79	Grad.	4	4.75	4.75	
220000	27.95	5.09	Corr.	3	5.06	5.06	
230000	27.89	5.05	Assumed	2	5.03	5.03	
0	27.74	5.03	OK HERE!!	1	5.02	5.02	4.93
10000	27.58	4.96	81595	1	4.97	4.97	
20000	27.54	4.85		2	4.87	4.87	
30000	27.52	4.8		3	4.83	4.83	
40000	27.49	4.68		4	4.72	4.72	
50000	27.45	4.77		5	4.82	4.82	
60000	27.41	4.54		6	4.6	4.6	
70000	27.47	4.59		7	4.66	4.66	
80000	27.5	4.6		8	4.68	4.68	
90000	27.54	4.54		9	4.63	4.63	
100000	27.45	4.9		10	5	5	
110000	27.39	4.88		11	4.99	4.99	
120000	27.43	4.91		12	5.03	5.03	
130000	27.49	4.73		13	4.86	4.86	
140000	27.74	4.97		14	5.11	5.11	
150000	27.93	5.28		15	5.43	5.43	
160000	28.16	4.97		16	5.13	5.13	
170000	28.01	4.7		17	4.88	4.88	
180000	28.14	4.84		18	5.03	5.03	
190000	28.14	4.77		19	4.97	4.97	
200000	28.14	4.91		20	5.12	5.12	
210000	28.12	4.82		21	5.04	5.04	
220000	28.16	4.72		22	4.95	4.95	
230000	28.05	4.84		23	5.08	5.08	
0	27.93	4.83	81695	24	5.08	5.08	5.15
10000	27.79	4.79		25	5.05	5.05	
20000	27.66	4.74		26	5.01	5.01	
30000	27.62	4.82		27	5.1	5.1	
40000	27.6	4.82		28	5.11	5.11	
50000	27.49	4.74		29	5.04	5.04	
60000	27.45	4.37		30	4.68	4.68	
70000	27.43	4.24		31	4.56	4.56	
80000	27.47	4.4		32	4.73	4.73	
90000	27.47	4.37		33	4.71	4.71	
100000	27.5	4.31		34	4.66	4.66	
110000	27.56	4.56		35	4.92	4.92	
120000	27.58	4.61		36	4.98	4.98	
130000	27.7	4.75		37	5.13	5.13	
140000	27.89	4.99		38	5.38	5.38	
150000	28.12	5.27		39	5.67	5.67	
160000	28.28	5.42		40	5.83	5.83	

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170000	28.36	.75	41	.17	6.17
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180000	28.3	5.46		42	5.89	5.89
190000	28.32	4.86		43	5.3	5.3
200000	28.32	4.89		44	5.34	5.34
210000	28.3	4.54		45	5	5
220000	28.28	4.58		46	5.05	5.05
230000	28.28	4.79		47	5.27	5.27
0	28.26	4.87	81795	48	5.36	5.36
10000	27.99	4.83		49	5.33	5.33
20000	28.01	4.79		50	5.31	5.31
30000	27.89	4.75		51	5.28	5.28
40000	27.85	4.77		52	5.31	5.31
50000	27.85	4.48		53	5.03	5.03
60000	27.83	4.34		54	4.9	4.9
70000	27.77	4.14		55	4.71	4.71
80000	27.76	4.35		56	4.93	4.93
90000	27.76	4.29		57	4.88	4.88
100000	27.81	4.2		58	4.8	4.8
110000	27.99	4.28		59	4.89	4.89
120000	27.93	4.45		60	5.07	5.07
130000	27.97	4.4		61	5.03	5.03
140000	28.14	4.7		62	5.34	5.34
150000	28.28	4.76		63	5.41	5.41
160000	28.53	5.08		64	5.74	5.74
170000	28.75	5.15		65	5.82	5.82
180000	28.75	4.72		66	5.4	5.4
190000	28.67	4.59		67	5.28	5.28
200000	28.55	4.39		68	5.09	5.09
210000	28.51	4.31		69	5.02	5.02
220000	28.47	4.49		70	5.21	5.21
230000	28.44	4.09		71	4.82	4.82
0	28.42	4.18	81895	72	4.92	4.92
10000	28.3	4.49		73	5.24	5.24
20000	28.34	4.51		74	5.27	5.27
30000	28.32	4.58		75	5.35	5.35
40000	28.26	4.56		76	5.34	5.34
50000	28.22	4.42		77	5.21	5.21
60000	28.14	4.11		78	4.91	4.91
70000	28.12	4.04		79	4.85	4.85
80000	28.14	4.15		80	4.97	4.97
90000	28.08	3.87		81	4.7	4.7
100000	28.1	4.02		82	4.86	4.86
110000	28.36	4.05		83	4.91	4.91
120000	28.14	4.08		84	4.95	4.95
130000	28.49	4.49		85	5.37	5.37
140000	28.69	4.6		86	5.49	5.49
150000	28.87	4.77		87	5.67	5.67
160000	29.14	5.16		88	6.07	6.07
170000	29.26	4.39		89	5.31	5.31
180000	29.4	4.74		90	5.67	5.67

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190000	29.22	4.5		91	5.44	5.44
200000	29.06	4.69		92	5.64	5.64
210000	29.04	4.37		93	5.33	5.33
220000	28.95	4.44		94	5.41	5.41
230000	28.91	4.11		95	5.09	5.09
0	28.85	3.82	81995	96	4.81	4.81
10000	28.81	3.89		97	4.89	4.89

20000	28.61	4.31		98	5.32	5.32
30000	28.57	4.25		99	5.27	5.27
40000	28.55	4.41		100	5.44	5.44
50000	28.38	4.41		101	5.45	5.45
60000	28.2	4.27		102	5.32	5.32
70000	28.08	3.94		103	5	5
80000	28.05	4.02		104	5.09	5.09
90000	28.08	4.02		105	5.1	5.1
100000	28.16	4.01		106	5.1	5.1
110000	28.16	3.98		107	5.08	5.08
120000	28.38	4		108	5.11	5.11
130000	28.53	3.79		109	4.91	4.91
140000	28.38	4.13		110	5.26	5.26
150000	28.47	4.44		111	5.58	5.58
160000	28.61	4.58		112	5.73	5.73
170000	28.57	4.67		113	5.83	5.83
180000	28.55	4.86		114	6.03	6.03
190000	28.53	4.8		115	5.98	5.98
200000	28.49	4.4		116	5.6	5.6
210000	28.42	4.34		117	5.55	5.55
220000	28.38	4.36		118	5.58	5.58
230000	28.32	4.03		119	5.26	5.26
0	28.32	4.09	82095	120	5.33	5.33
10000	28.32	4.05		121	5.3	5.3
20000	28.24	3.86		122	5.12	5.12
30000	28.03	4		123	5.27	5.27
40000	27.76	4.08		124	5.36	5.36
50000	27.7	4.1		125	5.39	5.39
60000	27.33	4.18		126	5.48	5.48
70000	27.03	4.19		127	5.5	5.5
80000	26.78	4.08		128	5.4	5.4
90000	26.7	3.89		129	5.22	5.22
100000	26.65	3.88		130	5.22	5.22
110000	27.04	4.1		131	5.45	5.45
120000	27.26	3.9		132	5.26	5.26
130000	27.35	4.16		133	5.53	5.53
140000	27.62	3.9		134	5.28	5.28
150000	27.79	4.3		135	5.69	5.69
160000	27.41	4.38		136	5.78	5.78
170000	27.33	4.41		137	5.82	5.82
180000	27.33	4.48		138	5.9	5.9
190000	27.49	4.76		139	6.19	6.19
200000	27.49	4.24		140	5.68	5.68

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210000	27.45	3.15		141	5.6	5.6	
220000	27.27	4.14		142	5.6	5.6	
230000	27.18	3.62		143	5.09	5.09	
0	27.03	3.83	82195	144	5.31	5.31	5.56
10000	27.06	3.79		145	5.28	5.28	
20000	27.14	3.48		146	4.98	4.98	
30000	27.06	3.57		147	5.08	5.08	
40000	26.78	4.06		148	5.58	5.58	
50000	26.48	4.02		149	5.56	5.56	
60000	26.29	4.09		150	5.64	5.64	
70000	26.17	4.26		151	5.82	5.82	
80000	25.89	4.07		152	5.64	5.64	
90000	25.89	3.81		153	5.39	5.39	

100000	25.93	3.61		154	5.2	5.2	
110000	26.1	3.69		155	5.29	5.29	
120000	26.57	3.87		156	5.48	5.48	
130000	26.66	3.35		157	4.97	4.97	
140000	26.49	3.8		158	5.43	5.43	
150000	27.1	4.48		159	6.12	6.12	
160000	26.76	4.27		160	5.92	5.92	
170000	27.04	4.47		161	6.13	6.13	
180000	27.45	4.67		162	6.34	6.34	
190000	27.52	4.52		163	6.2	6.2	
200000	27.5	3.9		164	5.59	5.59	
210000	27.43	4.09		165	5.79	5.79	
220000	27.41	2.95		166	4.66	4.66	
230000	27.16	4.33		167	6.05	6.05	
0	26.99	3.6	82295	168	5.33	5.33	5.47
10000	26.87	3.12		169	4.86	4.86	
20000	26.82	3.12		170	4.87	4.87	
30000	26.76	3.65		171	5.41	5.41	
40000	26.68	4.08		172	5.85	5.85	
50000	26.7	4.09		173	5.87	5.87	
60000	26.8	4.11		174	5.9	5.9	
70000	26.7	3.73		175	5.53	5.53	
80000	26.66	3.72		176	5.53	5.53	
90000	26.84	3.54		177	5.36	5.36	
100000	26.89	2.98		178	4.81	4.81	
110000	26.95	3.42		179	5.26	5.26	
120000	27.08	3.3		180	5.15	5.15	
130000	27.18	3.57		181	5.43	5.43	
140000	27.45	3.14		182	5.02	5.02	
150000	27.7	3.89		183	5.78	5.78	
160000	27.5	4.18		184	6.08	6.08	
170000	27.74	4.12		185	6.03	6.03	
180000	27.93	3.9	5.82	186	5.82	5.82	

8/22/95 Total Mean Daily DO =

PMK048.80, Pamunkey F er at Carters Landing, 8/ - 30/95

IM
STCET

3/13/96

Time	Temp	Sonde DO, mg/l	Date/ QAQC DO	Number	Corr.DO Formula	Corr.DO Value	Mean Daily DO
180000	27.23	6.93	82295	105	5.82	5.82	5.04
190000	28.03	6.13	5.82	104	5.03	5.03	
200000	27.93	6.1		103	5.01	5.01	
210000	27.79	5.95		102	4.87	4.87	
220000	27.83	5.86		101	4.79	4.79	
230000	27.72	5.76		100	4.7	4.7	
0	27.64	5.6	82395	99	4.55	4.55	4.66
10000	27.54	5.68		98	4.64	4.64	
20000	27.47	5.61		97	4.58	4.58	
30000	27.39	5.55		96	4.53	4.53	
40000	27.29	5.6		95	4.59	4.59	
50000	27.29	5.56		94	4.56	4.56	
60000	27.12	5.53		93	4.55	4.55	
70000	26.97	5.47		92	4.5	4.5	
80000	26.89	5.49		91	4.53	4.53	
90000	26.81	5.5		90	4.55	4.55	
100000	26.76	5.43		89	4.49	4.49	
110000	26.99	5.4		88	4.47	4.47	
120000	27.2	5.63		87	4.71	4.71	
130000	27.35	5.3		86	4.39	4.39	
140000	27.5	5.47		85	4.57	4.57	
150000	27.72	5.6		84	4.71	4.71	
160000	27.6	5.23		83	4.35	4.35	
170000	27.77	5.81		82	4.94	4.94	
180000	27.74	5.8		81	4.94	4.94	
190000	27.74	5.91		80	5.06	5.06	
200000	27.66	5.97		79	5.13	5.13	
210000	27.47	5.82		78	4.99	4.99	
220000	27.35	5.48		77	4.66	4.66	
230000	27.37	5.65		76	4.85	4.85	
0	27.39	5.57	82495	75	4.78	4.78	4.79
10000	27.29	5.47		74	4.69	4.69	
20000	27.35	5.41		73	4.64	4.64	

30000	27.29	5.06		72	4.3	4.3
40000	27.23	5.31		71	4.56	4.56
50000	27.14	5.44		70	4.7	4.7
60000	27.06	5.4		69	4.67	4.67
70000	26.78	5.41		68	4.69	4.69
80000	26.43	5.29		67	4.58	4.58
90000	26.36	5.34		66	4.64	4.64
100000	26.43	5.44		65	4.75	4.75
110000	26.6	5.29		64	4.61	4.61
120000	26.83	5.41		63	4.74	4.74
130000	27.04	5.44		62	4.78	4.78
140000	27.43	5.58		61	4.93	4.93
150000	27.77	5.35		60	4.71	4.71

000785

160000	27.58	5.13		59	5.51	4.51
170000	27.81	5.87		58	5.26	5.26
180000	27.64	5.73		57	5.13	5.13
190000	27.52	5.73		56	5.14	5.14
200000	27.48	5.86		55	5.28	5.28
210000	27.33	5.85		54	5.28	5.28
220000	27.18	5.41		53	4.85	4.85
230000	27.14	5.37		52	4.82	4.82
0	27.18	5.37	82595	51	4.83	4.83
10000	27.23	5.19		50	4.66	4.66
20000	27.25	5.15		49	4.63	4.63
30000	27.33	5.03		48	4.52	4.52
40000	27.37	4.93		47	4.43	4.43
50000	27.35	5.31		46	4.82	4.82
60000	27.22	5.31		45	4.83	4.83
70000	26.97	5.34		44	4.87	4.87
80000	26.72	5.32		43	4.86	4.86
90000	26.57	5.29		42	4.85	4.85
100000	26.53	5.46		41	5.03	5.03
110000	26.55	5.57		40	5.15	5.15
120000	26.76	5.58		39	5.17	5.17
130000	27.02	5.33		38	4.93	4.93
140000	27.27	5.5		37	5.11	5.11
150000	27.47	5.48		36	5.1	5.1
160000	27.66	5.65		35	5.28	5.28
170000	27.79	5.22		34	4.86	4.86
180000	27.64	5.63		33	5.28	5.28
190000	27.47	5.61		32	5.27	5.27
200000	27.31	5.63		31	5.3	5.3
210000	27.14	5.63		30	5.31	5.31
220000	26.95	5.6		29	5.29	5.29
230000	26.74	5.24		28	4.94	4.94
0	26.72	5.41	82695	27	5.12	5.12
10000	26.79	5.31		26	5.03	5.03
20000	26.85	5.06		25	4.8	4.8
30000	26.95	4.86		24	4.61	4.61
40000	26.95	5.03		23	4.79	4.79
50000	26.99	4.67		22	4.44	4.44
60000	26.85	5.17		21	4.95	4.95
70000	26.76	5.25		20	5.04	5.04
80000	26.49	5.22		19	5.02	5.02
90000	26.15	5.14		18	4.95	4.95
100000	25.96	5.12		17	4.94	4.94

000786

110000	26.04	5.33		16	5.16	5.16
120000	26.24	5.47		15	5.31	5.31
130000	26.23	5.36		14	5.21	5.21
140000	26.41	5.23		13	5.09	5.09
150000	26.57	5.28		12	5.15	5.15
160000	26.78	5.1		11	4.98	4.98
170000	26.95	5.08		10	4.97	4.97

180000	27.02	.14		9	.04	5.04	
190000	26.95	5.4		8	5.32	5.32	
200000	26.76	5.37		7	5.3	5.3	
210000	26.53	5.36	Grad.	6	5.3	5.3	
220000	26.3	5.31	Corr.	5	5.26	5.26	
230000	26.21	5.3	Assumed	4	5.26	5.26	
0	26.13	5	82795	3	4.97	4.97	4.97
10000	26.17	5.16	OK	2	5.14	5.14	
20000	26.17	4.92	HERE!!!	1	4.91	4.91	
30000	26.24	5.07		1	5.08	5.08	
40000	26.36	5.05		2	5.07	5.07	
50000	26.4	4.51		3	4.54	4.54	
60000	26.47	4.6		4	4.64	4.64	
70000	26.38	5.06		5	5.11	5.11	
80000	26.19	5.01		6	5.07	5.07	
90000	26.02	4.99		7	5.06	5.06	
100000	25.89	4.93		8	5.01	5.01	
110000	25.91	4.99		9	5.09	5.09	
120000	26.02	5.02		10	5.13	5.13	
130000	26.04	4.97		11	5.09	5.09	
140000	26	4.72		12	4.85	4.85	
150000	26.04	4.86		13	5	5	
160000	26.13	4.71		14	4.86	4.86	
170000	26.23	4.83		15	4.99	4.99	
180000	26.3	4.69		16	4.86	4.86	
190000	26.32	4.65		17	4.83	4.83	
200000	26.19	4.84		18	5.03	5.03	
210000	26.06	4.81		19	5.01	5.01	
220000	25.92	4.82		20	5.03	5.03	
230000	25.85	4.78		21	5	5	
0	25.85	4.84	82895	22	5.07	5.07	4.85
10000	25.85	4.64		23	4.88	4.88	
20000	25.81	4.58		24	4.83	4.83	
30000	25.81	4.53		25	4.79	4.79	
40000	25.81	4.3		26	4.58	4.58	
50000	25.87	4.35		27	4.64	4.64	
60000	25.94	4.19		28	4.49	4.49	
70000	25.96	4.29		29	4.6	4.6	
80000	25.85	4.52		30	4.84	4.84	
90000	25.77	4.52		31	4.85	4.85	
100000	25.72	4.5		32	4.84	4.84	
110000	25.79	4.58		33	4.93	4.93	
120000	25.91	4.65		34	5.01	5.01	
130000	26.02	4.64		35	5.01	5.01	
140000	26.19	4.29		36	4.67	4.67	
150000	26.28	4.65		37	5.04	5.04	
160000	26.47	4.27		38	4.67	4.67	
170000	26.55	4.59		39	5	5	
180000	26.57	4.43		40	4.85	4.85	

000787

190000	26.57	4.3	41	4.73	4.73
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200000	26.53	4.46		42	1.9	4.9	
210000	26.47	4.7		43	5.16	5.16	
220000	26.36	4.51		44	4.98	4.98	
230000	26.19	4.59		45	5.07	5.07	
0	26.04	4.52	82995	46	5.01	5.01	4.73
10000	25.91	4.42		47	4.92	4.92	
20000	25.87	3.97		48	4.48	4.48	
30000	25.87	4.25		49	4.77	4.77	
40000	25.85	3.95		50	4.48	4.48	
50000	25.87	3.48		51	4.02	4.02	
60000	25.91	3.75		52	4.3	4.3	
70000	25.92	3.91		53	4.47	4.47	
80000	25.89	4.06		54	4.63	4.63	
90000	25.79	4.4		55	4.98	4.98	
100000	25.76	4.39		56	4.98	4.98	
110000	25.64	4.41		57	5.01	5.01	
120000	25.61	4.36		58	4.97	4.97	
130000	25.72	4.43		59	5.05	5.05	
140000	25.96	3.7		60	4.34	4.34	
150000	26.11	3.96		61	4.61	4.61	
160000	26.09	3.9		62	4.56	4.56	
170000	26.26	4.27		63	4.94	4.94	
180000	26.36	4.18		64	4.86	4.86	
190000	26.38	3.96		65	4.65	4.65	
200000	26.41	3.99		66	4.69	4.69	
210000	26.4	4.04		67	4.75	4.75	
220000	26.15	4.2		68	4.92	4.92	
230000	26.11	4.35		69	5.08	5.08	
0	25.91	4.32	83095	70	5.06	5.06	4.71
10000	25.76	4.23		71	4.98	4.98	
20000	25.74	4.17		72	4.93	4.93	
30000	25.68	4.04		73	4.81	4.81	
40000	25.66	3.82		74	4.6	4.6	
50000	25.62	3.45		75	4.24	4.24	
60000	25.66	3.87		76	4.67	4.67	
70000	25.68	3.4		77	4.22	4.22	
80000	25.72	3.58		78	4.41	4.41	
90000	25.64	3.79		79	4.63	4.63	
100000	25.64	3.99		80	4.84	4.84	
110000	25.64	4.05		81	4.91	4.91	
120000	25.72	4.09	4.96	82	4.96	4.96	

83095 Total Mean Daily = 5.03

000728

PMK048.80, Pamunkey River at Carters Landing, 8/30 - 9/6/95

Time	Temp	Sonde DO	Date/ QAQC DO	Number	Corr.DO Formula	Corr.DO Value	Mean Daily DO
120000	25.67	4.9	83095	0	4.9	4.9	5.37
130000	25.82	5.31	4.96	1	5.32	5.32	
140000	26.08	5.75		2	5.77	5.77	
150000	26.23	5.65		3	5.67	5.67	
160000	26.27	5.68		4	5.71	5.71	
170000	26.36	5.45		5	5.49	5.49	
180000	26.38	5.25		6	5.3	5.3	
190000	26.36	4.99		7	5.05	5.05	
200000	26.4	5.13		8	5.19	5.19	
210000	26.48	5.2		9	5.27	5.27	
220000	26.4	5.3		10	5.38	5.38	
230000	26.29	5.28		11	5.37	5.37	
0	26.15	5.25	83195	12	5.35	5.35	5.39
10000	26.06	5.3		13	5.4	5.4	
20000	25.97	5.37		14	5.48	5.48	
30000	25.93	5.4		15	5.52	5.52	
40000	25.87	4.97		16	5.1	5.1	
50000	25.82	4.75		17	4.89	4.89	
60000	25.82	4.71		18	4.85	4.85	
70000	25.78	4.64		19	4.79	4.79	
80000	25.76	4.67		20	4.83	4.83	
90000	25.82	4.66		21	4.83	4.83	
100000	25.87	4.98		22	5.15	5.15	
110000	25.89	5.12		23	5.3	5.3	
120000	26	5.29		24	5.48	5.48	
130000	26.15	5.62		25	5.82	5.82	
140000	26.32	6.05		26	6.26	6.26	
150000	26.48	5.81		27	6.02	6.02	
160000	26.63	6		28	6.22	6.22	
170000	26.59	5.68		29	5.91	5.91	
180000	26.7	5.43		30	5.67	5.67	
190000	26.72	5.23		31	5.48	5.48	
200000	26.7	4.98		32	5.23	5.23	
210000	26.68	4.84		33	5.1	5.1	
220000	26.65	4.88		34	5.15	5.15	
230000	26.61	5.22		35	5.5	5.5	
0	26.59	5.36	90195	36	5.65	5.65	5.74
10000	26.49	5.42		37	5.71	5.71	
20000	26.36	5.48		38	5.78	5.78	
30000	26.29	5.52		39	5.83	5.83	
40000	26.25	5.48		40	5.8	5.8	
50000	26.19	5.34		41	5.67	5.67	
60000	26.19	5.22		42	5.55	5.55	
70000	26.19	4.83	000729	43	5.17	5.17	
80000	26.21	4.82		44	5.17	5.17	
90000	26.27	4.81		45	5.17	5.17	
100000	26.44	5.01		46	5.38	5.38	
110000	26.36	5.14		47	5.51	5.51	
120000	26.42	5.32		48	5.7	5.7	
130000	26.51	5.68		49	6.07	6.07	
140000	26.65	5.86		50	6.26	6.26	

150000	26.68	1.13	51	.54	6.54
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160000	26.82	6.04	52	6.45	6.45
170000	26.66	5.99	53	6.41	6.41
180000	26.53	5.77	54	6.2	6.2
190000	26.63	5.3	55	5.74	5.74
200000	26.63	5.18	56	5.63	5.63
210000	26.66	4.93	57	5.38	5.38
220000	26.66	4.95	58	5.41	5.41
230000	26.55	5.07	59	5.54	5.54
0	26.44	5.37	60	5.85	5.85
10000	26.27	5.46	61	5.95	5.95
20000	25.65	5.41	62	5.9	5.9
30000	25.39	5.34	63	5.84	5.84
40000	25.41	5.44	64	5.95	5.95
50000	25.31	5.15	65	5.67	5.67
60000	25.26	4.95	66	5.47	5.47
70000	25.28	4.99	67	5.52	5.52
80000	25.33	4.73	68	5.27	5.27
90000	25.48	4.85	69	5.4	5.4
100000	25.63	4.7	70	5.26	5.26
110000	25.61	4.84	71	5.4	5.4
120000	25.57	4.95	72	5.52	5.52
130000	25.57	5	73	5.58	5.58
140000	25.46	4.99	74	5.58	5.58
150000	25.63	5.3	75	5.9	5.9
160000	25.89	5.71	76	6.31	6.31
170000	26.04	5.57	77	6.18	6.18
180000	25.93	5.08	78	5.7	5.7
190000	25.74	5.03	79	5.66	5.66
200000	25.72	4.81	80	5.45	5.45
210000	25.82	4.89	81	5.53	5.53
220000	25.82	4.47	82	5.12	5.12
230000	25.85	4.58	83	5.24	5.24
0	25.78	4.84	84	5.51	5.51
10000	25.59	4.89	85	5.57	5.57
20000	25.33	4.9	86	5.58	5.58
30000	24.98	5.09	87	5.78	5.78
40000	24.78	5.01	88	5.71	5.71
50000	24.78	5.15	89	5.86	5.86
60000	24.72	4.96	90	5.68	5.68
70000	24.63	4.94	91	5.66	5.66
80000	24.56	4.69	92	5.42	5.42
90000	24.45	4.2	93	4.94	4.94
100000	24.74	4.55	94	5.3	5.3
110000	25.33	4.53	95	5.29	5.29
120000	24.91	4.58	96	5.34	5.34
130000	24.98	4.66	97	5.43	5.43
140000	25.07	4.95	98	5.73	5.73
150000	25.18	5.24	99	6.03	6.03
160000	25.39	5.4	100	6.2	6.2

90295

90395

000790

170000	25.44	3.49	101	.29	6.29
180000	25.52	5.1	102	5.91	5.91
190000	25.41	5.18	103	6	6
200000	25.29	5.11	104	5.94	5.94
210000	25.28	4.84	105	5.67	5.67
220000	25.24	4.47	106	5.31	5.31
230000	25.18	4.21	107	5.06	5.06

0	25.29	4.18	90495	108	5.04	5.04	5.56
10000	25.35	4.23		109	5.1	5.1	
20000	25.09	4.63		110	5.5	5.5	
30000	25.02	4.9		111	5.78	5.78	
40000	24.81	4.95		112	5.84	5.84	
50000	24.46	4.89		113	5.79	5.79	
60000	24.21	4.89		114	5.8	5.8	
70000	24.19	4.51		115	5.42	5.42	
80000	24.15	4.46		116	5.38	5.38	
90000	24.15	4.21		117	5.14	5.14	
100000	24.26	4.54		118	5.48	5.48	
110000	24.59	4.5		119	5.45	5.45	
120000	25.07	4.4		120	5.35	5.35	
130000	24.91	4.04		121	5	5	
140000	25.35	4.96		122	5.93	5.93	
150000	25.05	4.94		123	5.92	5.92	
160000	25.11	4.95		124	5.94	5.94	
170000	25.22	5.16		125	6.15	6.15	
180000	25.16	4.98		126	5.98	5.98	
190000	25.15	4.69		127	5.7	5.7	
200000	25.13	4.36		128	5.38	5.38	
210000	25.13	4.65		129	5.68	5.68	
220000	25.05	4.42		130	5.45	5.45	
230000	25.04	4.13		131	5.17	5.17	
0	25.04	4.14	90595	132	5.19	5.19	5.46
10000	25.02	3.99		133	5.05	5.05	
20000	25.11	4.03		134	5.1	5.1	
30000	24.92	4.52		135	5.59	5.59	
40000	24.81	4.57		136	5.65	5.65	
50000	24.59	4.65		137	5.74	5.74	
60000	24.3	4.56		138	5.66	5.66	
70000	24.1	4.43		139	5.54	5.54	
80000	23.99	4.33	006791	140	5.44	5.44	
90000	24.1	3.92		141	5.04	5.04	
100000	24.23	4.3		142	5.43	5.43	
110000	24.43	3.76		143	4.9	4.9	
120000	24.7	4.41		144	5.56	5.56	
130000	25.13	4.13		145	5.28	5.28	
140000	25.15	3.87		146	5.03	5.03	
150000	25.57	4.75		147	5.92	5.92	
160000	25.13	4.62		148	5.8	5.8	
170000	25.16	4.6		149	5.78	5.78	
180000	25.24	4.64		150	5.83	5.83	

190000	25.09	1.55		151	.75	5.75
200000	24.92	4.3		152	5.51	5.51
210000	24.94	4.19		153	5.41	5.41
220000	25.05	4.23		154	5.45	5.45
230000	25.04	4.18		155	5.41	5.41
0	25.05	4.24	90695	156	5.48	5.48
10000	25.05	3.87		157	5.12	5.12
20000	25.05	4		158	5.26	5.26
30000	25.07	3.77		159	5.03	5.03
40000	24.92	4.27		160	5.54	5.54
50000	24.83	4.27		161	5.55	5.55
60000	24.63	4.22		162	5.51	5.51
70000	24.34	4.18		163	5.48	5.48
						5.3

80000	24.17	3.99		164	5.29	5.29
90000	24.23	3.5		165	4.81	4.81
100000	24.23	3.88	5.2	166	5.2	5.2

90695 Total Mean Daily DO =

000792

7/7-12 L.S.V.

in STORET

3/13/96

PMK048.80, Pamunkey River at Carters Landing, 9/6 - 13/95

Time	Temp	Sonde DO, mg/l	Date/ QAQC DO	Number	Corr.DO Formula	Corr.DO Value	Mean Daily DO
100000	24.31	5.2	90695	1	5.21	5.21	5.27
110000	24.4	5.07	5.2	2	5.09	5.09	
120000	24.66	4.9		3	4.92	4.92	
130000	24.99	5.31		4	5.34	5.34	
140000	25.18	5.14		5	5.18	5.18	
150000	25.29	5		6	5.05	5.05	
160000	25.36	5.48		7	5.53	5.53	
170000	25.2	5.37		8	5.43	5.43	
180000	25.18	5.4		9	5.47	5.47	
190000	25.12	5.42		10	5.5	5.5	
200000	24.94	5.34		11	5.42	5.42	
210000	24.73	5.08		12	5.17	5.17	
220000	24.7	5.15		13	5.25	5.25	
230000	24.77	5.13		14	5.24	5.24	
0	24.86	5.06	90795	15	5.17	5.17	5.33
10000	24.92	5.12		16	5.24	5.24	
20000	24.99	5.15		17	5.28	5.28	
30000	24.97	5.19		18	5.33	5.33	
40000	25.05	5.18		19	5.32	5.32	
50000	24.84	5.34		20	5.49	5.49	
60000	24.71	5.29		21	5.45	5.45	
70000	24.46	5.15		22	5.32	5.32	
80000	24.14	5.02		23	5.19	5.19	
90000	24.07	4.99		24	5.17	5.17	
100000	24.14	5.14		25	5.33	5.33	
110000	24.2	5.07		26	5.27	5.27	
120000	24.36	4.96		27	5.16	5.16	
130000	24.64	4.97		28	5.18	5.18	
140000	24.82	5.03		29	5.25	5.25	
150000	25.05	5.28		30	5.51	5.51	
160000	25.29	5.09		31	5.32	5.32	
170000	25.18	5.37		32	5.61	5.61	
180000	25.07	5.29		33	5.54	5.54	
190000	24.94	5.23		34	5.49	5.49	
200000	24.79	5.21		35	5.48	5.48	
210000	24.64	5.14		36	5.41	5.41	
220000	24.49	5.11		37	5.39	5.39	
230000	24.42	4.82		38	5.11	5.11	
0	24.51	5.02	90895	39	5.32	5.32	5.17
10000	24.49	4.93		40	5.23	5.23	
20000	24.64	4.89		41	5.2	5.2	
30000	24.73	4.95		42	5.27	5.27	
40000	24.7	4.8	000793	43	5.13	5.13	
50000	24.81	4.91		44	5.24	5.24	
60000	24.66	5.11		45	5.45	5.45	
70000	24.53	5.03		46	5.38	5.38	
80000	24.25	4.92		47	5.28	5.28	
90000	24.02	4.77		48	5.13	5.13	
100000	23.98	4.8		49	5.17	5.17	
110000	24.2	4.84		50	5.22	5.22	
120000	24.27	4.64		51	5.03	5.03	

130000	24.44	4.54	52	..93	4.93
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140000	24.77	4.83		53	5.23	5.23
150000	25.08	4.82		54	5.23	5.23
160000	25.25	4.89		55	5.31	5.31
170000	25.36	4.42		56	4.84	4.84
180000	25.23	4.83		57	5.26	5.26
190000	25.08	4.88		58	5.32	5.32
200000	24.94	4.8		59	5.25	5.25
210000	24.77	4.61		60	5.06	5.06
220000	24.6	4.43		61	4.89	4.89
230000	24.49	4.28		62	4.75	4.75
0	24.4	4.06	90995	63	4.54	4.54
10000	24.51	4		64	4.48	4.48
20000	24.66	4.29		65	4.78	4.78
30000	24.73	4.4		66	4.9	4.9
40000	24.79	4.22		67	4.73	4.73
50000	24.84	4.21		68	4.72	4.72
60000	24.82	4.38		69	4.9	4.9
70000	24.71	4.56		70	5.09	5.09
80000	24.53	4.4		71	4.94	4.94
90000	24.27	4.12		72	4.67	4.67
100000	24.09	3.84		73	4.39	4.39
110000	24.22	4		74	4.56	4.56
120000	24.38	3.61		75	4.18	4.18
130000	24.55	3.82		76	4.4	4.4
140000	24.9	4.05		77	4.63	4.63
150000	25.21	4.22		78	4.81	4.81
160000	25.47	4.26		79	4.86	4.86
170000	25.55	4.38		80	4.99	4.99
180000	25.59	4.25		81	4.86	4.86
190000	25.46	4.23		82	4.85	4.85
200000	25.33	4.41		83	5.04	5.04
210000	25.18	4.16		84	4.8	4.8
220000	25.03	3.91		85	4.55	4.55
230000	24.9	3.63		86	4.28	4.28
0	24.81	3.22	91095	87	3.88	3.88
10000	24.82	3.28		88	3.95	3.95
20000	24.82	3.26		89	3.93	3.93
30000	24.94	3.22		90	3.9	3.9
40000	25.03	3.74		91	4.43	4.43
50000	25.12	3.64	000794	92	4.34	4.34
60000	25.16	3.77		93	4.47	4.47
70000	25.2	3.92		94	4.63	4.63
80000	24.99	3.99		95	4.71	4.71
90000	24.86	3.78		96	4.51	4.51
100000	24.64	3.65		97	4.38	4.38
110000	24.55	3.64		98	4.38	4.38
120000	24.68	3.71		99	4.46	4.46
130000	24.77	3.9		100	4.66	4.66
140000	24.92	3.57		101	4.33	4.33

150000	25.14	3.53	102	4.3	4.3
160000	25.36	3.78	103	4.56	4.56
170000	25.47	3.63	104	4.42	4.42
180000	25.53	3.9	105	4.7	4.7
190000	25.47	3.89	106	4.69	4.69
200000	25.38	4.35	107	5.16	5.16
210000	25.2	4.08	108	4.9	4.9

220000	24.99	3.96	109	4.79	4.79		
230000	24.64	3.76	110	4.59	4.59		
0	24.42	3.63	91195	111	4.47	4.47	4.55
10000	24.25	3.42	112	4.27	4.27		
20000	24.22	3.28	113	4.14	4.14		
30000	24.31	3.17	114	4.03	4.03		
40000	24.36	3.61	115	4.48	4.48		
50000	24.42	3.36	116	4.24	4.24		
60000	24.51	3.19	117	4.08	4.08		
70000	24.51	3.13	118	4.02	4.02		
80000	24.31	3.82	119	4.72	4.72		
90000	24.14	3.7	120	4.61	4.61		
100000	23.85	3.68	121	4.6	4.6		
110000	23.6	3.74	122	4.66	4.66		
120000	23.83	4.05	123	4.98	4.98		
130000	24.09	4.3	124	5.24	5.24		
140000	24.16	4.18	125	5.13	5.13		
150000	24.16	3.82	126	4.77	4.77		
160000	24.36	3.61	127	4.57	4.57		
170000	24.57	3.5	128	4.47	4.47		
180000	24.64	2.98	129	3.96	3.96		
190000	24.64	3.29	130	4.27	4.27		
200000	24.58	3.69	131	4.68	4.68		
210000	24.38	3.99	132	4.99	4.99		
220000	24.16	3.9	133	4.91	4.91		
230000	23.8	3.89	134	4.9	4.9		
0	23.6	3.94	91295	135	4.96	4.96	4.83
10000	23.58	3.99	136	5.02	5.02		
20000	23.47	3.8	137	4.84	4.84		
30000	23.38	3.88	138	4.92	4.92		
40000	23.4	3.66	139	4.71	4.71		
50000	23.47	3.27	140	4.33	4.33		
60000	23.63	3.49	000795	141	4.56	4.56	
70000	23.71	3.1	142	4.18	4.18		
80000	23.71	3.35	143	4.43	4.43		
90000	23.51	3.74	144	4.83	4.83		
100000	23.34	3.88	145	4.98	4.98		
110000	23.25	3.84	146	4.95	4.95		
120000	23.25	4.12	147	5.23	5.23		
130000	23.56	4.5	148	5.62	5.62		
140000	23.74	4.28	149	5.41	5.41		
150000	23.72	4.08	150	5.22	5.22		
160000	23.6	3.8	151	4.94	4.94		

170000	23.71	3.5		152	4.65	4.65
180000	23.81	3.41		153	4.57	4.57
190000	23.96	3.29		154	4.46	4.46
200000	24.05	3.05		155	4.22	4.22
210000	23.94	3.74		156	4.92	4.92
220000	23.72	3.78		157	4.97	4.97
230000	23.52	3.88		158	5.08	5.08
0	23.36	3.94	91395	159	5.14	5.14
10000	23.34	3.87		160	5.08	5.08
20000	23.41	3.74		161	4.96	4.96
30000	23.34	3.55		162	4.78	4.78
40000	23.29	3.7		163	4.93	4.93
50000	23.2	3.44		164	4.68	4.68

60000	23.2	3.3		165	4.55	4.55
70000	23.29	3.34		166	4.6	4.6
80000	23.34	3.05		167	4.31	4.31
90000	23.25	3.69		168	4.96	4.96
100000	23.22	3.97		169	5.25	5.25
110000	23.27	4.11		170	5.4	5.4
120000	23.49	4.44		171	5.73	5.73
130000	23.87	4.68		172	5.98	5.98
140000	24.2	4.56	5.87	173	5.87	5.87

91395 Total Mean Daily DO = 5.18

000796

9/14 15, 17, 18 < S.O. ✓

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3/13/90

PMK048.80, Pamunkey River at Carters Landing, 9/13 - 20/95

Unusually large graduated correction, but corr. data appear normal.)

Time	Temp	Sonde DO, mg/l	Date/ QAQC DO	Number	Corr.DO Formula	Corr.DO Value	Mean Daily DO
140000	24.12	8.31	91395	0	5.87	5.87	5.27
150000	24.13	8.49	5.87	1	6.04	6.04	
160000	24.17	8.18		2	5.72	5.72	
170000	24.17	7.82		3	5.34	5.34	
180000	24.23	7.56		4	5.07	5.07	
190000	24.21	7.46		5	4.96	4.96	
200000	24.23	7.37		6	4.86	4.86	
210000	24.23	7.44		7	4.92	4.92	
220000	24.15	7.52		8	4.98	4.98	
230000	24.12	7.5		9	4.95	4.95	
0	24.04	7.63	91495	10	5.07	5.07	4.83
10000	24.04	7.66		11	5.09	5.09	
20000	24.06	7.68		12	5.09	5.09	
30000	24.03	7.74		13	5.14	5.14	
40000	23.97	7.61		14	5	5	
50000	23.95	7.47		15	4.85	4.85	
60000	23.9	7.25		16	4.62	4.62	
70000	23.9	7.08		17	4.43	4.43	
80000	23.92	6.97		18	4.31	4.31	
90000	23.95	7.3		19	4.63	4.63	
100000	23.95	7.42		20	4.74	4.74	
110000	24.01	7.49		21	4.8	4.8	
120000	24.17	7.5		22	4.79	4.79	
130000	24.37	7.54		23	4.82	4.82	
140000	24.7	7.96		24	5.23	5.23	
150000	24.81	7.71		25	4.97	4.97	
160000	24.83	7.85		26	5.1	5.1	
170000	24.92	7.67		27	4.9	4.9	
180000	24.91	7.71		28	4.93	4.93	
190000	24.87	7.34		29	4.55	4.55	
200000	24.81	7.34		30	4.54	4.54	
210000	24.8	7.61		31	4.8	4.8	
220000	24.72	7.59		32	4.76	4.76	
230000	24.74	7.69		33	4.85	4.85	
0	24.72	7.77	91595	34	4.92	4.92	4.93
10000	24.67	7.72		35	4.86	4.86	
20000	24.61	7.8		36	4.92	4.92	
30000	24.59	8.03		37	5.14	5.14	
40000	24.46	7.86		38	4.96	4.96	
50000	24.41	7.66		39	4.75	4.75	
60000	24.45	7.75	000797	40	4.83	4.83	
70000	24.39	7.62		41	4.68	4.68	
80000	24.34	7.66		42	4.71	4.71	
90000	24.32	7.59		43	4.63	4.63	
100000	24.39	7.71		44	4.74	4.74	
110000	24.5	7.74		45	4.76	4.76	
120000	24.59	7.74		46	4.74	4.74	
130000	24.8	8.01		47	5	5	
140000	24.91	8.02		48	5	5	
150000	25	7.88		49	4.85	4.85	
160000	25.22	8.37		50	5.33	5.33	

170000	25	3.16		51	5.1	5.1	
180000	25	8.25		52	5.18	5.18	
190000	25.02	8.28		53	5.2	5.2	
200000	25.02	8.03		54	4.94	4.94	
210000	24.98	8.14		55	5.03	5.03	
220000	24.94	7.97		56	4.85	4.85	
230000	24.91	8.39		57	5.26	5.26	
0	24.81	8.52	91695	58	5.38	5.38	5.03
10000	24.67	8.33		59	5.18	5.18	
20000	24.43	8.27		60	5.1	5.1	
30000	24.32	8.28		61	5.1	5.1	
40000	24.23	8.17		62	4.98	4.98	
50000	24.21	8.34		63	5.14	5.14	
60000	24.17	8.24		64	5.03	5.03	
70000	24.1	8.06		65	4.83	4.83	
80000	24.15	8.01		66	4.77	4.77	
90000	24.24	8.13		67	4.88	4.88	
100000	24.32	8.12		68	4.86	4.86	
110000	24.28	8.09		69	4.82	4.82	
120000	24.26	8.43		70	5.14	5.14	
130000	24.21	8.43		71	5.13	5.13	
140000	24.08	8.43		72	5.12	5.12	
150000	23.99	8.49		73	5.17	5.17	
160000	23.95	8.49		74	5.15	5.15	
170000	23.92	8.29		75	4.94	4.94	
180000	23.92	8.39		76	5.03	5.03	
190000	23.99	8.53		77	5.16	5.16	
200000	24.08	8.2		78	4.82	4.82	
210000	24.1	8.46		79	5.06	5.06	
220000	24.1	8.1		80	4.69	4.69	
230000	24.1	8.62		81	5.2	5.2	
0	24.04	8.52	91795	82	5.09	5.09	4.99
10000	24.03	8.86		83	5.42	5.42	
20000	23.9	8.76		84	5.3	5.3	
30000	23.75	8.71		85	5.24	5.24	
40000	23.53	8.64		86	5.16	5.16	
50000	23.37	8.61		87	5.12	5.12	
60000	23.32	8.28		88	4.78	4.78	
70000	23.34	8.19		89	4.67	4.67	
80000	23.37	8.46		90	4.93	4.93	
90000	23.44	8.59		91	5.05	5.05	
100000	23.52	8.17		92	4.62	4.62	
110000	23.53	8.54		93	4.98	4.98	
120000	23.46	8.83		94	5.25	5.25	000738
130000	23.32	8.8		95	5.21	5.21	
140000	23.16	8.74		96	5.14	5.14	
150000	23.1	8.78		97	5.17	5.17	
160000	23.23	8.93		98	5.3	5.3	
170000	23.26	8.79		99	5.15	5.15	
180000	23.25	7.64		100	3.99	3.99	

190000	23.17	3.76		101	5.1	5.1
200000	23.1	8.62		102	4.95	4.95
210000	23.14	8.22		103	4.53	4.53
220000	23.17	8.45		104	4.75	4.75
230000	23.25	8.53		105	4.82	4.82
0	23.25	8.07	91895	106	4.35	4.35
10000	23.16	8.8		107	5.07	5.07

20000	23.03	8.82		108	5.07-	5.07
30000	22.85	8.75		109	4.99	4.99
40000	22.65	8.73		110	4.96	4.96
50000	22.58	8.7		111	4.92	4.92
60000	22.58	8.84		112	5.05	5.05
70000	22.53	8.74		113	4.93	4.93
80000	22.49	9.02		114	5.2	5.2
90000	22.49	8.56		115	4.73	4.73
100000	22.62	8.7		116	4.86	4.86
110000	22.83	8.71		117	4.85	4.85
120000	22.87	8.22		118	4.35	4.35
130000	22.85	8.8		119	4.92	4.92
140000	22.8	8.75		120	4.86	4.86
150000	22.81	8.91		121	5.01	5.01
160000	22.9	8.89		122	4.97	4.97
170000	22.89	9.19		123	5.26	5.26
180000	22.89	9.12		124	5.18	5.18
190000	22.83	9.24		125	5.29	5.29
200000	22.8	9.22		126	5.26	5.26
210000	22.78	8.75		127	4.77	4.77
220000	22.8	8.55		128	4.56	4.56
230000	22.83	8.61		129	4.61	4.61
0	22.85	8.99	91995	130	4.98	4.98
10000	22.85	8.78		131	4.76	4.76
20000	22.71	9.14		132	5.1	5.1
30000	22.62	9.17		133	5.12	5.12
40000	22.44	9.2		134	5.14	5.14
50000	22.21	9.33		135	5.26	5.26
60000	22.05	9.43		136	5.34	5.34
70000	22.01	9.5		137	5.4	5.4
80000	21.92	9.38		138	5.27	5.27
90000	21.94	9.54		139	5.42	5.42
100000	22.01	9.36		140	5.23	5.23
110000	22.22	9.02		141	4.87	4.87
120000	22.47	8.97		142	4.81	4.81
130000	22.62	8.93		143	4.76	4.76
140000	22.56	9.4		144	5.22	5.22
150000	22.46	9.37		145	5.18	5.18
160000	22.38	9.45		146	5.24	5.24
170000	22.37	9.57		147	5.35	5.35
180000	22.37	9.71		148	5.48	5.48
190000	22.29	9.56		149	5.32	5.32
200000	22.21	9.62		150	5.37	5.37

000799

210000	22.24	1.78		151	.51	5.51	
220000	22.22	9.57		152	5.29	5.29	
230000	22.26	9.48		153	5.19	5.19	
0	22.33	9.27	92095	154	4.97	4.97	5.08
10000	22.35	8.96		155	4.65	4.65	
20000	22.42	8.7		156	4.37	4.37	
30000	22.29	9.34		157	5	5	
40000	22.17	9.61		158	5.26	5.26	
50000	22.05	9.71		159	5.35	5.35	
60000	21.8	9.72		160	5.34	5.34	
70000	21.53	9.65		161	5.26	5.26	
80000	21.43	9.68		162	5.28	5.28	
90000	21.43	9.56		163	5.15	5.15	

100000	21.55	9.72		164	5.3	5.3	
110000	21.82	9.38		165	4.94	4.94	
120000	22.17	9.39		166	4.94	4.94	
130000	22.44	9.72	5.26	167	5.26	5.26	

9/20/95 Total Mean Daily DO =

000800

PMK048.80, Pamunkey River at Carters Landing, 9/20 - 27/95

Time	Temp	Sonde DO, mg/l	Date/ QAQC DO	Number	Corr.DO Formula	Corr.DO Value	Mean Daily DO
130000	22.64	5.93	92095	102	5.26	5.26	5.17
140000	22.44	5.55	5.26	101	4.89	4.89	Partial
150000	22.28	5.45		100	4.79	4.79	Day
160000	22.33	5.62		99	4.97	4.97	
170000	22.3	5.73		98	5.09	5.09	
180000	22.23	5.87		97	5.23	5.23	
190000	22.17	6.02		96	5.39	5.39	
200000	22.12	6.04		95	5.42	5.42	
210000	22.1	5.9		94	5.28	5.28	
220000	22.08	5.94		93	5.33	5.33	
230000	22.12	5.82		92	5.22	5.22	
0	22.17	5.73	92195	91	5.13	5.13	5.06
10000	22.23	5.5		90	4.91	4.91	
20000	22.3	5.55		89	4.97	4.97	
30000	22.35	5.54		88	4.96	4.96	
40000	22.23	5.51		87	4.94	4.94	
50000	22.17	5.6		86	5.04	5.04	
60000	22.03	5.64		85	5.08	5.08	
70000	21.85	5.67		84	5.12	5.12	
80000	21.73	5.61		83	5.06	5.06	
90000	21.68	5.58		82	5.04	5.04	
100000	21.69	5.5		81	4.97	4.97	
110000	21.76	5.42		80	4.89	4.89	
120000	21.92	5.48		79	4.96	4.96	
130000	22.08	5.47		78	4.96	4.96	
140000	22.33	5.46		77	4.95	4.95	
150000	22.51	4.7		76	4.2	4.2	
160000	22.75	5.7		75	5.21	5.21	
170000	22.35	5.59		74	5.1	5.1	
180000	22.33	5.72		73	5.24	5.24	
190000	22.37	5.88		72	5.41	5.41	
200000	22.3	5.9		71	5.43	5.43	
210000	22.23	5.7		70	5.24	5.24	
220000	22.25	5.75		69	5.3	5.3	
230000	22.28	5.73		68	5.28	5.28	
0	22.33	5.59	92295	67	5.15	5.15	5.18
10000	22.35	5.59		66	5.16	5.16	
20000	22.42	5.31		65	4.88	4.88	
30000	22.48	5.46		64	5.04	5.04	
40000	22.5	5.34		63	4.93	4.93	
50000	22.41	5.54		62	5.13	5.13	
60000	22.32	5.54		61	5.14	5.14	
70000	22.21	5.63		60	5.24	5.24	
80000	22.14	5.6		59	5.21	5.21	
90000	22.07	5.59		58	5.21	5.21	
100000	22.07	5.59		57	5.22	5.22	
110000	22.1	5.5		56	5.13	5.13	
120000	22.26	5.49		55	5.13	5.13	
130000	22.37	5.52		54	5.17	5.17	
140000	22.78	5.47		53	5.12	5.12	
150000	22.85	5.54		52	5.2	5.2	

000801

160000	22.87	5.3	51	..97	4.97
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170000	22.85	5.61	50	5.28	5.28
180000	22.68	5.57	49	5.25	5.25
190000	22.59	5.68	48	5.36	5.36
200000	22.55	5.72	47	5.41	5.41
210000	22.41	5.67	46	5.37	5.37
220000	22.25	5.57	45	5.27	5.27
230000	22.21	5.54	44	5.25	5.25
0	22.26	5.65	43	5.37	5.37
10000	22.3	5.61	42	5.33	5.33
20000	22.25	5.19	41	4.92	4.92
30000	22.26	5.47	40	5.21	5.21
40000	22.21	5.38	39	5.12	5.12
50000	22.21	5.44	38	5.19	5.19
60000	22.17	5.53	37	5.29	5.29
70000	22	5.54	36	5.3	5.3
80000	21.8	5.57	35	5.34	5.34
90000	21.43	5.53	34	5.31	5.31
100000	21.18	5.47	33	5.25	5.25
110000	21.04	5.57	32	5.36	5.36
120000	21.04	5.58	31	5.38	5.38
130000	21.16	5.44	30	5.24	5.24
140000	21.32	5.34	29	5.15	5.15
150000	21.48	5.45	28	5.27	5.27
160000	21.5	5.27	27	5.09	5.09
170000	21.5	5.45	26	5.28	5.28
180000	21.46	5.53	25	5.37	5.37
190000	21.29	5.57	24	5.41	5.41
200000	20.99	5.6	23	5.45	5.45
210000	20.51	5.67	22	5.53	5.53
220000	20.29	5.71	21	5.57	5.57
230000	20.2	5.85	20	5.72	5.72
0	20.08	5.77	19	5.65	5.65
10000	20.13	5.72	18	5.6	5.6
20000	20.18	5.59	17	5.48	5.48
30000	20.29	5.41	16	5.3	5.3
40000	20.46	5.43	15	5.33	5.33
50000	20.53	5.41	14	5.32	5.32
60000	20.39	5.57	13	5.48	5.48
70000	20.13	5.6	12	5.52	5.52
80000	19.78	5.68	11	5.61	5.61
90000	19.49	5.74	10	5.67	5.67
100000	19.56	5.91	9	5.85	5.85
110000	19.71	5.94	8	5.89	5.89
120000	19.68	5.96	7	5.91	5.91
130000	19.66	5.81	6	5.77	5.77
140000	19.8	5.77	5	5.74	5.74
150000	20.01	5.69 Grad.	4	5.66	5.66
160000	20.16	5.49 Corr.	3	5.47	5.47
170000	20.3	5.65 Assumed	2	5.64	5.64

92395

5.31

92495

5.65

00080

180000	20.34	.48	OK HERE!!	1	.47	5.47	
190000	20.2	5.71		1	5.72	5.72	
200000	20.01	5.74		2	5.75	5.75	
210000	19.73	5.84		3	5.86	5.86	
220000	19.49	5.95		4	5.98	5.98	
230000	19.47	6.01		5	6.04	6.04	
0	19.43	5.95	92595	6	5.99	5.99	5.83

10000	19.4	5.96		7	6.01	6.01	
20000	19.43	5.72		8	5.77	5.77	
30000	19.54	5.62		9	5.68	5.68	
40000	19.71	5.66		10	5.73	5.73	
50000	19.73	5.6		11	5.67	5.67	
60000	19.83	5.51		12	5.59	5.59	
70000	19.71	5.72		13	5.81	5.81	
80000	19.52	5.78		14	5.87	5.87	
90000	19.28	5.86		15	5.96	5.96	
100000	19.12	5.88		16	5.99	5.99	
110000	19.16	5.95		17	6.06	6.06	
120000	19.33	5.96		18	6.08	6.08	
130000	19.33	5.86		19	5.98	5.98	
140000	19.31	5.68		20	5.81	5.81	
150000	19.43	5.82		21	5.96	5.96	
160000	19.57	5.54		22	5.68	5.68	
170000	19.64	5.38		23	5.53	5.53	
180000	19.8	5.26		24	5.42	5.42	
190000	19.89	5.45		25	5.61	5.61	
200000	19.71	5.7		26	5.87	5.87	
210000	19.54	5.73		27	5.91	5.91	
220000	19.35	5.79		28	5.97	5.97	
230000	19.21	5.79		29	5.98	5.98	
0	19.23	5.82	92695	30	6.02	6.02	5.87
10000	19.23	5.73		31	5.93	5.93	
20000	19.21	5.72		32	5.93	5.93	
30000	19.18	5.71		33	5.93	5.93	
40000	19.28	5.56		34	5.78	5.78	
50000	19.4	5.3		35	5.53	5.53	
60000	19.45	5.45		36	5.69	5.69	
70000	19.52	5.41		37	5.65	5.65	
80000	19.38	5.49		38	5.74	5.74	
90000	19.28	5.7		39	5.96	5.96	
100000	19.14	5.71		40	5.97	5.97	
110000	19.09	5.7		41	5.97	5.97	
120000	19.19	5.76		42	6.04	6.04	
130000	19.26	5.79		43	6.07	6.07	
140000	19.24	5.68		44	5.97	5.97	
150000	19.24	5.63		45	5.93	5.93	
160000	19.28	5.58		46	5.88	5.88	
170000	19.35	5.36		47	5.67	5.67	
180000	19.38	5.45		48	5.77	5.77	
190000	19.45	5.49		49	5.81	5.81	

000803

200000	19.52	5.55		50	5.88	5.88	
210000	19.31	5.56		51	5.89	5.89	
220000	19.21	5.58		52	5.92	5.92	
230000	19.09	5.51		53	5.86	5.86	
0	18.99	5.34	92795	54	5.69	5.69	5.62
10000	19	5.29		55	5.65	5.65	
20000	18.97	5.01		56	5.38	5.38	
30000	18.93	5.03		57	5.4	5.4	
40000	18.92	5.09		58	5.47	5.47	
50000	18.93	5.19		59	5.58	5.58	
60000	18.95	5.25		60	5.64	5.64	
70000	18.95	5.26		61	5.66	5.66	
80000	18.81	5.35		62	5.76	5.76	

90000	18.87	5.42		63	5.83	5.83	
100000	18.78	5.29		64	5.71	5.71	
110000	18.73	5.11		65	5.54	5.54	
120000	18.85	5.13		66	5.56	5.56	
130000	19.18	5.4	5.84	67	5.84	5.84	

92795 Total Mean Daily DO = 5.58

000804

PMK048.80, Pamunkey River at Carters Landing, 9/27 - 10/4/95

Time	Temp	Sonde DO, mg/l	Date/ QAQC DO	Number	Corr.DO Foemula	Corr.DO Value	Mean Daily DO
130000	19.37	5.84	92795	1	5.84	5.84	5.54
140000	19.35	5.83	5.84	2	5.84	5.84	
150000	19.32	5.28		3	5.29	5.29	
160000	19.51	5.24		4	5.26	5.26	
170000	19.65	5.28		5	5.3	5.3	
180000	19.68	5.46		6	5.49	5.49	
190000	19.68	5.36		7	5.39	5.39	
200000	19.71	5.63		8	5.67	5.67	
210000	19.63	5.68		9	5.72	5.72	
220000	19.51	5.62		10	5.67	5.67	
230000	19.3	5.44		11	5.49	5.49	
0	19.2	5.3	92895	12	5.36	5.36	5.58
10000	19.23	5.52		13	5.58	5.58	
20000	19.27	5.67		14	5.74	5.74	
30000	19.21	5.64		15	5.71	5.71	
40000	19.13	5.41		16	5.48	5.48	
50000	19.04	5.31		17	5.39	5.39	
60000	19.04	5.26		18	5.34	5.34	
70000	18.99	4.94		19	5.03	5.03	
80000	19.02	5.25		20	5.34	5.34	
90000	18.92	5.28		21	5.38	5.38	
100000	18.94	5.33		22	5.43	5.43	
110000	19.01	5.55		23	5.66	5.66	
120000	19.06	5.82		24	5.93	5.93	
130000	19.2	6.19		25	6.31	6.31	
140000	19.35	6.32		26	6.44	6.44	
150000	19.65	6.21		27	6.34	6.34	
160000	19.61	5.72		28	5.85	5.85	
170000	19.75	5.51		29	5.64	5.64	
180000	19.78	5.25		30	5.39	5.39	
190000	19.77	5.21		31	5.35	5.35	
200000	19.77	4.96		32	5.11	5.11	
210000	19.75	5.09		33	5.24	5.24	
220000	19.66	5.21		34	5.37	5.37	
230000	19.59	5.31		35	5.47	5.47	
0	19.44	5.51	92995	36	5.68	5.68	5.85
10000	19.32	5.69		37	5.86	5.86	
20000	19.21	5.82		38	6	6	
30000	19.15	5.87		39	6.05	6.05	
40000	19.15	5.8		40	5.99	5.99	
50000	19.15	5.55		41	5.74	5.74	
60000	19.2	5.45		42	5.65	5.65	
70000	19.2	5.26		43	5.46	5.46	
80000	19.21	5.07		44	5.27	5.27	
90000	19.21	5.15		45	5.36	5.36	
100000	19.23	5.3		46	5.51	5.51	
110000	19.27	5.53		47	5.75	5.75	
120000	19.28	5.74		48	5.96	5.96	
130000	19.32	5.98		49	6.21	6.21	
140000	19.35	6.17		50	6.4	6.4	
150000	19.39	6.23		51	6.47	6.47	
160000	19.59	6.09		52	6.33	6.33	

000805

170000	19.7	5.97	53	.22	6.22
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180000	19.82	5.75	54	6	6
190000	19.82	5.49	55	5.75	5.75
200000	19.84	5.5	56	5.76	5.76
210000	19.85	5.31	57	5.57	5.57
220000	19.87	5.35	58	5.62	5.62
230000	19.71	5.45	59	5.72	5.72
0	19.61	5.66	60	5.94	5.94
10000	19.46	5.73	61	6.01	6.01
20000	19.21	5.8	62	6.09	6.09
30000	19.04	5.86	63	6.15	6.15
40000	18.97	6	64	6.3	6.3
50000	18.99	5.87	65	6.17	6.17
60000	19.04	6.14	66	6.45	6.45
70000	19.16	5.67	67	5.98	5.98
80000	19.2	5.56	68	5.88	5.88
90000	19.28	5.31	69	5.63	5.63
100000	19.35	5.57	70	5.9	5.9
110000	19.35	5.55	71	5.88	5.88
120000	19.32	5.65	72	5.98	5.98
130000	19.21	5.84	73	6.18	6.18
140000	19.21	6.48	74	6.82	6.82
150000	19.25	6.28	75	6.63	6.63
160000	19.27	6.23	76	6.58	6.58
170000	19.32	6.12	77	6.48	6.48
180000	19.42	6.04	78	6.4	6.4
190000	19.52	5.96	79	6.33	6.33
200000	19.63	5.76	80	6.13	6.13
210000	19.65	5.68	81	6.06	6.06
220000	19.7	5.69	82	6.07	6.07
230000	19.71	5.61	83	6	6
0	19.54	5.64	84	6.03	6.03
10000	19.46	5.77	85	6.16	6.16
20000	19.21	5.81	86	6.21	6.21
30000	18.94	5.88	87	6.28	6.28
40000	18.75	6.1	88	6.51	6.51
50000	18.65	5.72	89	6.13	6.13
60000	18.61	5.86	90	6.28	6.28
70000	18.66	5.91	91	6.33	6.33
80000	18.72	5.89	92	6.32	6.32
90000	18.84	5.61	93	6.04	6.04
100000	19.04	5.62	94	6.06	6.06
110000	19.18	5.6	95	6.04	6.04
120000	19.16	5.82	96	6.27	6.27
130000	19.09	5.98	97	6.43	6.43
140000	19.04	6.16	98	6.62	6.62
150000	19.08	6.39	99	6.85	6.85
160000	19.06	6.44	100	6.9	6.9
170000	19.13	6.61	101	7.08	7.08
180000	19.15	6.38	102	6.85	6.85

93095

100195

000806

190000	19.16	5.23		103	6.71	6.71
200000	19.25	6.05		104	6.53	6.53
210000	19.28	5.59		105	6.08	6.08
220000	19.32	5.76		106	6.25	6.25
230000	19.4	5.81		107	6.31	6.31
0	19.49	5.46	100295	108	5.96	5.96
10000	19.28	5.8		109	6.31	6.31

20000	19.13	5.87		110	6.38	6.38
30000	18.94	5.98		111	6.5	6.5
40000	18.72	6		112	6.52	6.52
50000	18.6	6.11		113	6.64	6.64
60000	18.54	6.01		114	6.54	6.54
70000	18.49	6.1		115	6.63	6.63
80000	18.54	5.94		116	6.48	6.48
90000	18.61	5.98		117	6.52	6.52
100000	18.78	6.05		118	6.6	6.6
110000	19.15	5.81		119	6.36	6.36
120000	18.94	5.86		120	6.42	6.42
130000	19.08	6		121	6.56	6.56
140000	19.2	6.19		122	6.76	6.76
150000	19.4	6.41		123	6.98	6.98
160000	19.58	6.58		124	7.16	7.16
170000	19.52	6.79		125	7.37	7.37
180000	19.51	6.66		126	7.25	7.25
190000	19.51	6.67		127	7.26	7.26
200000	19.56	6.38		128	6.97	6.97
210000	19.58	6.38		129	6.98	6.98
220000	19.59	6.18		130	6.78	6.78
230000	19.63	6.13		131	6.74	6.74
0	19.7	6.09	100395	132	6.7	6.7
10000	19.65	5.8		133	6.42	6.42
20000	19.58	6.1		134	6.72	6.72
30000	19.49	6.29		135	6.92	6.92
40000	19.39	6.44		136	7.07	7.07
50000	19.3	6.51		137	7.15	7.15
60000	19.2	6.28		138	6.92	6.92
70000	19.13	6.31		139	6.96	6.96
80000	19.16	6.28		140	6.93	6.93
90000	19.21	6.05		141	6.71	6.71
100000	19.32	5.85		142	6.51	6.51
110000	19.59	5.93		143	6.59	6.59
120000	20.03	5.96		144	6.63	6.63
130000	19.65	5.85		145	6.52	6.52
140000	19.85	6.03		146	6.71	6.71
150000	19.94	6.12		147	6.8	6.8
160000	20.18	6.43		148	7.12	7.12
170000	20.24	6.55		149	7.24	7.24
180000	20.1	6.41		150	7.11	7.11
190000	19.99	6.5		151	7.2	7.2
200000	20.04	6.42		152	7.13	7.13

000807

210000	20.22	5.22		153	.93	6.93	
220000	20.24	6.21		154	6.93	6.93	
230000	20.22	5.71		155	6.43	6.43	
0	20.24	5.68	100495	156	6.4	6.4	6.63
10000	20.29	5.9		157	6.63	6.63	
20000	20.3	5.79		158	6.52	6.52	
30000	20.22	5.95		159	6.69	6.69	
40000	20.17	5.95		160	6.69	6.69	
50000	20.11	6.02		161	6.77	6.77	
60000	20.03	6.03		162	6.78	6.78	
70000	19.87	6.03		163	6.79	6.79	
80000	19.82	6.07		164	6.83	6.83	
90000	19.91	5.84		165	6.61	6.61	

100000	20.01	6.07		166	6.84	6.84
110000	20.1	5.87		167	6.65	6.65
120000	20.17	5.73		168	6.51	6.51
130000	20.24	5.56		169	6.35	6.35
140000	20.3	5.63	6.42	170	6.42	6.42

100495 Total Mean Daily DO = 6.56

000808

PMK048.80, Pamunkey River at Carters Landing, 11/95

STOP- 3/13/95

Time	Temp	Sonde DO, mg/l	Date/ QAQC DO	Number	Corr.DO Formula	Corr.DO Value	Mean Daily DO
140000	20.17	6.42	100495	1	6.42	6.42	6.53
150000	20.27	6.37	6.42	2	6.38	6.38	
160000	20.2	6.42		3	6.43	6.43	
170000	20.15	6.55		4	6.56	6.56	
180000	20.08	6.58		5	6.59	6.59	
190000	19.99	6.59		6	6.61	6.61	
200000	19.89	6.45		7	6.47	6.47	
210000	19.9	6.68		8	6.7	6.7	
220000	19.99	6.53		9	6.56	6.56	
230000	20.09	6.54		10	6.57	6.57	
0	20.15	6.41	100595	11	6.44	6.44	6.28
10000	20.18	6.39		12	6.43	6.43	
20000	20.23	6.26		13	6.3	6.3	
30000	20.25	6.18		14	6.22	6.22	
40000	20.25	6.21		15	6.25	6.25	
50000	20.2	6.33		16	6.38	6.38	
60000	20.11	6.48		17	6.53	6.53	
70000	20.02	6.43		18	6.48	6.48	
80000	19.94	6.38		19	6.44	6.44	
90000	19.9	6.08		20	6.14	6.14	
100000	19.97	6.18		21	6.24	6.24	
110000	20.13	6.2		22	6.26	6.26	
120000	20.3	6.11		23	6.18	6.18	
130000	20.43	6.11		24	6.18	6.18	
140000	20.51	6.13		25	6.2	6.2	
150000	20.6	5.89		26	5.97	5.97	
160000	20.55	6.19		27	6.27	6.27	
170000	20.53	6.13		28	6.21	6.21	
180000	20.53	6.15		29	6.24	6.24	
190000	20.58	6.13		30	6.22	6.22	
200000	20.6	6.24		31	6.33	6.33	
210000	20.51	6.38		32	6.47	6.47	
220000	20.51	6.08		33	6.18	6.18	
230000	20.57	6.04		34	6.14	6.14	
0	20.64	5.99	100695	35	6.09	6.09	5.94
10000	20.69	5.75		36	5.86	5.86	
20000	20.69	5.64		37	5.75	5.75	
30000	20.71	5.64		38	5.75	5.75	
40000	20.71	5.97		39	6.09	6.09	
50000	20.67	5.87		40	5.99	5.99	
60000	20.57	5.87		41	5.99	5.99	

000809

70000	20.48	5.85	42	5.97	5.97
80000	20.29	5.84	43	5.97	5.97
90000	20.2	5.88	44	6.01	6.01
100000	20.2	5.8	45	5.93	5.93
110000	20.32	6.01	46	6.15	6.15
120000	20.5	5.77	47	5.91	5.91

130000	20.79	5.65		48	5.79	5.79
140000	20.95	5.62		49	5.76	5.76
150000	21.3	5.7		50	5.85	5.85
160000	20.95	5.27		51	5.42	5.42
170000	21.2	5.77		52	5.92	5.92
180000	20.93	5.71		53	5.87	5.87
190000	20.92	5.79		54	5.95	5.95
200000	21.02	6.04		55	6.2	6.2
210000	21.02	6.2		56	6.37	6.37
220000	20.95	5.94		57	6.11	6.11
230000	20.95	5.69		58	5.86	5.86
0	20.99	6.01	100795	59	6.18	6.18
10000	21.02	5.69		60	5.87	5.87
20000	21.02	5.39		61	5.57	5.57
30000	21.02	5.42		62	5.6	5.6
40000	21.02	5.47		63	5.66	5.66
50000	21.04	5.54		64	5.73	5.73
60000	21.02	5.71		65	5.9	5.9
70000	20.95	5.82		66	6.01	6.01
80000	20.97	5.74		67	5.94	5.94
90000	21.04	5.54		68	5.74	5.74
100000	21.13	5.43		69	5.63	5.63
110000	21.2	5.41		70	5.62	5.62
120000	21.36	5.44		71	5.65	5.65
130000	21.55	5.43		72	5.64	5.64
140000	21.68	5.41		73	5.63	5.63
150000	21.64	5.27		74	5.49	5.49
160000	21.69	4.66		75	4.88	4.88
170000	21.52	5.08		76	5.3	5.3
180000	21.69	5.43		77	5.66	5.66
190000	21.71	5.35		78	5.58	5.58
200000	21.84	5.28		79	5.51	5.51
210000	22.03	5.17		80	5.41	5.41
220000	22.07	5		81	5.24	5.24
230000	22.01	4.46		82	4.7	4.7
0	21.94	4.64	100895	83	4.88	4.88
10000	21.96	4.48		84	4.73	4.73
20000	21.92	4.52		85	4.77	4.77
30000	21.82	4.21		86	4.46	4.46
40000	21.69	4.73		87	4.99	4.99
50000	21.62	4.62		88	4.88	4.88
60000	21.48	4.96		89	5.22	5.22
70000	21.55	4.99		90	5.26	5.26
80000	21.5	4.92		91	5.19	5.19
90000	21.34	4.82		92	5.09	5.09
100000	21.3	4.69		93	4.96	4.96
110000	21.45	4.23		94	4.51	4.51
120000	21.55	4.47		95	4.75	4.75
130000	21.6	4.48		96	4.76	4.76
140000	21.78	4.31		97	4.6	4.6

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150000	21.91	4.65		98	.94	4.94
160000	21.94	4.11		99	4.4	4.4
170000	21.91	4.2		100	4.5	4.5
180000	21.84	4.12		101	4.42	4.42
190000	21.69	4.78		102	5.08	5.08
200000	21.55	4.69		103	4.99	4.99
210000	21.46	4.67		104	4.98	4.98
220000	21.48	4.87		105	5.18	5.18
230000	21.5	4.8		106	5.11	5.11
0	21.39	4.63	100995	107	4.95	4.95
10000	21.34	4.21		108	4.53	4.53
20000	21.3	4.62		109	4.94	4.94
30000	21.2	4.21		110	4.53	4.53
40000	21.13	4.35		111	4.68	4.68
50000	21.06	4.36		112	4.69	4.69
60000	20.85	4.58		113	4.91	4.91
70000	20.86	4.85		114	5.19	5.19
80000	20.86	4.93		115	5.27	5.27
90000	20.67	5.06		116	5.4	5.4
100000	20.55	5.29		117	5.64	5.64
110000	20.65	5.34		118	5.69	5.69
120000	20.9	5.48		119	5.83	5.83
130000	20.93	5.37		120	5.72	5.72
140000	21.07	5.32		121	5.68	5.68
150000	21.16	5.37		122	5.73	5.73
160000	21.34	5.14		123	5.5	5.5
170000	21.23	4.93		124	5.3	5.3
180000	21.2	4.8		125	5.17	5.17
190000	21.07	4.87		126	5.24	5.24
200000	20.99	5.16		127	5.53	5.53
210000	20.85	5.4		128	5.78	5.78
220000	20.81	5.42		129	5.8	5.8
230000	20.85	5.42		130	5.8	5.8
0	20.81	5.34	101095	131	5.73	5.73
10000	20.72	5.2		132	5.59	5.59
20000	20.71	5.26		133	5.65	5.65
30000	20.62	4.82		134	5.22	5.22
40000	20.44	4.66		135	5.06	5.06
50000	20.41	4.41		136	4.81	4.81
60000	20.36	4.96		137	5.36	5.36
70000	20.22	5.06		138	5.47	5.47
80000	20.22	5.17		139	5.58	5.58
90000	20.16	5.21		140	5.62	5.62
100000	19.99	5.28		141	5.7	5.7
110000	20.01	5.38		142	5.8	5.8
120000	20.2	5.45		143	5.87	5.87
130000	20.48	5.42		144	5.85	5.85
140000	20.39	5.36		145	5.79	5.79
150000	20.65	5.18		146	5.61	5.61
160000	20.71	4.94		147	5.37	5.37
170000	20.79	5.05		148	5.49	5.49
180000	20.72	4.4		149	4.84	4.84
190000	20.65	4.94		150	5.38	5.38
200000	20.36	4.59		151	5.04	5.04
210000	20.43	4.83		152	5.28	5.28
220000	20.32	4.95		153	5.4	5.4

000811

230000	20.23	5.01		154	5.46	5.46	
0	20.15	4.99	101195	155	5.45	5.45	5.21
10000	20.08	4.73		156	5.19	5.19	
20000	20.15	4.71		157	5.17	5.17	
30000	20.11	4.9		158	5.37	5.37	
40000	20.08	4.85		159	5.32	5.32	
50000	20.08	4.72		160	5.19	5.19	
60000	20	4.41		161	4.89	4.89	
70000	20.01	4.27		162	4.75	4.75	
80000	19.85	4.65		163	5.13	5.13	
90000	19.9	4.73		164	5.21	5.21	
100000	19.9	4.79		165	5.28	5.28	
110000	19.96	5.09	5.58	166	5.58	5.58	

101195 Total Mean Daily DO =

000812

PMK048.80, Pamunkey River at Carters Landing, 10/11 - 18/95

Time	Temp	Sonde DO, mg/l	Date/ QAQC DO	Number	Corr.DO Formula	Corr.DO Value	Mean Daily DO
110000	19.8	5.6	101195	1	5.6	5.6	5.55
120000	19.91	5.72		2	5.73	5.73	+5.21
130000	20.04	5.82		3	5.83	5.83	10.76
140000	20.3	5.85		4	5.86	5.86	5.38
150000	20.36	5.65		5	5.66	5.66	Day
160000	20.46	5.6		6	5.62	5.62	
170000	20.55	5.51		7	5.53	5.53	
180000	20.57	5.4		8	5.42	5.42	
190000	20.55	5.24		9	5.26	5.26	
200000	20.55	5.31		10	5.34	5.34	
210000	20.43	5.29		11	5.32	5.32	
220000	20.37	5.45		12	5.48	5.48	
230000	20.17	5.49		13	5.52	5.52	
0	20.04	5.51	101295	14	5.55	5.55	5.57
10000	19.96	5.6		15	5.64	5.64	
20000	19.87	5.64		16	5.68	5.68	
30000	19.84	5.58		17	5.62	5.62	
40000	19.87	5.48		18	5.53	5.53	
50000	19.85	5.34		19	5.39	5.39	
60000	19.84	5.32		20	5.37	5.37	
70000	19.8	5.08		21	5.13	5.13	
80000	19.8	5.26		22	5.32	5.32	
90000	19.7	5.35		23	5.41	5.41	
100000	19.66	5.5		24	5.56	5.56	
110000	19.58	5.58		25	5.64	5.64	
120000	19.56	5.68		26	5.75	5.75	
130000	19.59	5.89		27	5.96	5.96	
140000	19.75	5.98		28	6.05	6.05	
150000	19.85	5.89		29	5.96	5.96	
160000	20.01	5.7		30	5.78	5.78	
170000	20.22	5.56		31	5.64	5.64	
180000	20.3	5.48		32	5.56	5.56	
190000	20.3	5.15		33	5.23	5.23	
200000	20.34	5.28		34	5.37	5.37	
210000	20.27	5.33		35	5.42	5.42	
220000	20.11	5.38		36	5.47	5.47	
230000	19.89	5.55		37	5.64	5.64	
0	19.63	5.61	101395	38	5.71	5.71	5.91
10000	19.52	5.71		39	5.81	5.81	
20000	19.46	5.87		40	5.97	5.97	
30000	19.37	5.94		41	6.04	6.04	
40000	19.35	5.74		42	5.85	5.85	
50000	19.37	5.7		43	5.81	5.81	
60000	19.32	5.6		44	5.71	5.71	
70000	19.37	5.54		45	5.65	5.65	
80000	19.42	5.49		46	5.61	5.61	
90000	19.28	5.54		47	5.66	5.66	
100000	19.25	5.71		48	5.83	5.83	
110000	19.21	5.87		49	5.99	5.99	
120000	19.27	5.96		50	6.09	6.09	

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150000	19.91	1.94	101	.19	6.19
160000	19.92	5.72	102	5.98	5.98
170000	20.04	5.99	103	6.25	6.25
180000	19.85	5.62	104	5.88	5.88
190000	19.87	5.69	105	5.95	5.95
200000	19.89	5.9	106	6.17	6.17
210000	19.94	5.86	107	6.13	6.13
220000	19.92	5.8	108	6.07	6.07

230000	19.7	5.93	109	6.2	6.2
0	19.47	5.95	110	6.23	6.23
10000	19.2	5.96	111	6.24	6.24
20000	18.85	5.97	112	6.25	6.25
30000	18.66	6.01	113	6.29	6.29
40000	18.53	6.12	114	6.41	6.41
50000	18.41	6	115	6.29	6.29
60000	18.24	6.06	116	6.35	6.35
70000	18.17	5.85	117	6.14	6.14
80000	18.2	5.89	118	6.19	6.19
90000	18.25	5.94	119	6.24	6.24
100000	18.34	5.84	120	6.14	6.14
110000	18.31	6.1	121	6.4	6.4
120000	18.36	6.28	122	6.59	6.59
130000	18.29	6.4	123	6.71	6.71
140000	18.37	6.54	124	6.85	6.85
150000	18.43	6.63	125	6.94	6.94
160000	18.61	6.55	126	6.87	6.87
170000	18.63	6.44	127	6.76	6.76
180000	18.56	5.64	128	5.96	5.96
190000	18.39	6.13	129	6.45	6.45
200000	18.29	5.75	130	6.08	6.08
210000	18.2	6.25	131	6.58	6.58
220000	18.1	6.33	132	6.66	6.66
230000	18.13	6.41	133	6.74	6.74
0	18.05	6.44	134	6.78	6.78
10000	17.83	6.45	135	6.79	6.79
20000	17.56	6.55	136	6.89	6.89
30000	17.39	6.73	137	7.07	7.07
40000	17.2	6.94	138	7.29	7.29
50000	16.93	7	139	7.35	7.35
60000	16.64	6.83	140	7.18	7.18
70000	16.64	6.71	141	7.06	7.06
80000	16.56	6.66	142	7.02	7.02
90000	16.64	6.27	143	6.63	6.63
100000	16.81	6.87	144	7.23	7.23
110000	16.61	7.01	145	7.37	7.37
120000	16.59	7.17	146	7.54	7.54
130000	16.66	7.19	147	7.56	7.56
140000	16.71	7.26	148	7.63	7.63
150000	16.8	7.3	149	7.67	7.67
160000	16.76	7.35	150	7.73	7.73

170000	16.61	.44		151	.82	7.82
180000	16.53	7.08		152	1.46	7.46
190000	16.43	7.18		153	7.56	7.56
200000	16.38	6.62		154	7.01	7.01
210000	16.31	6.63		155	7.02	7.02
220000	16.32	7.08		156	7.47	7.47
230000	16.21	7.44		157	7.83	7.83
0	16.14	7.41	101895	158	7.81	7.81
10000	16.07	7.44		159	7.84	7.84
20000	15.97	7.43		160	7.83	7.83
30000	15.86	7.36		161	7.76	7.76
40000	15.77	7.35		162	7.76	7.76
50000	15.62	7.62		163	8.03	8.03
60000	15.49	7.67		164	8.08	8.08
						7.76

70000	15.32	7.25		165	7.66	7.66
80000	15.24	7.01		166	7.43	7.43
90000	15.3	7.09		167	7.51	7.51
100000	15.42	7.09		168	7.51	7.51
110000	15.89	7.13		169	7.55	7.55
120000	16.17	7.48		170	7.91	7.91
130000	15.77	7.48	7.91	171	7.91	7.91

101895 Total Mean Daily DO =

000816

PMK048.80, Pamunkey River at Carters Landing, 10/18 - 25/95

Time	Temp	Sonde DO, mg/l	Date/ QAQC DO	Number	Corr.DO Formula	Corr.DO Value	Mean Daily DO
130000	15.61	7.89	101895	1	7.89	7.89	8.12
140000	15.78	8.01	7.91	1	8.02	8.02	
150000	15.95	8.21		2	8.22	8.22	Day
160000	15.78	8.22		3	8.24	8.24	7.92.
170000	15.63	8.23		4	8.25	8.25	
180000	15.5	8.2		5	8.23	8.23	
190000	15.43	8.15		6	8.19	8.19	
200000	15.4	7.96		7	8	8	
210000	15.4	7.96		8	8.01	8.01	
220000	15.46	8.09		9	8.14	8.14	
230000	15.48	8.06		10	8.12	8.12	
0	15.45	8.01	101995	11	8.07	8.07	8.14
10000	15.38	8.09		12	8.16	8.16	
20000	15.24	8.11		13	8.19	8.19	
30000	15.06	8.1		14	8.18	8.18	
40000	14.93	8.08		15	8.17	8.17	
50000	14.81	8.02		16	8.11	8.11	
60000	14.71	8.01		17	8.11	8.11	
70000	14.61	7.96		18	8.07	8.07	
80000	14.51	7.92		19	8.03	8.03	
90000	14.49	7.87		20	7.99	7.99	
100000	14.69	7.93		21	8.05	8.05	
110000	14.88	7.87		22	8	8	
120000	15.01	7.88		23	8.01	8.01	
130000	14.93	7.88		24	8.02	8.02	
140000	15.03	7.95		25	8.1	8.1	
150000	15.23	7.98		26	8.13	8.13	
160000	15.36	8.04		27	8.2	8.2	
170000	15.38	8.13		28	8.29	8.29	
180000	15.16	8.15		29	8.32	8.32	
190000	15.04	8.14		30	8.32	8.32	
200000	15.03	8.05		31	8.23	8.23	
210000	15.03	8		32	8.19	8.19	
220000	15.06	7.98		33	8.17	8.17	
230000	15.18	7.96		34	8.16	8.16	
0	15.23	7.75	102095	35	7.96	7.96	8.07
10000	15.24	7.83		36	8.04	8.04	
20000	15.19	7.89		37	8.11	8.11	
30000	15.11	7.94		38	8.16	8.16	
40000	14.93	7.99		39	8.22	8.22	
50000	14.76	7.94		40	8.17	8.17	
60000	14.68	7.9		41	8.14	8.14	
70000	14.68	7.87		42	8.12	8.12	
80000	14.69	7.84		43	8.09	8.09	
90000	14.71	7.58		44	7.84	7.84	
100000	14.79	7.79		45	8.05	8.05	
110000	14.89	7.77		46	8.04	8.04	
120000	15.11	7.71		47	7.99	7.99	
130000	15.5	7.84		48	8.12	8.12	
140000	15.45	7.48		49	7.77	7.77	
150000	15.23	7.77		50	8.06	8.06	
160000	15.38	7.76		51	8.06	8.06	

00081

170000	15.4	.78	52	.08	8.08
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180000	15.63	7.81	53	8.12	8.12
190000	15.7	7.83	54	8.15	8.15
200000	15.55	7.83	55	8.15	8.15
210000	15.51	7.74	56	8.07	8.07
220000	15.63	7.85	57	8.18	8.18
230000	15.73	7.64	58	7.98	7.98
0	15.76	7.68	59	8.03	8.03
10000	15.75	7.49	60	7.84	7.84
20000	15.78	7.54	61	7.9	7.9
30000	15.9	7.69	62	8.05	8.05
40000	15.9	7.72	63	8.09	8.09
50000	15.81	7.53	64	7.9	7.9
60000	15.78	7.61	65	7.99	7.99
70000	15.63	7.57	66	7.96	7.96
80000	15.45	7.45	67	7.84	7.84
90000	15.33	7.32	68	7.72	7.72
100000	15.28	7.42	69	7.82	7.82
110000	15.35	7.2	70	7.61	7.61
120000	15.5	7.47	71	7.89	7.89
130000	15.8	7.27	72	7.69	7.69
140000	15.85	7.15	73	7.58	7.58
150000	15.78	6.8	74	7.23	7.23
160000	15.81	6.8	75	7.24	7.24
170000	15.93	7.38	76	7.83	7.83
180000	15.73	7.49	77	7.94	7.94
190000	15.6	7.4	78	7.86	7.86
200000	15.36	7.5	79	7.96	7.96
210000	15.31	7.48	80	7.95	7.95
220000	15.21	7.42	81	7.89	7.89
230000	15.19	7.4	82	7.88	7.88
0	15.18	7.34	83	7.83	7.83
10000	15.14	7.21	84	7.7	7.7
20000	15.14	7.22	85	7.72	7.72
30000	15.16	6.87	86	7.37	7.37
40000	15.13	7.24	87	7.75	7.75
50000	14.96	7.34	88	7.86	7.86
60000	14.83	7.32	89	7.84	7.84
70000	14.53	7.25	90	7.78	7.78
80000	14.28	7.22	91	7.75	7.75
90000	14.24	7.22	92	7.76	7.76
100000	14.28	7.2	93	7.74	7.74
110000	14.39	7.14	94	7.69	7.69
120000	14.46	7.11	95	7.67	7.67
130000	14.73	6.77	96	7.33	7.33
140000	14.91	7.03	97	7.6	7.6
150000	14.74	6.84	98	7.41	7.41
160000	15.08	7.13	99	7.71	7.71
170000	14.83	7.09	100	7.68	7.68
180000	14.96	7.35	101	7.94	7.94

102195

102295

000818

190000	14.89	7.42		102	8.02	8.02
200000	15.04	7.43		103	8.03	8.03
210000	15.06	7.43		104	8.04	8.04
220000	14.93	7.49		105	8.11	8.11
230000	14.81	7.56		106	8.18	8.18
0	14.71	7.53	102395	107	8.16	8.16
10000	14.58	7.69		108	8.32	8.32

20000	14.38	7.96		109	8.6	8.6
30000	14.21	8.08		110	8.72	8.72
40000	14.24	8.09		111	8.74	8.74
50000	14.23	7.89		112	8.55	8.55
60000	14.43	7.62		113	8.28	8.28
70000	14.79	7.4		114	8.07	8.07
80000	15.4	7.14		115	7.81	7.81
90000	15.86	7.06		116	7.74	7.74
100000	16.23	7.09		117	7.78	7.78
110000	16.52	7.12		118	7.81	7.81
120000	16.79	7.12		119	7.82	7.82
130000	16.95	7.17		120	7.87	7.87
140000	17.05	7.18		121	7.89	7.89
150000	17.1	7.21		122	7.92	7.92
160000	17.08	7.24		123	7.96	7.96
170000	17.08	7.3		124	8.03	8.03
180000	17.09	7.11		125	7.84	7.84
190000	17.1	7.12		126	7.86	7.86
200000	17.11	7.18		127	7.92	7.92
210000	17.06	7.08		128	7.83	7.83
220000	17.01	7.06		129	7.82	7.82
230000	16.98	7.15		130	7.91	7.91
0	16.98	7.14	102495	131	7.91	7.91
10000	16.99	7.1		132	7.87	7.87
20000	16.94	7.15		133	7.93	7.93
30000	16.84	7.12		134	7.9	7.9
40000	16.7	7.12		135	7.91	7.91
50000	16.49	7.39		136	8.19	8.19
60000	16.25	7.43		137	8.23	8.23
70000	16.03	7.41		138	8.22	8.22
80000	15.83	7.47		139	8.28	8.28
90000	15.61	7.47		140	8.29	8.29
100000	15.41	7.45		141	8.28	8.28
110000	15.28	7.45		142	8.28	8.28
120000	15.24	7.61		143	8.45	8.45
130000	15.33	7.64		144	8.48	8.48
140000	15.38	7.68		145	8.53	8.53
150000	15.36	7.66		146	8.52	8.52
160000	15.3	7.72		147	8.58	8.58
170000	15.16	7.8		148	8.67	8.67
180000	15.04	7.81		149	8.68	8.68
190000	14.98	7.79		150	8.67	8.67
200000	14.96	7.66		151	8.54	8.54

000819

210000	14.88	7.64		152	8.53	8.53	
220000	14.91	7.58		153	8.48	8.48	
230000	14.91	7.49		154	8.39	8.39	
0	14.91	7.5	102595	155	8.41	8.41	8.12
10000	14.84	7.45		156	8.36	8.36	
20000	14.76	7.53		157	8.45	8.45	
30000	14.74	7.55		158	8.48	8.48	
40000	14.74	7.55		159	8.48	8.48	
50000	14.74	7.53		160	8.47	8.47	
60000	14.74	7.46		161	8.4	8.4	
70000	14.73	7.37		162	8.32	8.32	
80000	14.69	7.32		163	8.27	8.27	
90000	14.68	7.13		164	8.09	8.09	

100000	14.73	6.9		165	7.87	7.87	
110000	14.83	6.67		166	7.64	7.64	
120000	14.88	6.73		167	7.71	7.71	
130000	14.93	6.49		168	7.47	7.47	
140000	14.98	6.39	7.38	169	7.38	7.38	

102595 Total Mean Daily DO =

000820

PMK048.80, Pamunkey River at Carters Landing, 10/25 - 11/1/95

Time	Temp	Sonde DO, mg/l	Date/ QAQC DO	Number	Corr.DO Formula	Corr.DO Value	Mean Daily DO
150000	15.15	7.43	7.42	1	7.43	7.43	7.37
160000	15.22	7.46	102595	2	7.46	7.46	7.52
170000	15.24	7.44		3	7.45	7.45	Day
180000	15.19	7.43		4	7.44	7.44	
190000	15.14	7.45		5	7.46	7.46	
200000	15.05	7.35		6	7.36	7.36	
210000	15	7.25		7	7.26	7.26	
220000	14.97	7.25		8	7.26	7.26	
230000	14.95	7.21		9	7.23	7.23	
0	14.94	7.12	102695	10	7.14	7.14	7.32
10000	14.87	7.17		11	7.19	7.19	
20000	14.8	7.02		12	7.04	7.04	
30000	14.72	7.03		13	7.05	7.05	
40000	14.74	6.85		14	6.87	6.87	
50000	14.72	7		15	7.03	7.03	
60000	14.65	7.08		16	7.11	7.11	
70000	14.6	7.25		17	7.28	7.28	
80000	14.48	7.57		18	7.6	7.6	
90000	14.44	7.55		19	7.58	7.58	
100000	14.36	7.49		20	7.52	7.52	
110000	14.41	7.39		21	7.43	7.43	
120000	14.57	7.53		22	7.57	7.57	
130000	14.84	7.42		23	7.46	7.46	
140000	14.9	7.35		24	7.39	7.39	
150000	14.95	7.37		25	7.41	7.41	
160000	14.89	7.19		26	7.24	7.24	
170000	14.89	7.22		27	7.27	7.27	
180000	14.87	7.09		28	7.14	7.14	
190000	14.84	7.18		29	7.23	7.23	
200000	14.75	7.3		30	7.35	7.35	
210000	14.79	7.46		31	7.51	7.51	
220000	14.79	7.61		32	7.67	7.67	
230000	14.67	7.56		33	7.62	7.62	
0	14.57	7.39	102795	34	7.45	7.45	7.51
10000	14.52	7.45		35	7.51	7.51	
20000	14.44	7.39		36	7.45	7.45	
30000	14.44	7.34		37	7.4	7.4	
40000	14.39	7.34		38	7.41	7.41	
50000	14.41	7.17		39	7.24	7.24	
60000	14.37	7.17		40	7.24	7.24	
70000	14.37	7.12		41	7.19	7.19	
80000	14.31	7.3		42	7.37	7.37	
90000	14.29	7.5		43	7.57	7.57	
100000	14.29	7.69		44	7.77	7.77	
110000	14.29	7.64		45	7.72	7.72	
120000	14.41	7.5		46	7.58	7.58	
130000	14.52	7.62		47	7.7	7.7	
140000	14.7	7.61		48	7.69	7.69	
150000	14.79	7.53		49	7.62	7.62	
160000	14.74	7.42		50	7.51	7.51	
170000	14.82	7.42		51	7.51	7.51	

000821

180000	14.87	7.3		52	.39	7.39	
190000	14.85	7.42		53	7.51	7.51	
200000	14.92	7.44		54	7.53	7.53	
210000	15	7.66		55	7.76	7.76	
220000	14.89	7.37		56	7.47	7.47	
230000	14.99	7.57		57	7.67	7.67	
0	15.14	7.48	102895	58	7.58	7.58	7.53
10000	15.22	7.43		59	7.53	7.53	
20000	15.25	7.37		60	7.47	7.47	
30000	15.29	7.37		61	7.48	7.48	
40000	15.27	7.35		62	7.46	7.46	
50000	15.27	7.2		63	7.31	7.31	
60000	15.25	7.24		64	7.35	7.35	
70000	15.25	7.21		65	7.32	7.32	
80000	15.25	7.27		66	7.38	7.38	
90000	15.27	7.31		67	7.43	7.43	
100000	15.3	7.3		68	7.42	7.42	
110000	15.25	7.67		69	7.79	7.79	
120000	15.37	7.51		70	7.63	7.63	
130000	15.57	7.34		71	7.46	7.46	
140000	15.67	7.42		72	7.55	7.55	
150000	15.55	7.58		73	7.71	7.71	
160000	15.59	7.49		74	7.62	7.62	
170000	15.64	7.44		75	7.57	7.57	
180000	15.64	7.25		76	7.38	7.38	
190000	15.59	7.22		77	7.35	7.35	
200000	15.55	7.29		78	7.43	7.43	
210000	15.5	7.42		79	7.56	7.56	
220000	15.29	7.73		80	7.87	7.87	
230000	15.22	7.81		81	7.95	7.95	
0	15.25	7.73	102995	82	7.87	7.87	7.96
10000	15.2	7.6		83	7.74	7.74	
20000	15.14	7.58		84	7.73	7.73	
30000	15.05	7.67		85	7.82	7.82	
40000	14.99	7.81		86	7.96	7.96	
50000	14.94	7.78		87	7.93	7.93	
60000	14.9	7.77		88	7.92	7.92	
70000	14.9	7.96		89	8.11	8.11	
80000	14.92	8.03		90	8.19	8.19	
90000	14.94	8.11		91	8.27	8.27	
100000	14.95	8.16		92	8.32	8.32	
110000	15	8.03		93	8.19	8.19	
120000	15.1	7.85		94	8.01	8.01	
130000	15.25	7.8		95	7.97	7.97	
140000	15.54	7.71		96	7.88	7.88	
150000	15.7	7.68		97	7.85	7.85	
160000	15.77	7.75		98	7.92	7.92	
170000	15.86	7.66		99	7.83	7.83	
180000	15.87	7.7		100	7.87	7.87	
190000	15.91	7.72		101	7.9	7.9	

000822

200000	15.99	7.75		102	7.93	7.93
210000	16.21	7.84		103	8.02	8.02
220000	16.46	7.83		104	8.01	8.01
230000	16.8	7.73		105	7.91	7.91
0	16.91	7.77	103095	106	7.95	7.95
10000	16.95	7.69		107	7.88	7.88
20000	16.88	7.67		108	7.86	7.86

30000	16.83	7.63		109	7.82	7.82
40000	16.71	7.68		110	7.87	7.87
50000	16.71	7.74		111	7.93	7.93
60000	16.68	7.8		112	7.99	7.99
70000	16.61	7.79		113	7.99	7.99
80000	16.48	7.83		114	8.03	8.03
90000	16.39	7.84		115	8.04	8.04
100000	16.27	7.91		116	8.11	8.11
110000	16.21	7.94		117	8.14	8.14
120000	16.12	7.95		118	8.16	8.16
130000	16.06	7.97		119	8.18	8.18
140000	16.02	7.97		120	8.18	8.18
150000	15.92	7.98		121	8.19	8.19
160000	15.84	8.02		122	8.23	8.23
170000	15.74	8.04		123	8.25	8.25
180000	15.64	8.01		124	8.23	8.23
190000	15.54	8.01		125	8.23	8.23
200000	15.47	7.96		126	8.18	8.18
210000	15.37	7.96		127	8.18	8.18
220000	15.25	8		128	8.22	8.22
230000	15.09	8.05		129	8.27	8.27
0	14.95	8.03	103195	130	8.26	8.26
10000	14.85	8.02		131	8.25	8.25
20000	14.74	8.02		132	8.25	8.25
30000	14.67	8.01		133	8.24	8.24
40000	14.6	8.04		134	8.27	8.27
50000	14.57	8.14		135	8.37	8.37
60000	14.56	8.1		136	8.34	8.34
70000	14.52	8.13		137	8.37	8.37
80000	14.51	8.09	8.33	138	8.33	8.33
90000	14.51	8		139	8.24	8.24
100000	14.52	8.13		140	8.37	8.37
110000	14.52	8.15		141	8.4	8.4
120000	14.51	8.24		142	8.49	8.49
130000	14.52	8.2		143	8.45	8.45
140000	14.57	8.19		144	8.44	8.44
150000	14.59	8.16		145	8.41	8.41
160000	14.59	8.2		146	8.45	8.45
170000	14.59	8.31		147	8.57	8.57
180000	14.57	8.22		148	8.48	8.48
190000	14.56	8.2		149	8.46	8.46
200000	14.56	8.13		150	8.39	8.39
210000	14.54	7.91		151	8.17	8.17

000823

220000	14.54	1.05		152	8.31	8.31
230000	14.52	8.16		153	8.43	8.43
0	14.49	8.21	110195	154	8.48	8.48
10000	14.44	8.29		155	8.56	8.56
20000	14.41	8.27		156	8.54	8.54
30000	14.36	8.18		157	8.45	8.45
40000	14.29	8.14		158	8.41	8.41
50000	14.22	8.24		159	8.52	8.52
60000	14.17	8.23		160	8.51	8.51
70000	14.16	8.11		161	8.39	8.39
80000	14.16	7.94		162	8.22	8.22
90000	14.17	7.76		163	8.04	8.04
100000	14.19	7.8		164	8.09	8.09

110000	14.24	7.31		165	7.6	7.6
120000	14.22	7.89		166	8.18	8.18
130000	14.24	8.08		167	8.37	8.37
140000	14.19	8.31		168	8.6	8.6
150000	14.22	8.26		169	8.55	8.55
160000	14.26	8.19		170	8.49	8.49
170000	14.24	8.13		171	8.43	8.43

000824

SUBJECT: Advisory Notification of Effluent Limits for Swamp and Marsh Waters

TO: L. G. Lawson

FROM: A. J. Anthony *AJA*

DATE: March 9, 1987

COPIES: M. A. Bellanca, W. L. Woodfin, M. D. Phillips, J. W. Gregory, Regional Directors, file

In the event that a proposal is received for discharge to a swamp or marsh that cannot be modeled and the current standards are being violated for whatever reason, OERS recommends the following effluent limits:

CBOD ₅ =	10 mg/l
TSS =	10 mg/l
TKN =	3 mg/l
D.O. =	3 mg/l
Cl ₂ =	0.011 mg/l

Our rationale for these recommendations are as follow:

We have found over the past years, through application of modeling technology to small streams, that the above limits are representative of effluents that are "self-sustaining"; that is: such an effluent will not normally violate the stream standard even if the stream consists of 100% effluent.

Given the fact that the areas of intended application of our recommendations are such that the stream will not possess good mixing processes and may in fact contain 100% effluent for significant distances and times render it necessary, in our opinion, that discharges be essentially of "self-sustaining" quality.

2. CBOD₅ -- We are recommending nitrification and consequently CBOD₅ is what will be measured. In addition, we believe that where both unoxidized nitrogen and hydrocarbons are limited due to considerations of stream dissolved oxygen, it is correct and reasonable to specify them separately to avoid double counting their impacts.

263.10

Date 3/89

0. 398

SECTION 111-D7 Page 2

1. There are no models available with which to evaluate various alternatives.
 2. The recommended limits are based on professional opinion and are therefore not subject to negotiation.
 3. The recommended limits are very stringent and essentially leave no room for trade-offs among the parameters.
- It must be pointed out that the above limits are based on the professional opinion of OMS. They are not the result of the application of any predictive technology. The negotiations and trade-offs normally associated with the application of modeling to identify limits are simply not practical in this case for the following reasons:

1. Provide consistency with the intent and requirements of the law.
 2. Ensure that the limits will not result in additional degradation to the receiving stream.
 3. Protect the beneficial uses of and the aquatic life to be expected in swampy and/or marshy streams.
- It is our belief that the above limits will be adequate to:

1. -- Mixing can be expected to be extremely poor or non-existent and the stream can be expected to contain 100% effluent for significant distances and times. In order to ensure that the effluent standard is not violated, the discharge must meet the standard.
2. -- We are recommending that the dissolved oxygen in the effluent be reasonably consistent with that expected to occur in the receiving stream.
3. -- We are recommending that unoxidized nitrogen be removed in the treatment plant. The recommended limit on the recognized effluent usually contains 2-3 mg/l nitrogen. That is satisfactory and cannot be removed by biological treatment. For industrial discharges this may vary and may be verified by testing. The intent of our recommendation is to remove all biologically oxidizable nitrogen compounds from the effluent.
4. -- We are recommending that the limits be consistent with the BOD limit. This is consistent with past and current practice and should not be difficult to attain.

SECTION 111

As is the case with all guidance provided by OERS, the Regions should obtain concurrence from OERS prior to drafting a permit with the above limits. In addition, if the proposed discharger disagrees with the limits established, then it is our opinion that ample precedent has been established to allow the dischargers to model the system or provide other documentation that the limits as established are not correct subject to the review and approval of the Board.

Please note that toxic requirements are not covered in this memo, and should follow the normal routine for toxics-related issues.

:swamp

MEMORANDUM

VIRGINIA WATER CONTROL BOARD
Piedmont Regional Office

4200 Cox Road Glen Allen, VA 23060 804/527-5020

SUBJECT: New Kent STP Effluent Limits

TO: File

FROM: Curt Linderman

DATE: April 13, 1992

COPIES: G. Seeley, J.R. Bell, G. Mustafa

A meeting was conducted April 3, 1992 with Gerry Seeley, Dave Paylor, J.R. Bell, Allan Breckenbrough, Diane Osborne and myself to discuss a policy decision regarding application of Section 1.5.C.6 of the Permit Regulation to the New Kent County STP VPDES permit application. Under the Regulation, permits may not be issued that cause or contribute to water quality standard violations.

New Kent County has recently submitted a revised permit application, reducing their design flow to 0.25 MGD and relocating the proposed outfall to a point coincident with the existing Cumberland Hospital outfall. Under these conditions, water quality modeling indicates that a maximum averaged cross sectional DO sag of less than 0.2 mg/l would be expected under at a CBOD_5 concentration of 30 mg/l. Modeling analysis also indicates that DO impacts along the same cross section would be virtually eliminated at a CBOD_5 of 10 mg/l.

New Kent County has indicated that upon completion of the STP, Cumberland Hospital would be hooked up to the County system allowing for closure of the Hospital outfall.

At the April 3, 1992 meeting, a decision was made to allow a VPDES permit to be issued, with policy dictating effluent limits that would assure virtual elimination of impacts to water quality. This would be addressed by (a) the reduced design flow of 0.25 MGD, (b) relocation of the outfall downstream (e.g. the Cumberland Hospital site), and (c) assignment of restrictive "self sustaining" effluent limits. As a result, the following effluent limits are recommended:

Design Flow	= 0.250 MGD
5-Day Carbonaceous Biological Oxygen Demand (CBOD_5)	= 10.0 mg/l
Total Suspended Solids (TSS)	= 10.0 mg/l
Total Kjeldahl Nitrogen (TKN)	= 3.0 mg/l
Dissolved Oxygen (DO)	= 5.0 mg/l
Total Residual Chlorine (TRC)	= Non-detect
Total Phosphorus (TP)	= 2.0 mg/l

0. 700

Page 2
SUBJECT: New Kent STP Effluent Limits

The recommended effluent limits are based on professional judgement and incorporate HQ's "self sustaining" waters guidance for CBOD₅, TSS, and TKN. DC is set at the water quality standard; TBC reflects no net addition to the resource; and TP proactively incorporates general nutrient enriched control measures. It was a general consensus that the above limits would not result in additional degradation of the Pamunkey River.

Assessment of effluent limits for metals and other toxic parameters, where appropriate, are deferred to the Regulatory Services staff.

\\wqmodels\newkent.wp\CJL

0. 701

MEMORANDUM

DEPARTMENT OF ENVIRONMENTAL QUALITY

Pediment Regional Office

400 Ch. 1st, Dallas, TX 75201

84/72-500

Subject: Pediment Landfill STP Proposed Discharge
To: Diane O'Brien
From: *SE* Lindemann, J. van Soestbergen *DL*
Date: May 27, 1994
Copies: G. Sooley, J.R. Bell, D. Phillips

Based on a review of available water quality data for the Pediment River in the vicinity of the proposed Pediment Landfill STP, results of modeling performed by VIMS on behalf of the permit applicant, and a review of current Water Quality Standards and Permit Regulations, we recommend the following effluent limitations for the subject discharge at a flow of 0.560 mgd:

CBOD₅ = 10 mg/L
TSS = 10 mg/L
TKN = 3 mg/L
DO = 5 mg/L
TP = 2 mg/L

This section of the Pediment River is designated water quality limited in the current York River Basin Water Quality Management Plan (WQAMP). A review of available ambient water quality monitoring data for the Pediment River near the proposed discharge indicates that the river is subject to DO standard violations. These violations are considered to be primarily the result of the effects of extensive marshes adjacent to the Pediment River on water quality in the river. Marsh waters are generally assigned effluent limits based on A. J. Anthony's March 9, 1987 memorandum "Advisory Notification of Effluent Limits for Swamp and Marsh Waters".

The intent of assigning effluent limits based on A. J. Anthony's memorandum is to establish effluent limits which are "self-sustaining". The applicant performed modeling to determine if less stringent limits could be achieved that would not further contribute to the water quality standards violation. The modeling results submitted by the applicant did not show a virtual elimination of DO impacts or relaxed limits. Therefore, self-sustaining effluent limits for CBOD₅, TSS, and TKN are recommended based on the limits established in A. J. Anthony's March 9, 1987 memorandum. The recommended DO limit was set equal to the water quality standard.

Because the Pediment River is designated a Nutrient Enriched Water under the Water Quality Standards, (VR680-21-07.3, May 20, 1992), and the proposed discharge flow exceeds 0.05 mgd, the proposed discharge will be required to meet a monthly average total phosphorus effluent limitation of 2 mg/L under the Policy for Nutrient Enriched Waters, (VR690-14-02, May 25, 1988). If you have any questions or need additional information, please don't hesitate to ask.

Vrs
ASSESS:perind2.mmm

000702

MEMORANDUM

DEPARTMENT OF ENVIRONMENTAL QUALITY
Piedmont Regional Office

4343-A Oak Road, Glen Allen, VA 23060-0306

804/537-5820

SUBJECT: Results of Stream Sanitation Analysis and Effluent Discharge Recommendations
King William County Sewage Treatment Plant Discharge (VA0088102)
Discharge to Moncuin Creek (8-1840003.88)

TO: Curt Linderman

FROM: Jon van Soestbergen

DATE: March 28, 1987

COPIES: Debra Barnes, Modeling File

A stream sanitation analysis for the King William County Sewage Treatment Plant (STP) discharge to Moncuin Creek in King William County was received. The discharge is currently permitted (VA0088102), but the stream sanitation analysis was submitted because of a modification in discharge location. Moncuin Creek is a tributary of the Pamunkey River in watershed VAP-F13R. The discharge is at river mile 3.88. The latitude and longitude of the discharge are 374224 and 0770840, respectively. The location of the proposed discharge, as well as the currently permitted discharge location, is shown on the attached map.

A flow frequency analysis dated February 21, 1987 performed by Paul Herman for the discharge was received subsequent to the stream sanitation analysis request. The flow frequency analysis reported the 7Q10 flow of Moncuin Creek at the discharge point to be 0.0 cfs. However, the analysis assumes there are no significant discharges, withdrawals or springs influencing the flow in the creek upstream of the discharge point. Boehrs Millpond is an impoundment on an unnamed tributary just upstream of the discharge point. In its application, the permittee indicated that flow from the impoundment is maintained daily, even during dry periods, through three 2-inch siphons. The application estimated continuous flow to be 150 gpm (0.216 mgd).

The proposed discharge is not addressed in the current (02/12/82) York River Basin Water Quality Management Plan (WR 680-16-06) (WQMP). The receiving stream is in Stream Segment 9-7 of the WQMP, and is classified EL (effluent limited) per the WQMP. A stream sanitation analysis for the currently permitted discharge was performed and documented by DEQ-PRO in a July 9, 1983 memorandum. The 1983 stream sanitation analysis is not applicable because the discharge is to a different location upstream of the currently proposed discharge site.

DEQ-PRO maintains an ambient water quality monitoring (AWQM) station on Moncuin Creek at the Route 618 bridge (8-MN0004.39), approximately 1/2 mile upstream of the proposed discharge point. Monitoring at the AWQM station was initiated in June 1986. Monitoring is performed once every three months. A total of three monitoring data sets were available at the time of this stream sanitation analysis. The data set for each parameter is considered too small to be statistically significant. However, two violations of the fecal coliform standard were recorded in the three samples analyzed, indicating a potential in-stream pathogen problem.

The DEQ-PRO staff, as well as the DEQ-PRO staff, as well as the permittee's consultant, Dewberry & Davis. Stream flow at the time of the site visit was high. A marshy area was observed adjacent to the creek, but the creek itself was considered free flowing at the discharge point itself. A marshy area 1.6 miles downstream of the

Stream Sanitation Analysis - Monouin Creek
Page 2

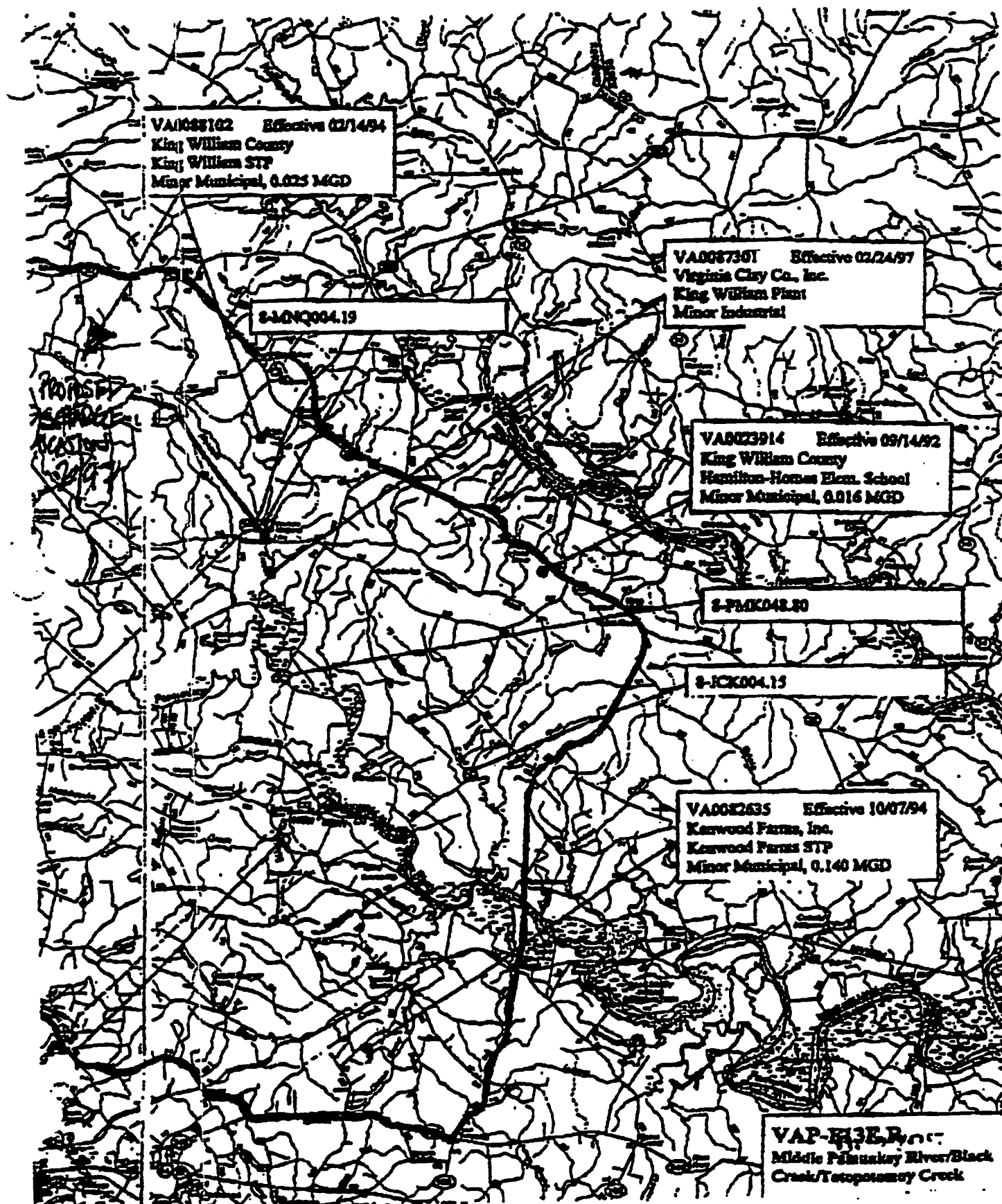
discharge point was identified from the USGS topographic survey map. Any water quality model prepared for this discharge should include the downstream marsh as a boundary conditions, at which DEQ adopted swamp effluent limits would apply. Because of the proximity of the AWQM station to the proposed discharge site, no water quality measurements were taken during the site inspection.

At the time of the site inspection, there was no evidence of the siphons at Boshers Millpond dam, as claimed in the application. Therefore, it was assumed that Paul Herman's flow frequency analysis is correct, and the background 7Q10 flow in Monouin Creek is zero. Under these conditions, the receiving stream is considered a dry ditch, and the regional model (V3.2) is not considered applicable. For proposed discharges to dry ditches, current DEQ practice is to recommend effluent limits at least as stringent as DEQ adopted swamp limits to maintain dissolved oxygen concentrations above the water quality standard in the receiving stream. As such, the following discharge limits are recommended for the subject discharge:

Flow	0.025 mgd
CBOD ₅	10.0 mg/l
TKN	3.0 mg/l
DO	5.0 mg/l

If the applicant can, to DEQ's satisfaction, provide information substantiating the claim of continuous flow through the dam at Boshers Millpond, the stream sanitation analysis can be revised to reflect the more current background flow information.

I trust this information is sufficient for your needs at this time. If you have any questions, please do not hesitate to contact me.





COMMONWEALTH of VIRGINIA
DEPARTMENT OF ENVIRONMENTAL QUALITY

James S. Gilmore, III
Governor

John Paul Woodley, Jr.
Secretary of Natural Resources

PIEDMONT REGIONAL OFFICE

4949-A Cox Road
Glen Allen, Virginia 23060
(804) 527-5020
Fax (804) 527-5106
<http://www.deq.state.va.us>

Dennis H. Treacy
Director

Gerard Seeley, Jr.
— Piedmont Regional Director

March 3, 1999

MEMORANDUM

TO: Members of the State Water Control Board

FROM: Gerry Seeley - Piedmont Regional Office Director *GS*

SUBJECT: Totopotomoy Sewage Treatment Plant - VPDES Permit

COPIES: Cindy Berndt

Attached is a compilation of public comments and a summary of issues regarding the proposed issuance of a VPDES permit for the Totopotomoy Sewage Treatment Plant in Hanover County. Also included are letters that some of the commentators asked us to mail to you directly.

There are some complex issues involved, so we wanted to give you an opportunity to review the materials before the Board Meeting. At the meeting our staff will be presenting a brief summary of these issues and our responses. We can answer any questions you have at that time.

Based upon our evaluation of the input received, we are considering some possible changes to the permit. These are described in the attached summary of issues. We have been discussing these possible changes with the County and hope to gain their acceptance before the meeting. We will make you aware of the County's position on these changes before we recommend them to you.

Please feel free to call me at 804-527-5053 if you have any questions.

001344

**Summary of Hearing Comments
Totopotomoy WWTP - January 19, 1999**

The following is a summary of comments received during the January 19, 1999 public hearing at Hanover Courthouse on the proposed issuance of VPDES Permit No. VA0089915 to the County of Hanover for the Totopotomoy WWTP. Opening remarks by the hearing officer, Thomas Van Auken, and the staff presentation by Allan Brockenbrough are included in the hearing record. The comments from the public were as follows:

John Hodges, Deputy County Administrator, Hanover County

Mr. Hodges explained that Hanover County needs additional sewerage capacity by 2003 to accommodate growth included in their land use plan. The County evaluated many options over the years and concluded that construction of the Totopotomoy WWTP was the best alternative. The Pamunkey River was identified as the best receiving stream in many studies over the years. A Conditional Use Permit for the WWTP and outfall was approved in August '97. The County looked at an alternative discharge location approximately 4000 ft. downstream at the request of one family member. Although the downstream alternative was a good location from a water quality perspective, it impacted additional property owners, cost more and didn't have land use approval. The County went back to the original discharge location after the landowner chose not to sell an easement at the downstream location. The County believes that the discharge location minimizes impacts on the river due to strong tidal mixing, provides for less of an impact on neighboring properties, is protective of historic resources (the outfall is separated from the New Castle archeological site by an abandoned rail line), minimizes wetlands impacts and does not impact any endangered species (survey performed). Mr. Hodges indicated that the DEQ permit limits were appropriate and requested that the permit be issued.

Henry Broadbus, owner of Newcastle Farm

Mr. Broadbus stated that the record shows the owners have never considered any outfall location on the Newcastle Farm. The County continued to go on the property after permission was revoked. He is frustrated by the progress of the proposal despite heavy opposition. He stated that Newcastle and the Pamunkey River are in pristine condition due to the diligent stewardship by he and his forbearers from his 6th great-grandfather the great agricultural scientist Edmund Ruffin, up to his father Woodford Meade Broadbus who refused to use any harmful chemicals on the land. With the WWTP discharge, Mr. Broadbus is unable to enforce his father's standards on the property. Impacts of rare mussels, aquatic life and water quality have not been adequately studied. He is powerless to do so but DEQ can require further study and a thorough evaluation. We should not rely on the hypothetical models which are before us.

001345

Charles D. McGhee

Mr. McGhee farms the New Castle Farm property. He uses best management practices and has developed a Chesapeake Bay Plan and a nutrient management plan to minimize agricultural impacts. The outfall will run through a resource protection area. Irrigation water is pumped from the river 1/4 mile from the proposed outfall and

Dale Taylor

Ms. Taylor stated that she has begged the County to be thorough and move slowly on such issues but they seem to push things through on a fast track. Wanted to know how long it will take DEQ to react and how many WWTP's DEQ has shut down. The government, DEQ and Hanover County will not hurt their own interests. The County is heading in a bad direction.

J. J. Markow

Mr. Markow stated that Mr. Hodges job is to be a spin doctor. He has been on the Hanover County Board of Supervisors and knows that Henrico approached Hanover about providing additional capacity. Localities should cooperate on large infrastructure projects such as this. DEQ should not reward Hanover with a permit due to the County's mishandling of the landfill. Groundwater testing was not done and DEQ did not enforce the permit conditions. Capacity is available at Richmond WWTP. He stated that Hanover County and the state are governed by Republicans but hoped that the DEQ staff would do the right thing and not decide the issued based on politics.

Erika Shriner

Ms. Shriner indicated that water quality was Governor Gilmore's #1 priority and that DEQ should look critically at the proposal. Hanover has a history of problems and the landfill and has not been operated in accordance with their permit. Ms. Shriner apologized to the Broadus family on behalf of the citizens for the way that they have been treated by the County.

William Ellis, McSweeney, Burtch & Crump

Mr. Ellis is an attorney representing Frances Crutchfield, part owner of Newcastle Farm. He will file written comments (see Exhibit No. to the hearing record). Mr. Ellis made 3 major points: 1.) The County hasn't provided sufficient information to make a decision on the permit. Specifically, there is a probability of rare or endangered mussels in the Pamunkey River and adequate work hasn't been done to determine whether they are present or whether the water quality standards are protective of mussels which need very clean water, 2.) the County hasn't applied for a USCOE permit for the outfall structure and the site may not be permitted by USCOE due to the historic significance of Newcastle Farm which is registered as a national and state historical property, and 3.) the County has been manipulative in relocating the proposed outfall to the location which has the most impact on Newcastle Farm. Even though the County studied and agreed that a downstream location was superior, they relocated the outfall after the owners indicated that no location was acceptable. Mr. Ellis stated that he had filed suit against responsible County officials that day in Federal court and hoped that the SWCB would not allow themselves to be used in an effort to intimidate and punish the owners of Newcastle Farm.

001346

Darrell Hicks

Mr. Hicks stated that he is a resident of Sunshine House in Ashland and be related his experiences with being exposed to Dioxin and Kepone in Agent Orange as a soldier in Vietnam. Mr. Hicks thanked Supervisor Tim Ernst and Senator Bill Bolling for their help over the years.

Summary of Issues and Staff Response

1. Impact on Dissolved Oxygen Levels in the Pamunkey River

Discussion:

In 1995, DEQ personnel performed a special study on the Pamunkey River to document the extent of low dissolved oxygen levels which were known to occur on some frequency. Concurrently, Hanover County personnel also performed low and high water slack tide DO surveys from the Rt. 360 bridge in Hanover County downstream for 23 miles to the Whitehouse railroad bridge.

The Pamunkey river in this region is a deep channeled estuary with strong tidal action. The river is bordered by thousands of acres of tidal marsh. The results of these two studies showed that there were persistent summertime low dissolved oxygen occurrences in the river which seemed to most commonly occur below two large swampy tributaries. The upper sag occurs just below where Moncuin Creek enters the river after traveling through an approximately 700 acre wetland area known as The Island. This sag is approximately 6 miles downstream of the proposed discharge point. The second DO sag appears approximately 20 miles below the discharge point below where Black Creek enters the river and adjacent to several thousand acres of swamp/marsh land.

There have been a couple of possible explanations for the low DO levels in the Pamunkey estuary. The first is that upstream nonpoint source BOD loads settle out in the slower moving estuarine portion of the river and are exerted as sediment oxygen demand. The second and more likely explanation is that the swampy tributaries and thousands of acres of tidal marsh continually deliver a naturally occurring dissolved oxygen demand on the river with every tidal cycle. This second explanation is supported by the location of the two seemingly persistent DO sags in the vicinity of the two largest swamp-like tributaries and tidal marshes. This same phenomenon occurs on almost any coastal stream dominated by a large system of tidal marshes. DEQ staff believe that the extensive marshes are the cause of the low DO conditions in the river and have included the tidal Pamunkey River on Part V of the 303(d) List which includes waters which violate standards due to naturally occurring conditions.

Since 1987, the SWCB (now DEQ) staff have used effluent limitations of 10 mg/l CBOD₅, 10 mg/l TSS, and 3 mg/l TKN for discharges that do not meet water quality standards due to swamp and marsh-like conditions. These so-called "10-10-3" limitations establish a level of treatment which in the best professional judgement of the Board's staff will not further contribute to lower dissolved oxygen levels in the receiving stream, regardless of the size of the discharge. This same standard was used to establish effluent limitations for 3 other discharges to this section of the Pamunkey River over the past years (King William STP on Monquin Creek, and Cumberland WWTP and Parham Landing WWTP on the Pamunkey River).

2. Toxicity Impacts

Discussion:

There has been much discussion on the impact of the discharge on anadromous fish as well as various species of mussels in the river. The Water Quality Standards adopted by the Board are established at levels which are expected to protect all species, including anadromous fish fry and mussels. The Standards require that the staff use mixing zone concepts in establishing effluent limitations. In this case, the use of a multi-port diffuser ensures rapid mixing of the effluent and a relatively small mixing zone. The tidal action in the area also provides additional mixing which has conservatively been ignored in establishing instream waste concentrations for the effluent.

Unfortunately, it is impossible to accurately characterize the level of any toxic parameters in the discharge until after it is constructed and sampling can be performed. However, advanced wastewater treatment facilities meeting the "10-10-3" limitations outlined above do not typically show any toxic impact at the instream waste concentrations initially expected for this facility. One alternative for addressing toxicity concerns up front is to include a Whole Effluent Toxicity (WET) limit in the permit. WET limits are not typically included in VPDES permits until after the discharger has shown a reasonable potential to cause toxicity in the stream. In this case, we do not believe that the potential exists in the initial years of this project. Whole Effluent Toxicity monitoring is required in the permit. As a potential alternative, the applicant has proposed an instream benthic macroinvertebrate study to assess the impact of the discharge. The staff concurs with the applicant's proposal and recommends inclusion of the condition in the permit.

Recommendations under Consideration:

- Include the following condition in the VPDES permit:

An annual qualitative benthic macroinvertebrate study shall be performed on the Pamunkey River to assess impacts of the Totopotomoy WWTP discharge. The study shall be conducted between August 15th and October 15th beginning in 2002. Study design shall be approved by DEQ Water Division staff prior to initiation of testing.

011348

3. Endangered mussels

Several commenters have raised the issue of whether there are rare or endangered mussels located in the Pamunkey River in the vicinity of the proposed discharge at river mile 54.89. In 1972 and 1973, a VCU graduate student surveyed the Pamunkey River for the presence of mussels. At the 360 bridge (river mile 56.87), four species of mussels were found including the rare eastern lampmussel *Lampsilis radiata* and the rare green floater *Lasmigona subviridis* as

4. Discharge Location

Discussion:

The location of the discharge has been the subject of a great many of the comments. The staff is generally not responsible for establishing appropriate discharge locations. Selection of the discharge site is considered to be a local decision and the staff establishes permit conditions accordingly. However discharge locations have occasionally been moved in response to public comments.

The original discharge location for the project was the center of Newcastle Farm, adjacent to an existing boat ramp and irrigation water intake. At the request of the landowner, the County evaluated one upstream alternative at the Rt. 360 bridge and two downstream alternatives. The original and all three alternative locations were also located on Newcastle Farm. The County then selected the site dubbed "Downstream II" to be the best alternative and modified the application accordingly. After determining that the landowner was unwilling to sell, regardless of the location, the County moved the discharge location back to the original site. The County also determined that the downstream site, although on the same farm, was not located on the same tax parcel and had not been included in the local Conditional Use Permit (CUP). Use of the "Downstream II" location would require that the County go back through the local CUP approval process. The landowner's attorney has filed suit against County officials contending that relocating the outfall to the center of the property was a retaliatory attempt to intimidate the landowner.

Either discharge point is acceptable from a water quality standpoint. The upstream location is located approximately 50 yards above an existing boatramp in an area routinely used for swimming. The downstream site is located approximately 100 yards above a neighboring property owner's boat dock. Although effluent limitations are set to establish a level of disinfection which would meet regulatory definition of "swimmable" waters, the presence of the discharge will realistically eliminate swimming in the river in the vicinity of the outfall as people make a reasonable choice to minimize risks to their health.

In order to determine if there was a significant difference in mixing at the two locations, the staff performed a tidal survey at the two locations discussed above. The survey indicated that on an outgoing tide, the Downstream II location provided more tidal flow than did the upstream location. The difference in flow at the two stations is currently under study by the County's consultant and hopefully that information will be available to present to you at the Board meeting.

Recommendations under Consideration:

None

001349

7. Water Supply Issues

Discussion:

DEQ knows of no current plans for any municipal water withdrawals on the Pamunkey River and no jurisdiction has approached the agency in an effort to designate the river as a public water supply in the Board's Water Quality Standards. If and when the river is designated as a public water supply, then the appropriate water quality standards will be applied to the discharge. In most cases, the protection of aquatic life results in more stringent standards than the protection of human health in a public water supply.

Recommendations under Consideration:

None

8. Temperature Impacts

Discussion:

With regard to temperature impacts, typical municipal effluent does not vary significantly in temperature and the impacts of temperature on the receiving stream are negligible. Unless there is a very large source of industrial cooling water, temperature is not typically addressed in VPDES permits. Should the County attract an industry providing significant amounts of cooling water, the industrial pretreatment program would limit the amount of heat in the wastestream.

Recommendations under Consideration:

None

9. Other Miscellaneous Comments

Discussion:

There were many other issues raised during the hearing process which are not related to water quality and the VPDES permit. The staff does not believe that any action can be taken on the following issues:

- Impacts on historic resources
- Whether regional treatment options were sufficiently pursued with neighboring jurisdictions
- Hanover County's record in operating the county landfill which has

001350

1196 Huguenot Trail
Midlothian, Virginia 23113
January 19, 1999

Members of the Board
Virginia Department of Environmental Quality
4949-A Cox Road
Glen Allen, Virginia 23060

Dear Board Members:

This packet of letters is submitted with the hope that you will refuse to grant a permit for sewage outfall on our property, Newcastle Farm, because of the possibility of harming rare, threatened or endangered species susceptible to changes in water quality.

It is hard to believe that, here, with help from my adult son, husband and lawyer, I may be less able to save our land than I was as a young widow, holding my then infant son, as we stood alone in the fields of Newcastle. Would that I could cry enough tears to improve the quality of water in the Pamunkey River.

It is even harder to believe that, in a democracy, a family who has struggled for six generations to save a valuable, historic, 900-acre farm, can so quickly be threatened by government condemnation for outfall from a sewage plant deemed unnecessary by many citizens. More irresponsible than any government, however, is the family that facilitates the tragedy of harming a threatened or endangered creature by surrendering land too easily.

We are custodians, indeed, stewards of this land, which was here before us, and will be here long after we have returned to dust in its soil. We want to care for the property responsibly rather than to wring from it avariciously all possible profit.

Information in the attached letters indicates that rare, threatened or endangered aquatic species may exist in the Pamunkey River at Newcastle, and that no biological testing has been conducted to date. If present, such species can be harmed by changes in water quality from effluent discharged into the river. We ask your help in preventing an irreversible tragedy. Please allow time for thorough, actual testing to be performed before granting any permit for sewage outfall.

Thank you for your consideration.

Sincerely,

Frances Broadus-Crutchfield

00-1351

Frances Broadus-Crutchfield

James S. Gilmore, III
Governor

John Paul Woodley, Jr.
Secretary of Natural
Resources



David G. Brickley
Director

COMMONWEALTH of VIRGINIA
DEPARTMENT OF CONSERVATION AND RECREATION

217 Governor Street, 3rd Floor

TDD (804) 786-2121 Richmond, Virginia 23219 (804) 786-7951 FAX (804) 371-2674
<http://www.state.va.us/~dcr/vaher.html>

January 8, 1999

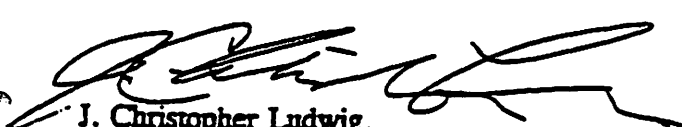
Ms. Francis Broaddus-Crutchfield
1196 Huguenot Trail
Midlothian, VA 23314-914

Dear Ms. Broaddus-Crutchfield:

This letter is sent at your request to reaffirm the possibility of rare mussel species in the Pamunkey River adjacent to Newcastle Farm. Three rare species, the green floater (*Lasmigona subviridis*), yellow lampmussel (*Lampsilis cariosa*), and eastern lampmussel (*Lampsilis radiata*), have been documented a short distance upstream of Newcastle Farm and there is a high probability that one or more occurs at or near the discharge sites. The Federally-listed dwarf wedge mussel (*Alasmodonta heterodon*) has been recorded in the watershed and is also possible at the site.

Due to the possibility of rare mussel species, we strongly recommend a survey to determine which species may occur in the vicinity of the discharge sites. Our records do not indicate that a survey has ever been conducted at this site. If you have any questions, please call me at 804-371-6206.

Sincerely,


J. Christopher Ludwig,
Chief Biologist,
Division of Natural Heritage

001352

James S. Gilmore, III
Governor

John Paul Woodley, Jr.
Secretary of Natural
Resources



David G. Brickley
Director

COMMONWEALTH of VIRGINIA
DEPARTMENT OF CONSERVATION AND RECREATION

217 Governor Street, 3rd Floor

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<http://www.state.va.us/~dcr/vaher.html>

November 20, 1998

Francis Crutchfield
1196 Huguenot Trail
Midlothian, VA 23113

RE: Totopotomoy Wastewater Treatment Plant
Freshwater mussel information

Dear Ms. Crutchfield:

Enclosed please find copies of Virginia Department of Conservation and Recreation - Division of Natural Heritage correspondence regarding the above referenced project and general aquatic information:

April 29, 1997 letter to Hazen & Sawyer
April 22, 1997 letter to Henry Broadus
Rivers of Life, Critical Watersheds for Protecting Freshwater Biodiversity
Effects of Contaminants on Naiad Mollusks (A review)

According to the information currently in our files, the green floater (*Lasmigona subviridis*, G3/S2/SOC/SC), yellow lampmussel (*Lampsilis cariosa*, G4/S2/SOC/SC) and Eastern lampmussel (*Lampsilis radiata*, G5/S2/NF/SC) have been documented upstream from the proposed discharge site.

0-1253

The green floater is a freshwater mussel species which ranges from New York to North Carolina in the Atlantic Slope drainages, as well as the New and Kanawha river systems in Virginia and West Virginia. This species is currently classified as a species of concern by the United States Fish and Wildlife Service (USFWS) and is believed to be declining throughout its range to the point that it may warrant Federal listing as Threatened or Endangered. This species inhabits riverine habitats ranging from small streams to medium or large rivers, and apparently has declined throughout much of its range; this species may even be extirpated from some drainage systems. Based on DCR staff knowledge recent efforts to reverify known populations throughout Virginia have been largely unsuccessful; no new occurrences were found during a 1997 status survey in the James River, New River, Nottoway River, Potomac River, Rappahannock River, Roanoke River and York River drainages (Chazal & Hobson, 1998).

Literature Cited

- Chazal, A.C. and C.S. Hobson. 1998. 1997 Conservation status assessment for the green floater (*Lasmigona subviridis*) in Virginia. Natural Heritage Technical Report 98-5. Virginia Department of Conservation and Recreation, Division of Natural Heritage, Richmond. Unpublished report submitted to the U.S. Geological Survey.
- Neves, R.J. 1991. Mollusks in Virginia's Endangered Species: Proceedings of a Symposium. K. Terwilliger ed. The McDonald and Woodward Publishing Company, Blacksburg, Virginia.
- Williams, J.C. 1969. Mussel fishery investigations Tennessee, Ohio and Green rivers. Unpublished report.

001354

Delivery By Hand
February 3, 1999

E. Clark Henley
3620 Spring Run Road
Mechanicsville, Virginia 23116
Phone (804) 273-6223



Members of the Board
Virginia Department of Environmental Quality
4949-A Cox Road
Glen Allen, Virginia 23060

Re: Permit No. VA0089915
Totopotomoy Wastewater Treatment Plant
Proposed Municipal Discharge into Pamunkey River

Dear Board Members:

This is to express my concerns regarding the above referenced proposed discharge permit requested by the County of Hanover (the "County"). I am strongly opposed to the issuance of the permit at this time. Listed below are some items for your consideration.

- The permit is inconsistent with the Clean Water Act because it will effectively prevent established recreational use. I have frequently used the site for swimming, fishing, and boating on a regular basis in the past. The site chosen by the County encompasses the "landing" or river access for both Newcastle Farm on the Hanover side of the river, and Mr. Woods' farm on the King William side of the river. The landings of course are the natural access points for using the river, chosen because of the ease of access provided by the topography. These points on the river have been in use for well in excess of two hundred years. Clearly, the discharge of five to ten million gallons of effluent a day at this location will prevent the past recreational use from occurring in the future.
- There has been insufficient study of the existence of rare or endangered aquatic species which may be damaged by the discharge.
- The models and evaluations do not adequately consider the effect of the tides, various obstructions, and small size of the river. The river is extremely narrow at the discharge point. Fallen trees and other obstructions combined with the tidal effects will hinder mixing of the effluent and most probably cause pooling of effluent.
- The issuance of the permit is premature. In addition to the unanswered questions regarding the effects of the effluent, there is substantial disagreement between the



Virginia Department of Environmental Quality
4949A Cox Road
Glen Allen, Virginia 23060

February 1, 1999

Dear Members of the Board:

It has come to my attention that the Virginia Department of Environmental Quality is considering granting a permit for a sewage outfall into the Pamunkey River on Newcastle Farm in Hanover County near the Route 360 bridge. In 1973 I published my Master's Degree Thesis which is entitled *Fresh Water Mussels of the Pamunkey River System, Virginia*. This study documented the presence of six (6) mussel species in the nearby area of the Pamunkey River and four (4) species at the Route 360 bridge (Page 26, Table 5). In the thesis I cited the probability that fresh water mussels could be used as a sensitive indicator of water quality and proceeded to survey the river system for the presence and distribution of mussel species. A premise of my thesis was that improved water quality, in this instance by the impoundment resulting from the Lake Anna Dam, would allow the mussel population to increase because heavy metal toxicity from acid mine drainage would be modified. There was documentation of greater mussel species diversity and populations below the confluence of the North and South Anna Rivers (*ie.* the Pamunkey River). I urge you to insist that a well documented qualified study be done in May and June 1999, so that an updated documentation can be compared to my study and so that those mussels that are in the rare and endangered category may be protected. Your office is entrusted with responsibility for helping improve and maintain the quality of our environment. As a Virginia citizen for many years and as a contributor of baseline data, I urge you to delay granting a permit until an adequate study has been done.

Sincerely,

Marceile B. Riddick

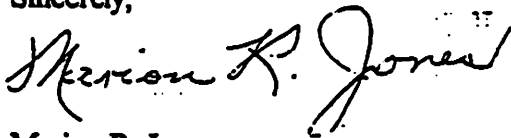
Marceile B. Riddick, M.S.
2701 Dix Inlet Road
Virginia Beach, Virginia, 23452

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large metropolitan cities did not try to compete with their services but formed a regional cooperative to handle safe drinking water and a safe method (to its citizens and to aquatic life) of disposing of waste water! This is the *best environmental* argument that there is!

Thank you for the opportunity to submit my views.

Sincerely,

A handwritten signature in cursive script that reads "Marion R. Jones". The signature is written in dark ink and is positioned above the printed name.

Marion R. Jones

CG1358

Yellow lampmussels typically occur in larger streams and rivers and is typically found in sand and gravel where good current exists. The information currently in our files, indicates that the Eastern lampinussel occurs in rivers or blackwater creeks in a substrate of soft sediments, silt, and sand which may contain a large amount of organic material or detritus.

Mussels and other benthic organisms have suffered irreparable declines in populations due to anthropogenic activities and pollutants in the waterways (Neves, 1991). Because mussels are sedentary, they are unable to move from habitats that are being degraded or are no longer suitable. Freshwater mussel are susceptible to such activities as degradation of riverine habitat and declining water quality. Impoundment, dredging, channelization or other activities that alter water flow may all adversely affect populations of mussels and possibly the fish which serve as hosts for mussel glochidia. Pollution and increased siltation and erosion into streams from adjacent lands can impair feeding, reproduction and respiration of mussels. In addition to direct impacts to the mussels, the local fish fauna may change, eliminating needed hosts (Neves, 1991).

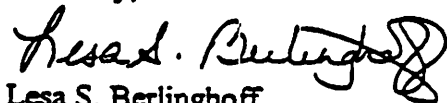
I have attached several other letters that may be interesting or useful to you. The first is DCR's response to the DEQ Water Quality Standards which includes some concerns about wastewater discharge and mussels. The second is a letter in response to a water withdrawal and wastewater treatment plant in Nelson County.

You may also want to consider contacting the Virginia Department of Game and Inland Fisheries and the United States Fish and Wildlife Service to see if they can provide further information that may be useful to you.

Any absence of data may indicate that the project area has not been surveyed, rather than confirm that the area lacks additional natural heritage resources. New and updated information is continually added to BCD. Please contact DCR for an update on this natural heritage information if a significant amount of time passes before it is utilized.

Should you have any questions or concerns, feel free to contact me at 804-371-2708. Thank you for the opportunity to offer this information.

Sincerely,



Les S. Berlinghoff
Project Review Coordinator

001259

S. B

VA0089915 Totopotomoy
Public Hearing – January 19, 2000

Tom Van Auken:

Good evening, my name is Tom Van Auken. I'm a member of the State Water Control Board and I'm the hearing officer for this evening's hearing. You've been talking to some of the staff here but let me introduce them anyway. This is Gerry Seeley. He is the Piedmont Regional Office Director for the Department of Environmental Quality. J.R. Bell is the Piedmont Water Permits Manager for the Department of Environmental Quality ... and Allan Brockenbrough is the Piedmont Regional Office Permit Engineer, also for the Department of Environmental Quality.

Now, in this hearing, we'll be taping the testimony, for public record. And, in addition to your comments tonight, if you want to enter written comments, the deadline for written comments has been extended to 4 p.m. on Thursday February the 4th, 1999. So, you're not restricted to what you might want to say tonight ... you can also give written comments to the Department of Environmental Quality. The State Water Control Board is holding this hearing to receive comments on the proposed issuance of a Virginia Pollution Discharge Elimination System Permit No. VA0089915 to the county of Hanover under the operation of the proposed Totopotomoy Wastewater Treatment Plant. This hearing is authorized by the Regional Director of the Piedmont Regional Office of the Department of Environmental Quality. The Department of Environmental Quality did notice for this hearing was published in the *Herald Progress*, *The Mechanicsville Local*, and *The Tidewater Review*. This fact finding proceeding is being held pursuant to section 9.6-1411 of the Code of Virginia and 3.7 of Virginia Regulations 6801401 and the Board's procedural rule number one. Tonight's hearing will lead to no decision; this is just a fact-finding hearing. The State Water Control Board ultimately decides whether to issue the permit that the County is asking for and that decision will be made at the Board's meeting on March the 11th, 1999. Tonight, we'll listen to whatever you've got to hear that's relevant to this permit. What we really want to do is get your input. Okay, the general procedure tonight will be ... first, the staff will make a presentation and Allan Brockenbrough will make that presentation for the staff. Then the applicant, that's the county, will make their presentation. Then, we'll hear from everybody who has signed up on a card. After everyone who has a card is signed up, has spoken, then we'll hear from anyone else who wants to speak.

Now there are a fair enough number of people here tonight, so when you come up to speak, I'd appreciate it if you'll hold your remarks to about three to five minutes ... please, so everybody can get his say in and we're not leaving here at two o'clock in the morning. If you're part of a group here, just have one spokesman or two spokesmen speak for you and ask the people in your group to stand up. All right, now, in the interest of saving time, and if there are no

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objections, I will enter the exhibits we have here. This information DEQ has already received to date at the end of the record by incorporating the exhibit list as exhibit number one. If there are no objections to that, okay, the hearing here are entered. This list is available for your inspection and, again, the public record will close on Thursday, February the 4th at four p.m. Allan-your game.

Allan Brockenbrough:

Good evening ladies and gentlemen. My name is Allan Brockenbrough and I am the permit writer for the proposed Totopotomoy Wastewater Treatment Plant in DEQ's Piedmont Regional Office. Tonight's hearing is being held to solicit comments from the public on the proposed issuance or denial of VPDES permit no. VA0089915 to the County of Hanover for discharge from a municipal wastewater treatment plant, to the Pamunkey River...and the affect of the treated wastewater discharge on water quality for beneficial uses in state waters. On April 11, 1997, Hanover County submitted a VPDES permit application for the proposed Totopotomoy Wastewater Treatment Plant. The County requested effluent limits for a wastewater treatment plant design flows for five and ten million gallons per day. Numerous supplements and amendments to the application were submitted over the next year and a half with a final submittal being received and the application being considered complete on October 13th, 1998.

The Pamunkey River is classified as a Tier 2 water, which means that the water quality exceeds the minimum standards adopted by the state. The anti-degradation provisions in the Clean Water Act and the State Water Control Board's VPDES regulation requires that any permits contain provisions which protect the existing life quality of water in the river. The proposed VPDES permit contains numerous provisions to ensure that existing water quality in the Pamunkey River is maintained. The proposed VPDES permit includes monthly average effluent limitations of ten milligrams per liter for a five day carbonaceous biochemical oxygen demand, fifteen milligrams per liter, total suspended solids, and three milligrams per liter for total - nitrogen. These limitations are established at a level that the DEQ staff believes will have a negligible impact on dissolved oxygen levels in the Pamunkey River. Although this particular section of the Pamunkey River is not considered to be nutrient-enriched, the total phosphorous limitation of two milligrams per liter has also been included in the permit. The permit also includes additional limitations for fecal coliform, pH, and dissolved oxygen. Additional major provisions of the permit include: 1) metals limitations and numerous management requirements, for the bio-solids it will produce, should the County choose to dispose of the material by land application through agricultural sites. 2) The requirement that an industrial pre-treatment program be developed. A treatment program ensures that any industrial waste receives adequate pre-treatment by the generator, such that waste will not adversely affect the biological treatment process at the wastewater treatment plant, the quality of any bio-solids which may be land-applied, or pass wastes through the

wastewater treatment plant and adversely affect the receiving waters. 3) Monitoring for numerous toxic parameters for which the State Water Control Board has adopted water quality standards. And finally, 4) a Toxics Management Program which includes whole effluent toxicity testing. This consists of looking at individual toxic parameters, or species of aquatic life (that is two vertebrates and two invertebrates) which are subjected to the wastewater's determine whether there are any cumulative toxic impacts. If the testing shows acute toxicity, in one hundred percent effluent, or any chronic impacts on survival, growth, and reproduction, concentrations below those in the receiving stream toxicity reduction evaluation will be required. In summary, the staff believes that the permit will adequately maintain existing high quality of water in the Pamunkey River. This concludes my comments. Following this public hearing, the Board's staff will consider all the comments received, specifically including the comments received to date, the comments made tonight, and any additional written comments which we receive by four p.m. on Thursday February 4th, 1999. The staff will then develop recommendations and then present them to the State Water Control Board, comprised by seven citizens appointed by the Governor, for their decision at the March 11, 1999 meeting.

John Hodges- Hanover County:

Mr. Van Auken, members of the DEQ staff, members of the public...years ago, Hanover recognized that in order to continue to successfully implement its land use plan additional wastewater treatment capacity would be required by 2003. Many options to provide this capacity were explored including regional alternatives. And after considerable effort, Hanover determined that the construction of a new wastewater treatment plant with a discharge to the Pamunkey River is its best option. The discharge permit we have applied for is critical if the County is to maintain the integrity of its land use plan, and to meet the wastewater treatment needs of its citizens and customers. Hanover County is unique in that its comprehensive land use plan limits the areas to which water and sewer service may be provided, which in turn helps control the suburbanization of the rural areas of the County. This discharge permit and the additional wastewater treatment capacity it makes available are consistent with the County's comprehensive land use plan. This consideration has been refined through a series of studies over the years, and a preliminary study was completed by *Black and Veatch* in 1989. The Pamunkey River was identified as the most viable alternative for a discharge in the event a new wastewater treatment facility was needed. In 1993, in the finalization of their 1989 study, *Black and Veatch* again identified the Pamunkey River as the most viable alternative for a new discharge. In 1995, *Hazen and Sawyer*, a new County consultant was retained to review the previous study and make specific recommendations regarding implementation. This independent review also identified the Pamunkey River as best alternative and further identified the portion of the Pamunkey River located downstream at

the route 360 bridge as the best location for the discharge. In April 1997, following a review of alternatives, the County applied for a VPDES discharge permit at the location being considered tonight. The County also began the process of obtaining local approval of the proposed wastewater treatment plant and its associated discharge. In August 1997, after the County-held public information meetings and hearings, the Hanover County Board of Supervisors approved the conditional use permit required to construct a new wastewater treatment plant at a site located off of Tate Lane, and a discharge for the new plant at a location identified in the County's VPDES permit application. After application for the discharge permit was submitted, and on the basis of conversations with one of the owners of the property, the County considered and at one point revised the location of the proposed discharge to a point approximately four thousand feet downstream. This was also a good location from a water quality perspective but it would have had a greater impact on nearby downstream property owners. It would have been more expensive to construct and did not have local land use approval. When the owners of the property subsequently ended their consideration of any location on the property, the County revised its application to the site originally approved in the County's public hearing. Hanover County has kept open the lines of communication and has recently, this last week, met with the property owners' lawyers to seek ways to reach agreement on this matter. There are many good reasons this location was selected and I would like to briefly go over these reasons. Minimizing the impacts to the Pamunkey River, as I stated earlier, the primary importance to the County was a location that would minimize the impact of the discharge on the Pamunkey River. The segment of the river where the discharge is being proposed is subject to strong tidal influence, which promote rapid mixing of the treated effluent throughout the stream cross section, which is protective of water quality and minimizes impacts on residences. To build the outfall anywhere downstream of the location proposed for the discharge would require much longer force main and would disrupt several residential areas. The property on which the discharge is proposed to be located is currently utilized for farming and the discharge point is approximately four thousand feet to the nearest adjoining property line and improved residential properties and minimizes the impact on historic resources. Hanover County is very sensitive to the many historic resources found within its boundaries. The County protects its historic resources whenever possible and in fact minimizing impacts on historic resources is a self-imposed condition of approval for the County's entire wastewater treatment plant project. The County is aware of the fact that the Town of New Castle archaeological site is located on the property on which the discharge is proposed. The actual site of the discharge and its associated force main have been located along the outer limits of the identified New Castle historic area and is separated by an abandoned twentieth century rail line. Because most of the New Castle historic area is farmed and has been disturbed there are no surface indications of New Castle. Further, the County is performing ongoing archaeological investigations across the ongoing force main and at the discharge site to ensure compliance with all

Federal, state and local requirements. Finally, we have avoided the burial site identified by the property owners. Environmental impacts: Minimizing impact on wetlands and endangered species was important when siting the discharge in our analysis as follows... wetland impacts: impacts on wetlands were considered in locating the discharge in the area. In the area of the discharge, the Pamunkey River has high banks with limited or no contiguous wetlands. The reiteration structure is identified here, associated with the discharge will be constructed in an upland area and is not subject to flooding. Upstream from the proposed discharge the riverbank is much lower in their significant wetland areas contiguous to the river... endangered species: Record research identified that there was a potential for endangered mussels to be located in this segment of the river. Although not required at this time, the County had a field survey of the Pamunkey River conducted in the vicinity of the proposed discharge. It was completed to determine if endangered mussels were located in this section of the river. No endangered mussels were identified by this survey. In summary, the proposed location for the discharge has strong tidal influence promoting better mixing for water quality, minimizes the impacts on residents in the vicinity, has local land use approval, and will have little or no impact on identified historic resources and minimizes impacts on wetlands and endangered species. We believe that the limits and conditions set forth in the draft permit developed by the Department of Environmental Quality and approved by EPA are appropriate and are protective of water quality. The County is committed to constructing and operating a state-of-the-art facility that will meet the conditions of the proposed permit, which is critical to the future vitality of Hanover County. We hope that the State Water Control Board agrees that the draft permit is environmentally sound and that the County's project has been well conceived. We respectfully request that a VPDES permit, based on the draft permit, being considered tonight be issued to Hanover County by the State Water Control Board. The County's staff and representatives, our engineers, and *Hazen and Sawyer* are here to answer any questions that may arise during the remainder of the public hearing that the state representatives deem this appropriate. Thank you.

Henry Broaddus:

Thank You. Initially, I must take issue with Mr. Hodges portrayal of me and my family as having, I believe the quote was, "ended their consideration of any location on the property." When in the fact the record shows, is very clearly, we never considered any location. We did allow the County to conduct some studies in the hope that they would create more hard data than the hypothetical models, which are all that you have right now. In fact, after we suspended their permission to enter the property they continued to do so anyway and still I think their research is sorely lacking. Adaline Stevenson, after yet another failed presidential candidate did introduce his remarks to a crowd with the following statement: "My job is to speak to you. Your job is to listen to me and if experience is any guide, your

job will be over long before mine is." And I introduce my remarks the same way tonight. Not to prepare you for a lengthy diatribe but to express the frustration that I feel at the fact that the proposal before you has made it even this far in the spite of the cacophony of voices, mine included, raised in opposition. What's so important to me is the preservation of that opposition and of the land itself that I have flown down here today from Dartmouth College in New Hampshire to restate it. And I offer you the following succinct statement with sincerest hope that you will not look past it as lip service but think about it as most heartfelt concern. I am the landowner on whose property this sewage discharge would fall. You're gonna be hearing, and in fact, in the question and answer session you've already heard, about some of the potential adverse affects this projects has on the Pamunkey River and you will continue to hear about the egregious lack of resources that has been done in any effort to minimize those effects. What I want to offer you now is a sense of context without which I do not believe that the Department of Environmental Quality can be well prepared to make its decision. When we speak of pristine land of a preserved natural environment it becomes necessary to explain that this condition is not accidental, rather is the consequence of concerted efforts on the part of those individuals to whom its care was entrusted. I call myself a landowner only in the loosest sense of the term. My role could be more properly be called that of a steward in that not only do I not wish to develop New Castle or to use it for any purposes other than agricultural ones. I actively dissuade those potentialities and this is consistent of those whose efforts came before me. My sixth great grandfather, Edwin Ruffin, one of the greatest agricultural scientists in American history had the revolutionary idea of using marl in the Pamunkey River bed to replenish the nutrients and soil there. And my own father, Woodfard Meade Broaddus, also a farmer refused to put any chemicals that he suspected would have adverse affects on marine biology of the Pamunkey river onto that same soil. His integrity is one of the few things I know about my father who died when I was five months old. His land is one of the few tangible monuments I have of him and you can bet that I have applied his same standards of integrity to its use thus far. What is disheartening to me now, even more so than the fact that I may not be listened to and the record shows that I have not been is that fact that I no longer have the ability to force those same standards of integrity, the one such as my father who made his living from this land not only upheld but lived as a credo. In violation of those standards, such as placing a sewage outfall on this property without having directly explored its impact on rare fresh water mussels, aquatic life and water quality, is not only an affront to my father's legacy...it's an affront to any reasonable individual's sense of the consideration the government owes any project before imposing it on its citizens. We don't know the extent of the environmental damage this outfall may cause and yet now, despite these pleadings of one who is part of a long-standing tradition of those who have resisted any such development, on the grounds of their fear of the extent of what might be damaged, this discharge is on the fast track to being built on the

grounds of an ignorance of the extent to which this river will be damaged. I don't have the power to stop it. I don't even have the power to impose the need for more extensive research...you do. And as one steward of the land, to a body of individuals whose responsibility is similar...please don't be anything less than thorough before you permit this travesty. Please do not grant your endorsement of this project now, at a time where the only data before you is based on hypothetical models and a desire to expediency. Please ensure that we are not careless and our responsibility to protect this pristine land, this preserved natural environment, for our County, our state, our ecology. Thank you.

Charles D. McGhee:

I come here tonight to express my concern over the placement of the discharge pipe at New Castle Farm. I'm not only a concerned citizen of Hanover County but I am responsible for the day to day agricultural operations at New Castle Farm. As good stewards of the land that is entrusted to me, I operate under the guidelines of the federal government's best management practices. A Chesapeake Bay plan is under construction at this moment, to ensure any water than runs off of that farm into the Pamunkey River is of the best quality. We are also enacting a state nutrient management plan to work in conjunction with the Chesapeake Bay plan. If the current route of this pipe is followed, you will be running it through Mr. Broaddus' farm. It will also be going through a resource protection area as denoted by the Chesapeake Bay plan. Now, I realize that the Pamunkey and its tributaries have other wastewater treatment plants along its banks; however, these are very far upstream, and I hopefully feel that any effluent has had time to assimilate into the water and to be diluted by the time it reaches this point in the river. We operate two similar irrigation systems that draw water out of the Pamunkey at a point less than a quarter of a mile from where you are planning to issue the permit for this discharge. I have concerns for my health and my safety that some of this effluent will not have time to be diluted and to assimilate into the water in such a fashion that it would not be detrimental to my health. I also feel that construction of this pipeline will be disruptive and detrimental to the agricultural operations at any given time. While I am sure the County is looking out for my well being, and is trying to protect me from any hardship, delays and mishaps will occur. I am concerned that possible construction of this pipe will cause me undue hardship. There has been a study and it has been already brought up in conversations tonight in Great Britain, and Cornell University, that is concerned with wastewater treatment effluent discharged into rivers. In North Carolina, there are two rivers that constantly come under attack for their animal units of concentration...the Neuse River and the Cape Fear River. The Neuse River can be described as probably the dirtiest river in North Carolina. The Cape Fear, however, is relatively clean. But there are two distinct differences between these rivers. You see, the Cape Fear River has only eleven discharge permits along its banks. The Neuse River has four hundred

and twenty-four discharge permits. So, you see, it seems to me that its not a matter of animal discharge to the water that is messing this river up but rather municipal discharge. Now, I am not sure that I have the authority to speak on such matters as to whether or not the County has exercised patience with Mr. Broaddus or whether they have exercised good will, but it seems to me that they have gone about this rather fast and rather expedient. Have they looked at other matters adjacent land and property to put this discharge pipe? We have not heard. Now, this route 605 on this map, there's another piece of land that has the same topographical features of the bank of the river at New Castle. Was this studied? The public does not know. However, one thing I do know is that the people that own that portion of land have no emotional attachments to this land as does Mr. Broaddus. Could it be that they are looking at an easy way out? Could it be that they are looking at Mr. Broaddus as an absentee landowner and trying to pull the wool over his eyes? This remains to be seen. Now, I have very grave concerns over the fact that this lake may have personal consequences to my health as I do come in contact with the water practically every day. And I think less than a quarter of a mile is not enough to dilute any effluent that comes in the water. Even though the Pamunkey has strong tidal flows as stated before, there are times when the river runs very slow and practically stops. There are times when the river actually runs backwards when the tide is coming in. So where is this three million gallons per day going to go? Have there been any studies done to the fact as to how fast the effluent moves down the river? In a tidal area such as this, I wouldn't think it would move very fast at all. All one has to do is place a Veach ball in the river and see that through the course of the day it will not move very far. I urge you to consider this matter very carefully. Mr. Broaddus wants to take care of his farm and as a steward of his farm, I want to take care of it. He has often times told the previous renters, and myself, to never apply solid waste sludge. I can't help but think that I would break that promise by allowing this effluent to be pumped through the irrigation systems and applied in such a manner. Thank you.

Meade Anderson:

Good evening. My name is Meade Anderson. I am a nearby property owner and a user of this river. The issue today seems to be, and Hanover has even mentioned it, minimizing the effect on the Pamunkey River and minimizing the effect of this effluent on the water quality. Well, if Hanover was really concerned about water quality it would have joined in with Henrico when the opportunity presented itself or with Richmond into a cooperative joint venture for a discharge on the James River. Henrico invited Hanover to do it and they passed the time up. I've swam in this river and fished in it for over thirty-five years right where the County now proposes to locate this discharge of wastewater from the sewage treatment. I actually swim there several times a week nearly six months out of the year and often take my daughter swimming with me. My mother swam here.

My grandfather swam and fished as did his father, and his father, and his father. The scientists and engineers said that their computer modeling data indicates that the ever-increasing discharge, which starts at five million gallons per day, will not hurt this river. Well, I think computers are a very valuable tool but I also believe in using a little bit of common sense occasionally too. Does anybody know what five million gallons actually is? Well I ran the numbers on it just on a calculator and Hanover's got four hundred and seventy one square miles. In one day alone, five million gallons per day would cover Hanover to the depth of three-quarters of an inch and in one year to 22.6 feet deep. Now, you know, everybody can run numbers, once you increase that to thirty five million gallons per day...that's a hundred and fifty eight feet deep of effluent. Just to give people a perspective of what five million gallons per day is. Well, so all the engineers and people who do all this modeling say it's perfectly fine to dump this discharge into the river, I'll leave everyone with one question. Would you swim in five million gallons a day of effluent and would you take your children swimming in it? I think I know the answer to that question. Thank you very much.

Georgie Myers:

——DEQ does not have a very good reputation and the state is not doing that grand and since you all let people like Smithfield and Warner, the EPA has to come in do their job to get ya'll to do yours. How do we know that you're even gonna do half of the monitoring that should be done? And how will we know if you do or not?

Magi Shapiro:

I've got more questions than I've got comments and, if possible, I would appreciate a written response to my questions. My address is 16411 Gun Barrel Rd. Montpelier VA 23192. I would appreciate a description of the project. As I stand here, right now, I really don't know what the details of this project are and I think it would have been more appropriate for this entire evening to be proceeded with a description of the project. What kinds of waste will be treated there...immediately and long term? So far, I haven't heard any response to those sorts of issues. What about the impact to the dwarf wedge mussel? Could we see a copy of the report? Apparently, an investigation was carried out; I would like to read it. What impacts beyond the dwarf wedge mussel...this is a tidal area...things come and go on tides, they don't just sit around. Tidal volume and reach varies considerably with the amount of rainfall and the amount of winter precipitation. There are all kinds of things that can affect the range of tidal movement. With effluent going into it at this critical point because this is almost the upper limit to tidal reach. I am concerned about what effects this effluent will have at this point, even if it has been processed through the tertiary impact stage. What are the baseline data? What's there now? What do we really know

about what's in that river...what's living in it...what kind of bottom does it have...what are in the sediments of that river? How are we gonna know there are any affects if we don't know what's there in the first place? What have we got to measure against? I haven't seen anyone speak to those kinds of data. I would also appreciate, this is gonna be a little disjunct because I've just taken notes throughout the evening. I would also appreciate having the telephone number of the contact person of DEQ on this so I can talk to him or her personally. I'm also concerned about exactly how fast DEQ will react to a potential problem. Will the County be out there everyday doing monitoring, I mean everyday? How long will it take the County to find out if there's a problem, and during that time frame, what will happen? Will it be irreversible? Will it be reversible? Will it be benign? Will it be detrimental? We don't know the answers to any of that. Typically, DEQ does not respond very fast and if Hanover County doesn't happen to be out there on the very day of an adverse impact, how long is it gonna take before DEQ knows about it and then turns that report around to action so that whatever it is, is stopped? In other words, can they shut that plant down within thirty minutes of detection of the toxic effluent? I don't know. Maybe they can, but it's a good question. And this is kind of by means of just comment...*Black and Beech* identified the Pamunkey River as a high candidate for this kind of project because it's so clean. They could have gone anywhere to a dirty river, but when you're talking about a dilution fraction...when you're putting a pollutant, whether it's a benign pollutant or an adverse pollutant, when you put a pollutant in a river, there's a mixing zone. And if the river, if the receiving water, is very very clean as in this case, the Pamunkey River, then it gives you a little more leeway to put pollutants in there because they will be more diluted once they get there. So, I think the Pamunkey, and I'm just guessing here, but I think the Pamunkey was chosen because it is so clean, which gives the County a lot more leeway to introduce pollutants. I'm also concerned about this magic four thousand linear feet. What is going on in that four thousand linear feet that makes it safe? I'm not sure that it's meaningful to me. That's all I have right now. Thank you.

Anne Melton:

Hi, I'm Anne Melton. I was just kind of clueless when I got here but listening to all this I had a few little questions and, first of all, this gentleman said (I think) that the lawyers had to work with the County over this. You apparently had hired lawyers...Mr. Broaddus or...and did you have you pay for that lawyer or is the County gonna pay for that lawyer? I mean, this seems a little unfair to me. But anyway, I was wondering who the mussel survey is conducted by. Is that some department, I mean somebody that you all choose or the County chooses, or I just kind of wonder about that good stuff. And, also the historical values, somebody was talking about the historical value of the County, I think, Mr. Hodges, to protect historical things and I know this is not totally in Hanover

County but this gentleman here from the Pamunkey Indian reservation...I mean, what larger historical, you know, value should be placed on that? And these, like, you know, he said these people depend on that for their livelihood and I can't imagine, you know, that you would even consider something like this that would adversely affect them so much. That's all.

BJ Ostergren:

Good evening, my name is BJ Ostergren. I live in the Ashland district and I was the first one that stood at this podium, in this room, on May 22 1996, and advised the citizens of this County when no one else did, that there would be a wastewater treatment plant right beside our new multimillion dollar park and nobody in this County, administration and John Hodges can attest to this fact, told the citizens of this County that we were going to have a sewage plant over there. Now, I learned how to swim in the Mattaponi River...I still fish there and let me tell you how clean it is...it is absolutely the most pristine river on the east coast that you all are aware. They have many mussels; I'd like to tell you. So, I don't know how long the Pamunkey will last but I do canoe and have canoed on the Pamunkey. I have put in at route 738, which is up near Bear Island, and I put in on the South Anna right out a half a mile before the confluence with of the Pamunkey. And it was a hot August day...the river was very low. There were many logs to get over and I almost gagged until I got to the confluent. The stench was unbelievable. So, my question I guess is where were you all when I was trying to breathe that gross smell? I have never been back there. That makes me bring up the other point. There are now two treatment plants on the South Anna; one is a small one that treats Country Club Hills, and another one is over there and I have looked at that map that Mr. Hodges pointed out. One is at Ashland, now we're up to three. One is at Doswell. We have a dumping place right up here at Hanover. We have one at the Boy's School. We have a major landfill down here that is the biggest polluter of all, whose leakage has something going into a pond, which then goes into the river. And then, of course, we have King William County which wants to put basically, I will call it number nine on the river. Henrico County has, someone here mentioned before, asked Hanover and wrote a letter to Jack Berry and if anybody denies this in this County, I've heard somebody deny it before, I will call them a liar to their face. Henrico County asked Hanover in three different letters and we ignored them all...how much capacity do you need? How much capacity do you need? Third time...Hanover, we've written to you, we need to know how much capacity do you need because we are doing our plant and we want to know so you can join in with us. Well, the third time Mr. Berry, former County administrator, wrote a letter back and said "well, we're gonna build our own plant." Now, Louisville landfill, Kentucky's sewage plant had a major accident and had all sorts of stuff from their sewage plant dumping into the river. Jacksonville, from fifty years of major problems, was just written up in a recent story in the *Richmond Times-Dispatch* from

dumping down into their river down in Jacksonville; they are having major problems and trying to come up with solutions to cure it. As we all know, there's a movie out today and it's called "A Civil Action," now that's not quite this because that involved TC being dumped on lands by two major companies. But now, because nobody from their State Water Control Board checked their wells or anything, many, many, many children died from leukemia. Now they're involved in like a seventy-two million-dollar cleanup. I would advise you to read the book rather than seeing the movie because there are many, many, many facts in that book and lots of technical stuff. My next point that I would like to address is, I just find it reprehensible that this County is going over these people's land which they have been good stewards for...they have no right of way and this County has applied for permit on somebody else's land without working it out or even asking anyone else in the area if they'd like to have a sewage dumping line on their property. In some places in this river when I've gone fishing down and I've put in down here at 301 and I've canoed down, there are many, many, many places where I've actually had to get out of the canoe and, you know, just let it float on by because with the weight in it, and it's not that I'm not so overweight, it's just that the water is only like this tall and of course the draft on the canoe is deeper than that. So, the water on the Pamunkey River, is so low during the summer time that I'm just questioning, with all of the plants up river dumping into this Pamunkey, how are we gonna have another one down here and I love the man's point about the Veatch ball because I put in one day at Mattiponi and I rode the current out and I got to a certain point and I was watching one piece of wood and it was sort of like going long with me as I was fishing and doggoned if that piece of wood didn't come back and ride back up in the tide. So, if we dump into this river, won't we be having effluent go down a certain place and then, when the tide comes back, I know it's mixing, however I don't think it's mixing to that point, then it'll come back and of course we're gonna dump more into there. Also, we're talking about testing daily. King George County, right now, Senator Bill Bolling of Hanover County has requested that King George landfill, which has been violating their dumping regulations and no one has been watching them...he wants an investigation into that and I think that that probably falls under the bailiwick of DEQ. So, if we can't watch how many dump truck loads and truckloads of trash are coming into King George landfill, and I don't know all the facts about that...I'll admit that. I only know what I've read in the paper today and read on the news. Then, if somebody isn't watching them then how do we know some accident can't occur over here? Also, I mentioned about how this Pamunkey River's affected by our own dump. Hanover County has had violations on this. Dr. Carter, who owns a pond adjoining the dump, has said his pond has been ruined. A spring at Portland Farm has been totally ruined, and of course we know that leakage has been running all over the place up here at any different time. And as far as I am concerned...don't swim in any open waters. Well I can tell you if you add another, and another, and another, and another effluent dumping ground on the Pamunkey River...we won't be able to do anything, because the smell will

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be just as bad as it was up there on the South Anna River. And what I'd like to do right now is I'd like to have everybody in this audience who is against this and having this point come out right there, please stand and let's just show these people...and I think that's pretty interesting. *(let the record show that most of the people in the room stood at that point)*

Dale Taylor.

My name is Dale Taylor and I live in the Beaver Dam district. I will be short because I've already questioned and addressed most of my thoughts, but I do applaud what Mr. Broaddus said, because I've stood at this podium before and literally begged this County to be thorough and accurate and go slow and make sure that you have the best information that you can get before you put something like this in the works. And I think the philosophy in this County is "if we can get it on the agenda quick enough and if we can ram it in, and do an end run around people, nobody will have the time to react." And I think that's exactly what happened to your family and it's happening all over this County but this is egregious situation. And I also want to follow up on what Ms. Shapiro said about just how long will DEQ take to react once there's a problem and you have you do an evaluation. How long is this gonna take? How many plants have you shut down or said no go until you get this straight? It's been my experience that government and DEQ, and certainly the County, is not going to do anything to hurt its own self. So, I think all of these things that you've heard today are very important and I don't live in site of this but I do know where this County's heading and it's in a bad direction.

J.J. Markow.

Mr. Van Auken and members of DEQ, ladies and gentlemen, I appreciate Mr. Van Auken you putting the Russian connotation on my name. It's not Markoff, It's MAIR-KOE. I guess I'm basically here to sort of underscore some comments that have already been made. Those, I guess, start with Mr. Hodges, with all due respect to Mr. Hodges. His job is to be the point man for the County and more or less like when you have a presidential debate and after the debate you get those spin doctors out there in front of the press and "well, you know it went this way and this guy really looked good this way and we did all the right things," and I've had the benefit to sit on this side of this dais as far as on the other side and it is not true that the County has not had any other alternatives. When I was on the Board, there were requests from Henrico County for us to go in with them again like Ms. Ostergren reiterated with Mr. Berry. How much do you need? How much capacity? They already were serving us through their plan and then to Richmond through their pipelines. We always talk about reasonable cooperation in the paper...staff comments, the Board of Supervisors comment about regional cooperation. But the only cooperation is when we have to spend

taxpayer dollars for economic development. This is the type of thing where we ought to have reasonable cooperation, these huge capital infrastructures. Also, I believe that the DEQ should look upon Hanover County as, because they are the regulating agency just the same as a parent looks over a child when the child behaved and wants something, they're rewarded; when they're not behaving, they don't get the reward. And what I'm speaking of, is I think you folks should look at the track record of this horrible, horrible manner of handling the landfill. Now it's been there, ever since it's been permitted in 1979, there have been state and federal violations virtually every year. Mr. Seeley, I wanna point out that earlier in the comments before the program started you made a comment that "well, they'll test everyday," well, I'll assure you that *that* won't be the case. If history serves us correctly, "history is our teacher," is what Patrick Henry had to say. And, I can tell you this...that you can look at the records of the landfill and you can see there have been years where monitoring of the wells has gone absent and has not been reported. DEQ did nothing about it. The County did nothing about it. They violated state, federal, and local laws. I've found local violations of trash, of pilfering, of sediment, of erosion...it just goes on and on and to say because of that track record you should allow them to reward them by allowing some more discharges into the river. It's beyond me that there are alternatives...Richmond, since Henrico has its own, I'm sure Richmond has some capacity. Again, regional cooperation...and I know these are tough decisions for you folks because this is primarily a political decision. As political Republican parties head up the state agencies, head up the state government, you folks work for the Republican governor, the Republican majority, the Republican co-chair in this County; but I hope that won't be the case. I hope that you'll be able to take your courage and do what is really right. Thank you.

Erika Shriner.

Hi, my name is Erika Shriner. Governor Gilmore has said that water quality is the number one environmental priority. He proposes spending 48.3 million of our tax dollars, cleaning up our rivers. Given the importance of clean water, and in light of the problems of water pollution in our state, we hope that you'll look very critically at this project. Incomplete studies, hypothetical models, and estimates are exactly what got us into the problems we face today with our rivers. Very sadly, Hanover County has not proven itself to be environmentally responsible. As Chip mentioned, the County currently operates a landfill, which is not in compliance and poses a serious problem to the health of both people and wildlife. The problems of the landfill have been allowed to continue, even though our County officials brag each year about a budget surplus. Earlier, one of you gentlemen said that we would have no problems if operated in accordance with this permit. Well, currently we're not operating in accordance with permit at our landfill and many of us residents feel very nervous about this being our only safeguard. In a completely rational world, this request would be turned down. We would not

allow, as rational men and women, this County to undertake a very environmentally sensitive project until they had shown both the willingness and an ability to operate existing projects within compliance of the law. I, as just one citizen of Hanover County, would like to apologize to the Broaddus family. I am ashamed of what we are doing to this family. I'm ashamed of what we're doing to the environment. People who are trying their hardest to keep land open, to keep it well operated, to keep it environmentally respected are being harassed by this County... and that's sad and I do apologize, and I think the vast majority of the other members of this community would do the same given the opportunity. Thank you.

William B. Ellis:

Thank you Mr. Van Auken. My name is Bill Ellis. I'm an attorney from Richmond and I'm here tonight speaking on behalf of Francis Crutchfield, one of the owners of New Castle Farm. I guess, by now, you all know that New Castle Farm is on the banks of the Pamunkey River, near the US route 360 bridge. It's the site of the proposed discharge. I intend to file some written comments and so I will not, I hope, go over your time limit tonight. But I do wish to emphasize three points and I certainly appreciate the opportunity to do so. The first point that I wanna make is that the County has not really provided the kind of sufficient information that I think you and the other Board members will want before making a decision on this matter. There are several examples of this, I think, but tonight I'm just gonna focus on one. The Natural Heritage Division of the Virginia Department of Conservation and Recreation has said that there is a high probability that three rare mussel species inhabit the stretch of the Pamunkey River where this discharge will be going. In addition, a 1993 Master's thesis by a fellow named David Michaelson from Virginia Tech indicates that the federally endangered dwarf wedge mussel historically has occupied this portion of the Pamunkey River. Now these things aren't really surprising. When you step back for a moment, you realize that the Pamunkey River is of course one of the cleanest streams left in Virginia...and, in fact, probably on the east coast. Mussels certainly need very clean water to survive and thrive. And what we have found is that as streams like the Pamunkey become polluted, even within existing water quality water standards, that mussels are becoming increasingly rare. And I think what that says is that water quality standards have not been set sufficiently to protect organisms like mussels that are and have been out there in the water body using it and yet, of course, we know that they should be. Now despite the probability that rare mussels are out in this stretch of the river, it is my understanding although I heard something different tonight...that Hanover County has not performed any fieldwork that had a credible chance of discovering those mussels. I've arrived at that conclusion after talking to Professor Neves, at Virginia Tech, also with representatives at the Natural Heritage Division. And after sending two Freedom of Information Act requests to

Hanover County, and the other to the Department of Environmental Quality. Although, any reports on mussels would have been within the scope of what we requested, no reports on mussels were furnished to us. And I conclude that either it hasn't been done or it hasn't been done in such a way and in such a time that it could produce meaningful results. According to Dr. Neves, a noted mussel expert, mussels burrow into the bottom sediments of rivers during the winter months, and if you go out there and look for them during the winter you're not likely to find them. To be credible, a mussel survey must be done in other times of the year and I ask that DEQ postpone action on this application certainly until it can perform an adequate study to determine whether or not mussels are in fact there...whether the existing water quality standards are really sufficient to protect them, which I think is a doubtful proposition. And, of course, if existing water quality standards aren't adequate, if I understand right, for the basis of the permit as it has been projected thus far...it's been assumed that achieving water quality standards would achieve a suitable level of water quality in the river...that may well not be the case. The second point I want to make tonight is that Hanover County has not yet applied for, much less obtained, a permit that it will require from the United States Army Corps of Engineers for the reiteration structure and outfall associated with this project. Now, I'm aware that ordinarily that's not a great problem. The Corps has nationwide permits and usually they can be applied in situations like this. However, that's just not the case here. The reason, I think, one of the reasons is because of the unique historical significance of New Castle Farm. And also, a federal law known as the National Historic Federation Act. As you may know, the Corps of Engineers is required by that act to take into account the impacts of federally licensed projects on historic resources. And because of the unique historic resources in this case, it's simply not going to be available to Hanover County to rely on a nationwide permit. They will have to pursue the individual permit process and go through the section 106 Historic Resource Review with particular reference to the unique resources that are on this property. That can be a very long process; I've been through it several times and I can speak from experience. Now, I said this property was historically unique. What's so unique about it? Well, a portion of the property is not merely eligible for listing on the national register; it's actually on the national register. The Town of New Castle that we've heard about is a listed Virginia Historic landmark. There may be other resources. Tonight, I'll spare you the history of New Castle town. Suffice it to say, I think that it has played a unique and pivotal role in Virginia history and at one point came within two votes of being the capitol of the Virginia colony. It's where Patrick Henry, in 1775, rallied volunteers to go march on Williamsburg and protest Governor Dunbar's seizure of the colonists' gunpowder. And now, this is the spot where Hanover County has proposed to discharge its treated sewage. This heritage may be an expendable resource to Hanover County. The Corps of Engineers doesn't have that luxury and I think that this site is probably for that reason, not permissible through the Corps of Engineers. What Hanover County is asking you to do is to

go forward with the evaluation of a discharge location that they haven't obtained a permit for from the Corps, and more importantly that they probably can't obtain a permit for from the Corps. Now, on the third point I want to make...is that the County has manipulated the proposed discharge location in a way that I think you should be aware that I hope DEQ will not wish to participate in. Originally, as Mr. Hodges indicated, the County had proposed to locate this discharge across the middle of New Castle Farm. That was absolutely the worst location as the County itself determined that it could have been put on the farm. And the County performed a study. They visited the farm. They ranked potential discharge locations according to a number of factors...the most important, of which, were water quality, historic resources, and damage to New Castle Farm itself. According to the County, they also considered matters of safety, access, cost, and wetland impacts. And, after considering all those factors, they came to the conclusion that a discharge location some four thousand feet downstream at site called "Downstream 2" was a demonstrably better solution. And, they said, superior in terms of water quality. Now, I'm not saying that that downstream site is without problems; it does have problems and they are not acceptable to the owners of New Castle Farm. But what happened, is that when the owners of New Castle said so publicly, the County officials responsible for this application did an abrupt about-face and they've now asked you to return to the original discharge site in spite of the fact that they've acknowledged that it's an inferior location. Now why do you think they've done that? Well, after examining the evidence, I've arrived at my conclusions and I want to announce that today I've filed a legal action in Federal District Court against the irresponsible officials of Hanover County who have engaged in this behavior. The suit alleges that the abrupt return to the original discharge location was an intentional effort to punish and intimidate the owners of New Castle Farm for exercising their constitutional rights to oppose the County's plans for their property. I intend to prove those allegations and I intend to collect both compensatory and punitive damages against those responsible. Now, to summarize this point, the County officials are attempting to abuse your board. They are asking you to participate in using these proceedings as a vehicle for punishing dissent and intimidating landowners in the County. And my sincere hope is that you won't allow that. On behalf of Mrs. Francis Crutchfield, I ask that you either deny this application outright or postpone consideration of it until the County has performed a complete assessment of the necessary information that you require and its obtained federal permits that it will need. Thank you very much, I appreciate it.

Darrell Hicks:

—People say I do not know much about the environment—cherry trees I had are called "the early Richmond," they're at Sunrise House. People try to pull them up early but they seem to come back each year. And in Tennessee, they had a -- — which it stood its own ground for many, many years. —in the

Philippine Islands and then in Vietnam. We were— on medicine—dioxin— people think that the Agent Orange was the dioxin—but—was the environment. It affected human eyesight. —question may ways my eyes are 28 over 100. The only knowledge I had of that— 1226, let's see —we sat and held a man's head, he's going to heaven—been shot in the head—Ten minutes later, he held another man's head. You can only —to the people that were called a suicide— this guy flew a Navy plane Marine Chopper's friend to keep on—dioxide. So, at Sunrise House, they have—got my name written on the stall. I do ask to be exempt from the legal procedure — and I get social security, you know, the kindness of the country. The papers I have with me—Bill Bolling, in Richmond they call him Senator — In Washington, they call him "miracle worker," because the money comes from international monetary sorts that they try to give to Korea —North Korea—they tried to give the money to Brazil—they take a wheelbarrow of money—American dollar—Honorable—came to Sunrise House on Labor Day of 1995 and —saw him yesterday. I voted in that district in 1994, unfamiliar with honorable people and I just—Honorable Bill Bolling— Thank you—Honorable—Honorable Bill Bolling—did not receive a response—Thank you very much. God Bless you each and everyone.

G. Warren Cook:

(Written statement. Did not testify)

Orville L. Cole:

My name's Orville Cole. I live on the Pamunkey River and we've owned this place since about 1951. A thing you might wanna put down in your books, which doesn't come up in a lot of your studies, that this water in the summer time when you get the least amount of rainfall like we did this year. This water gets up to about eighty-seven degrees and with the bacteria that's in the water and what your opposing dumping in the water is gonna have a big effect, not because of the amount you're gonna be putting into it, it's because of how fast it will grow. Now, I know by most answers if you take your swimming pool outside and I tried to do it one time....I pumped the river water into it and you get algae real quick, so I know how fast things will grow in it. This is one thing I was real puzzled...if you dump five million gallons in, it reaches two thousand, one hundred meters downstream before it gets fully mixed. That's on the outgoing tide and then on the tide coming back is gonna bring that same mixture back to a point where it's going to be half mixed on the incoming tide because it moves half the speed than it does going out. And in between the two tides, you get a still tide...which it doesn't move at all for about ten minutes. So, during this time, you've got a turmoil of water. So, like I say, I live in this area and about two hundred yards from where you're dumping it at, on the incoming tide, you can stand in the middle of the river on low tide and your chest is not going to get wet. And on the

downstream side of it, is where all the water sand sediments set at. Well, the sand is a nice deterrent, you know, for little shell life and everything else but that's where the rock fish like to lay their beds and —out their eggs and everything and they look for that sand bed. Like I said before, you know you can go down there while they're ponding and that river will be full of rock fish and I'd hate to see that change. And, if you put a ten millionth gallon down there, it's gonna reach my house before it ever mixes. That's all I've got to say. (*How far is your house?—*)

Bob Branner:

Good evening. I'm Bob Branner and I'm a resident of the Henry District in Hanover County and I serve as President of the Patrick Henry Concerned Citizens Association. We concur with the views expressed by others here tonight that the solution to this problem is to put no pollution in the Pamunkey River. By Hanover solving its sewage treatment problem requirements on a reasonable basis with neighboring jurisdictions. This was the original recommendation of a Citizen's Commission appointed to look into this matter some years ago. We never heard, I never saw a report from that Commission. We heard little or nothing of this Commission's report. We heard only of a very illogical sequence of negotiations with Henrico, by a Hanover County administration that did not indicate a valid bona fide attempt to successfully arrive at a mutually beneficial arrangement for the metropolitan area sewage requirements. Citizens' groups substantially confirmed this by presentations at a public meeting, at Lee Davis, on this project. Not only as to the real need for a plant in Hanover, but also as to the end bottom line cost. Patrick Henry Association suggests again a joint citizen, County, administrative task force be established to realistically study sewage treatment on an effective, reasonable basis and that the construction of the Hanover Treatment Plant be held in advance by holding up a permit... relieving the Pamunkey of this potential pollution and all the interests of an associated negative impact. And I thank Mr. Hodges as my good friend, now director of community relations, I think this would be a good job for him to undertake. Thank you.

Kevin Damian:

I agree with a lot of the higher speakers. One thing I do have to say is my father-in-law, of course, is a retired oceanographer, and he was employed for most of his career at the Virginia Institute for Marine Science. One thing I do know is that shellfish, of course, are filtering animals and they can tell us all kinds of things and it's not hypothetical. Shellfish, as I say, they bury in the sediment and they would be the best determining factor on long term and even short term effects of situations where what we're looking at tonight. I agree with Ms. Shapiro, that we need to have some kind of baseline. I believe it when the study that was done by

—By Dr. Albert —was not done, it was just done like hypothetical with figures from other areas. I really think that if you're going to discharge effluent all year long, that you should do an all year study to get a baseline idea of what affect you will have on this river. That way, there, you take into account low water, high water, slow water, cold water, warm water, and you can actually judge, of course, by these shellfish their reactions to what happens. My concern also is what will happen downstream to the saltwater shellfish when the salinity level decreases...that, along with parasites, which is a more or less an indirect result of lack of salinity is the reason that the oyster population in Virginia is about devastated...I mean, there's so few grounds that are productive and that they're even allowed to be fished. I would also like to know what kind of documents were used to determine the criteria on the effects on the environment. I read in the paper only yesterday that Goochland is seriously considering building its own wastewater treatment plant for use for West Creek and if that does in fact occur, it would allow us even more consideration for regional cooperation. I would just hope that the DEQ would delay the issuance of this permit to allow further baseline studies so that we can honestly know what effect we will have on this river, because there's no turning back. The other, and the final thing I'm concerned about is the use...the medical waste and also the heavy metal that's usually associated with industrial waste. I understand and I'm not an engineer but I understand that there's a special whole other process in a separate system, if you will, that actually deals with the industrial waste. Heavy metals, naturally, will settle once...I assume that we use an extraordinary amount of water in this process and naturally, the metals are suspended. However, once they get into the river, to slow water and whatever effects the environment will have, they will eventually settle. What happens then, once they're in the sediment, they don't go anywhere unless they're dredged up. Thank you very much and I hope you'll consider delaying this permit issuance.

Jane Osby.

I know very little about this but I talked with a friend today who has done quite a bit of study on the wastewater treatment plant and she came out of the hospital today and couldn't be here tonight...but one thing she made me aware of is plant failure and I never even stopped to think about plant failure before...didn't even realize that these plants failed but what I was told was when mechanically the plant can not handle treatment and it has to be shut down, that raw sewage is dumped into the river. I just can't believe that *that* would be done, but then I know she knows what she's talking about and so these water quality standards that we say are sufficient...surely they're not sufficient for these type of incidences, I wouldn't think. And, if they...what I'm thinking is these finicky mussels that we've been hearing about all night tonight, somebody said that they're already endangered...how long are they gonna be in our clean Pamunkey if this is the way plant failure is handled and are there any choices? Thank you.

Ms. Lowery:

I wanted to thank Mr. Makow. I have one general statement to make (now I'm yelling). This Hanover County had a Natural Resources and Environmental Committee, which operated, thanks to Mr. Markow and others on the —Board. The committee served ten....twelve years giving, I think, very studied responses to problems. It became evident, perhaps under my supervision, it became evident that we were not going to become rubber stamp committee any longer. Guess what? They demolished the committee. So, therefore, unfortunately, we have had no comments to make in this particular environmental problem. But I can tell you we would have and I'm not gonna bore you with the long list of things that we did work on, but we did work on them. Georgie, how many were turned down by the Board? Everything? Maybe not everything. But, again, we were not a rubber stamp committee and it was much easier to get rid of us. I think that's a general comment. Any questions? I guess not.

Kathy Cabe:

My name is Kathy Cabe, I live in Beaver Dam, Virginia which is a long way from where they're planning on putting this in and I would just like to address you gentlemen since you are not knee deep in the intricacies, hopefully, of Hanover County politics. And just say that it breaks my heart that this family has to hope for a rare mussel somewhere in that river, to save them from the bulldozers. There is something wrong with this. There is something wrong. This family has been harassed that they had to hire attorneys; they had to hire them before when the County wanted to put an off water storage basin. Now, if they couldn't get the water off river water storage basin, well we'll just run sewage through there. There's something wrong with this picture and I hope that the DEQ, since quality is in your name, that you will take quality of life for this County family who have been wonderful stewards of this land, into consideration when you are making your decision. The citizens of Hanover County stand up with this family and say, "we don't want this."

Tom Van Auken:

Thank you. This hearing is closed.

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JOINT BRIEF APPENDIX TABS

1. FINAL PERMIT
2. FINAL FACT SHEET
3. STATE 1995 D.O. STUDY REPORT DATED MARCH 19, 1996
4. "10-10-3" RELATED MEMORANDA
 - A. March 9, 1987, Memorandum from A. J. Anthony to L. G. Lawson regarding "Advisory Notification of Effluent Limits for Swamp and Marsh Waters"
 - B. April 15, 1992, Memorandum from Curt Linderman to File regarding "New Kent STP Effluent Limits:
 - C. May 27, 1994, Memorandum from C. Linderman and J. van Soestbergen to Diane Osborne regarding "Parham landing STP Proposed Discharge"
 - D. March 26, 1997 Memorandum from Jon van Soestbergen to Curt Linderman regarding "Results of Stream Sanitation Analysis and Effluent Discharge Recommendations King William County Sewage Treatment Plant Discharge (VA0088102) Discharge to Moncuin Creek (8-MNQ003.88")
5. SUMMARY OF COMMENTS AND RESPONSE TO COMMENTS
 - A. March 3, 1999, Memorandum from Gerry Seeley to Members of the State Water Control Board regarding "Totopotomoy Sewage Treatment Plant - VPDES Permit"
 - B. January 19, 2000 (Should be dated January 19, 1999), VA0089915 Totopotomoy - Public Hearing Comments
 - C. February 4, 1999, Hanover County's Response to Public Hearing Comments regarding Wastewater Treatment Plant - VPDES Permit VA0089915"
6. AGENCY COMMENTS AND HANOVER COMMISSIONED MUSSEL STUDIES
 - A. June 3, 1998, Letter from W.S. Shaw, Engineering Field Director, Office of Water Programs (DOH) to J.R. Bell, Jr., Regulatory Services Supervisor (DEQ) regarding "Hanover County. Totopotomoy STW VPDES Draft Permit"
 - B. July 20, 1998, letter from W.S. Shaw, Engineering Field Director, Office of Water Programs, (DOH) to J.R. Bell, Regulatory Services Supervisory (DEQ) regarding Hanover County Totopotomoy STW VPDES Draft Permit (2nd and 3rd revised drafts)

- C. July 31, 1998, letter from Bernard J. Grace, Environmental Engineer (EPA, Region III) to M. Dale Phillips, Technical Services Administrator (DEQ) regarding reissuance of draft VPDES Permit VA0089915 Totopotomoy WWTP,
- D. November 6, 1998, letter from Robert C. Singleton III, Environmental Engineer (EPA, Region III) to M. Dale Phillips (DEQ) regarding reissuance of draft VPDES Permit VA0089915 for Totopotomoy WWTP, Hanover County, VA
- E. January 6, 1999, Memorandum from Katherine Barrett (Richmond Regional Planning District Commission) to Allan Brockenbrough, II (DEQ) regarding "Environmental Review and Comment of the Totopotomoy WWTP, Proposed VPDES Permit Issuance Public Notice (VA0089915)
- F. January 20, 1999, letter from Steven Herzog, Utility Engineer (Hanover County) to Allan Brockenbrough, II (DEQ) regarding Public Hearing (January 19, 1999) comments on draft VPDES permit
- G. February 4, 1999, letter from Raymond T. Fernald, (Department of Game and Inland Fisheries) to Allan Brockenbrough (DEQ) regarding Department's comments on draft VPDES permit for Totopotomoy Creek Wastewater Treatment Plant
- H. March 11, 1999, letter from Karen L. Mayne, U.S. Department of the Interior, Fish and Wildlife Service, to Mr. Allan Brockenbrough (DEQ) containing comments regarding freshwater mussel survey report dated January 12, 1999
- I. March 29, 1999, letter from Robert C. Singleton III (EPA, Region III), to M. Dale Phillips (DEQ) regarding issuance of the draft VPDES Permit VA0089915
- J. April 27, 1999, letter from J.R. Bell, Jr. to Karen L. Mayne (U.S. Fish and Wildlife Service)
- K. May 11, 1999, letter from Karen Mayne (U.S. Fish and Wildlife Service) to Steven P. Herzog (Hanover County) regarding U.S. Fish and Wildlife Service recommendations for an additional survey for the dwarf wedge mussel
- L. June 3, 1999, letter from Karen Mayne (U.S. Fish and Wildlife Service) to Philip Stevenson (Creek Laboratory) regarding recommendations for an additional survey for the dwarf wedge mussel
- M. August 30, 1999, letter from Ronald L. Taylor (Hazen and Sawyer) to Karen Mayne (U.S. Fish and Wildlife Service) enclosing the additional mussel survey for the Pamunkey River in the vicinity of the proposed discharge for the Totopotomoy WWTP
- N. September 8, 1999, letter from Karen Mayne (U.S. Fish and Wildlife Service) to Ronald Taylor (Hazen and Sawyer) regarding their review of additional mussel survey (dated August 19, 1999)

7. SWCB MEETING TRANSCRIPT AND MINUTES

- A. March 11, 1999, Minute No. 11, State Water Control Board Meeting, regarding the "Proposed Issuance of Permit No. VA0089915, Totopotomoy WWTP, Hanover County"
- B. March 11, 1999, Transcript of State Water Control Board Meeting, "Discussion - Totopotomoy WWTP, Hanover County"

Presentations

● March 12, 1997- Presentation of Site
Selection Study

● March 25, 1997 - Public Information Fair

June 5, 1997 - Public Hearing -
Planning Commission

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Presentations

- August 12, 1997 - Public Hearing - Planning Commission
- August 27, 1997 - Public Hearing - Board of Supervisors
- September 15, 1998 - Public Information Fair
- January 12, 1999 - Public Information Meeting

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III. 1990 CITIZENS ADVISORY DRAFT REPORT, WITH STAFF COMMENTS

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Hanover County is proposing to construct a modern wastewater treatment plant north of Pole Green Road just west of the new East End Park. The County has received many questions from Citizens about the proposed facility. This is the third in a series of columns aimed at answering some of the frequently asked questions about the project.

In August of 1990, a "Citizens Advisory Committee on Wastewater Alternatives" prepared a draft report which was presented to the Board of Supervisors. The report made seven specific recommendations. Several citizens have asked what steps the County has taken to implement the recommendations of this Committee. Following are the seven recommendations of the report followed by a status and a summary of the actions that the County has taken in response to the recommendations:

Recommendation 1:

Current sewage treatment capacity will probably be exceeded in the year 1997. Planning should be tailored toward bringing additional capacity on line by that date. The Board should insist on a "Wastewater Plan" from the County Administration by December 31, 1990.

Status:

Accomplished.

Specific Actions Taken:

In 1995, the County successfully negotiated a contract with Henrico County to formalize our rights to the initial 3.7 million gallons per day (mgd) of capacity and to ultimately increase our sewage capacity to 5.4 mgd. This additional capacity will be paid for in July 1997.

In July 1990, Black and Veatch completed the report "Hanover County, Virginia Wastewater Alternatives Study, Interim Report". In 1991 a draft, and in 1993 the final Executive Summary for this study were submitted to the County. This study outlined a plan for meeting the future wastewater treatment needs of the County.

Some of the conclusions of this study are:

1. "The only viable location for treated wastewater discharge (other than the James River via Henrico Regional WWTP) is the Pamunkey River."
2. "Discharge to the Chickahominy River via Newport News tertiary treatment is not viable."
2. "It is highly doubtful that Henrico County would accommodate wastewater flows exceeding 5.4 mgd from Hanover County. This is due to significantly increased costs for increased capacities and due to high growth needs for themselves."

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06/27/97

3. "A wastewater treatment plant in the Totopotomoy watershed makes the most sense for wastewater collection, disposal, and reuse. Also, sites are more available and the area is less congested. A plant site near Route 615 is more efficient than a site near Route 643. Sites further downstream of Route 615 are impractical due to very limited projected growth in these area(s)."

Recommendation 2:

Hanover County should immediately negotiate a formal wastewater treatment agreement with Henrico County as soon as possible for existing treatment requirements (3.7 MGD) and begin formal discussions for an additional 1.7 MGD capacity. The preferred option for additional capacity is to develop a multi-jurisdictional, bio-regional solution with adequate safeguards to protect Hanover County's interests.

Status:

Accomplished.

Specific Actions Taken:

Hanover has formalized its agreement with Henrico County and obtained an additional 1.7 mgd capacity for a total capacity of 5.4 mgd. This was all the capacity that could be negotiated from Henrico County. While making plans to construct its own wastewater treatment plant, Hanover County has continued to explore the regional option of obtaining even more capacity from Henrico County. To date, Henrico County has not indicated that it can commit to the additional capacity needed to meet Hanover County's future requirements.

Recommendation 3:

The method of sewage treatment for additional capacity, based on current technology, should be the conventional activated sludge process. Phosphorus and/or nitrogen removal may also be required, depending upon the receiving stream. Industrial reuse and land application of treated water should be incorporated into the planning and design of treatment facilities. In addition, a septage (material pumped out of septic tanks) disposal system should be provided for in the facility design.

Status:

Pending.

Specific Actions Taken:

The proposed Totopotomoy Wastewater Treatment Plant is planned to be an advanced activated sludge wastewater treatment plant with nutrient removal (phosphorus and nitrogen removal). The facility is planned to be designed to allow the reuse of the treated effluent, with minor modifications to the plant, for irrigation. However, there are no current plans to use the treated effluent in this manner. In addition, a septage disposal station is proposed to be located at the plant to treat septage removed from septic tanks.

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Recommendation 4:

Growth should continue to be managed through adherence to the comprehensive plan and periodic updates, zoning, and sub-division ordinances. Incentives should be instituted to support efficient utilization of wastewater treatment capacity. The incentives should direct growth into urban areas, slow growth in rural areas, and, maximize connections to the public system within the urban service areas.

Status:

Accomplished and on-going

Specific Actions Taken:

The County has continued to implement its phased growth management plan as set forth in the adopted Comprehensive Plan to concentrate growth in the Urban Service Area and maintain the rural character of areas outside of the urban service area. Significant Comprehensive Plan updates have occurred in 1982, 1988, and 1994, re-adopting this concept. Revised updates in the Zoning and Subdivision Ordinances have also occurred. Most recently, comprehensive rural strategies were adopted by the Board of Supervisors that substantially increased the lot size and reduced the density by over one-third in the A-1 district. The AR-6 and Rural Conservation Districts also help preserve the County's rural character through incentives for open space and design standards. A major component of the site selection criteria for the proposed wastewater treatment plant was adherence to the County's Comprehensive Plan which calls for a plant close to the urban service area so as to limit urban growth in the eastern portion of the County and keep Studley, Old Church, and Black Creek rural.

The County adopted a Comprehensive Water Conservation Plan in 1993. As part of this plan, the County instituted a water conservation rate which increased the charge for users of more than 15,000 gallons per bi-monthly billing period to encourage effective utilization of the County's resources. The County has encouraged existing residents and businesses to connect to public facilities when they become available by providing a 50 percent reduction in the capacity fee when water or sewer initially becomes available adjacent to a property.

Recommendation 5:

A County wide mandatory five year cycle of septic tank pumpout and the adoption of a user fee to cover the administrative costs should be considered. In addition, the County should consider establishing a minimum separation distance of 24" from the bottom of drainfield trenches to the seasonal water table. Based on current technology, any new septic systems that can not meet the 24" separation requirements should be of the Wisconsin Mound design.

Status:

Partially accomplished.

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Specific Actions Taken:

The County's Chesapeake Bay Ordinances, adopted in 1992, require that septic tanks in the County be pumped out every five years as recommended in the Citizens report. The Virginia Department of Health regulates the design and construction of drainfields and generally requires 12" of separation between drainfield trenches and the seasonal water table. This may be increased or decreased based on the percolation rate of the soil. The County has not adopted any ordinances requiring increased separations between drainfield trenches and the seasonal water table.

Recommendation 6:

The sewage treatment plant location that takes into consideration most of the objectives of this committee (cost, reuse, location, and, regional approaches) is one on the Chickahominy River. Discharge of Hanover County effluent in the Chickahominy is a form of water reuse, since it is eventually the water supply source for Newport News. Newport News is currently investigating increasing water withdrawals to meet short-term needs. They may be interested in cooperatively constructing, operating and maintaining advanced wastewater facilities for treatment of all of Hanover's wastewater, if the treated effluent is discharged into the Chickahominy increasing their water supply.

Status:

Investigated. Not feasible.

Specific Actions Taken:

In its 1990 draft report and 1993 final report, Black and Veatch states that in order to have a discharge to the Chickahominy River "In essence, Newport News would have to agree with reuse of Hanover County treated wastewater. The possibility was explored and initially appeared possible. However, Newport News is currently pursuing a water supply plan that would eliminate any need to reuse treated wastewater as a supplement to its water supplies. Accordingly they are not currently interested and approval for a discharge into the Chickahominy River is very doubtful." The County has had additional contacts with Newport News since the report was issued and the City's position has not changed.

The Hazen and Sawyer report "Water Reclamation Facilities Alternatives Development Study" dated December 1995 also evaluated the feasibility of a Chickahominy discharge and concluded that "Of the alternatives considered for receiving discharge from a new, wastewater treatment plant in Hanover County, the Pamunkey River is the most viable alternative for both an initial plant of 5 mgd capacity and for future growth. ... The Chickahominy River has such stringent discharge limits imposed that it is not a likely alternative."

Recommendation 7:

Historically, water conservation efforts have shown that long-term real savings are difficult to document. It is felt that public education must be a component of any program. Water reuse can be a large water saving measure for industrial users. In

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addition, implementation of water rate schemes that encourage reuse and other forms of conservation are possible. The County should consider incentives to encourage reuse by businesses.

Status:

Accomplished and on-going.

Specific Actions Taken:

In April 1994 Hanover County's Building Code was amended to require the use of water conserving fixtures. The proposed Totopotomoy Wastewater treatment plant will be designed so that with minor modifications, the treated effluent from the facility could be used for irrigation purposes.

Also, as was mentioned earlier, the County instituted a water conservation rate which increased the charge for users of more than 15,000 gallons per bi-monthly billing period and the Board of Supervisors adopted a Comprehensive Water Conservation Plan in 1993 to encourage effective utilization of the County's resources.

The County has made much progress in the last seven years in evaluating and implementing the recommendations of the Citizen's committee. The proposed Totopotomoy Wastewater Treatment Plant is an important element in the County's overall plan to protect the character of Hanover while meeting the existing and future needs of its citizens. The County hopes to continue answering questions that its Citizens have about this important project in future columns in The Mechanicsville Local. All citizens are invited to contact the County if they have any questions or require additional information about the proposed wastewater treatment plant.

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XI. REGIONAL ISSUE

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DRAFT

Is a Regional Solution, such as expansion of the Henrico Wastewater Treatment Plant, a viable wastewater solution for Hanover County?

Regional utility solutions often are viable solutions and Hanover County has a track record of supporting such regional cooperation. After many years of analyzing and reviewing internal solutions to the County's water needs, the County ultimately decided to enter into a contract with the City of Richmond for 20 million gallons of treated water per day. Under the water contract, Hanover has purchased and reserved capacity to meet its long term needs. The capacity can be called upon at any time that it is needed. This regional approach was selected after evaluating available alternatives, and was determined to be a better approach than constructing water supply facilities in Hanover.

In the case of wastewater, the County originally negotiated for 3.7 million gallons per day (mgd) of wastewater treatment capacity from Henrico County, and obtained an additional 1.7 mgd as a part of Henrico County's current 15 million gallon expansion effort from 30 mgd to 45 mgd. The wastewater agreement with Henrico was reached in 1995 after over 4 years of negotiations. In addition to negotiating for the additional 1.7 mgd, Hanover has had numerous discussions with the County of Henrico concerning additional wastewater treatment capacity and sent several letters requesting that Henrico inform the County if additional capacity is available and the cost and terms of any additional capacity. Unfortunately, as Henrico continues to expand their wastewater treatment plant, the cost escalates significantly and the amount of treatment capacity is, at this point, limited. Henrico is planning another plant expansion to accommodate their own

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DRAFT

growth needs. Henrico is only 40% built-out and will ultimately have to more than double their 45 mgd plant to accommodate their own residential and industrial growth. As a result, Henrico is unwilling to commit to meeting Hanover's long-term wastewater treatment needs.

In response to the most recent letter from Hanover exploring the potential of obtaining additional treatment capacity from Henrico, Mr. Virgil Hazelett, P.E., Henrico's County Manager, responded that "The projected Henrico wastewater treatment needs will require expansion of the Henrico Regional Wastewater Treatment Facility beyond the 60 mgd originally contemplated at the Deep Bottom site." He continues later that "Since the Henrico discharge is mass limited, I am concerned that the discharge allocation may not be adequate to meet Henrico's long-term needs. Obviously, the additional allocation of capacity to Hanover would reduce the discharge capacity available for Henrico, and thus increase my concerns about meeting our own needs. ... I cannot commit to providing the permanent wastewater treatment capacity you requested, nor can I reserve capacity for your unforeseen needs." Mr. Hazelett's letter concludes that "Based on current information, I would not be in a position to recommend allocating our limited treatment capacity to Hanover. Therefore, I believe it would be prudent for Hanover to consider other alternatives to meet Hanover's long-term needs."

At this time, a long term regional solution for wastewater treatment with Henrico County is not available. We cannot use this option in our projections with any degree of certainty

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and there is no way to determine costs for this option or to complete cost comparisons since there is no offer on the table from Henrico County.

Hanover has actively sought regional solutions to meet its wastewater treatment needs and will continue to consider any available cost effective regional alternatives that meet its future needs with certainty. However, with Hanover's existing wastewater treatment capacity projected to be exceeded in 2002 we must avoid delays and take action now to assure that capacity for present and future residential, commercial, and industrial customers will be available when needed. Hanover needs a certain solution now as we are rapidly approaching the point that new capacity will be needed. Since wastewater treatment plants take a long time to build, Hanover must move forward, rather than wait to see what others in the area may or may not do.

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COMMONWEALTH OF VIRGINIA
COUNTY OF HENRICO

DEPARTMENT OF PUBLIC UTILITIES

December 21, 1995

PATRICK J. BRADY
DIRECTOR
(804) 672-4517

DEC 22 1995

Mr. Steven R. Lohr, Director
Department of Public Utilities
County of Hanover
P.O. Box 470
Hanover, Virginia 23069-0470

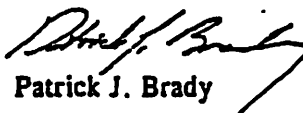
Dear Mr. Lohr:

Reference my letter of September 22, 1995, copy attached, which requested that you provide water and sewer flow projections by December 1, 1995.

Our Facilities Plan Study is underway and we request again that you provide the referenced information.

Please call me or Mr. Keith Snively, at 672-4601, if you or your staff have any questions.

Sincerely,


Patrick J. Brady

Attachment

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September 22, 1995

Mr. Steven R. Lohr, Director
Department of Public Utilities
County of Hanover
P.O. Box 470
Hanover, Virginia 23069-0470

Dear Mr. Lohr:

This is to advise that we are initiating an update to our Water and Wastewater Facilities Plans to provide for both a short and long term plan. This Facilities Plan will provide a detailed plan for water and sewer improvements through approximately Year 2010 and conceptual plan through the Year 2040.

In order to produce an accurate plan, it is essential to obtain updated projections from Hanover County so that the impact of your demands for water and sewer can be determined. Although long term projections will not be easy to obtain, they are critical to enable us to adequately and economically plan and schedule improvements. Once water and sewer system requirements necessary to supply your requested demands are determined, we can discuss the specific service requirements in accordance with our current Water and Wastewater Agreements. Failure to address your projected demands in this study could result in higher costs or an inability to provide capacity in future years.


Please provide projections for each service connection to the Henrico system on a yearly basis until the Year 2005. Thereafter, provide each projection on a 5 year basis until the Year 2040. The following information is required for each location and time period:

1. For water, the maximum day demand for a 24 hour period.
2. For water, the maximum hour demand.
3. For sewer, the average daily flow for the three highest consecutive months.
4. For sewer, the peak flow rate which is by State regulation the higher of 2.5 times the average daily flow or the observed peaking factor.

In order to promptly proceed with our study, we request that you provide the above information by December 1, 1995.

Please call me or Mr. Keith Snavey, at 672-4601, if you or your staff have any questions.

Sincerely,


Patrick J. Brady

bc: Reading File
KES/ccs

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HANOVER COUNTY

P. O. BOX 470
HANOVER, VIRGINIA 23069-0470

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COUNTY ADMINISTRATOR

RICHARD R. JOHNSON
DEPUTY COUNTY ADMINISTRATOR

STERLING E. RIVES, III
COUNTY ATTORNEY

January 16, 1996

Mr. Patrick J. Brady, Director
Department of Public Utilities
P.O. Box 27032
Richmond, VA 23273

Dear Pat:

Thank you for advising us of the proposed update on your water and wastewater facilities plan. We appreciate the opportunity to be included in the planning phase of this important project. During our recent contract negotiations we were advised that no additional water or wastewater capacity was available to Hanover County, and that discussions of additional water capacity could not be held until your new water treatment plant was constructed. We have been utilizing the information provided in Mr. Hazelett's letter of April 2, 1993, and thus have not been planning for increased utilization of your infrastructure. However, we are most interested in exploring all possibilities for providing water and wastewater services to our citizens in the most efficient and effective manner possible. We would appreciate your thoughts regarding any changes which have occurred in your ability to offer us these additional services.

We apologize for the delay in responding to this request, however, as mentioned above our planning has been focused on other alternatives. Also, as we have discussed, we have been very involved with our Richmond waterline project and the related financing as well as our water reclamation facility alternatives study. We appreciate your patience.

Attached you will find our updated water and wastewater demand projections. The water demands are based on our current plan to utilize our Richmond contract for water needs. We currently anticipate constructing a wastewater treatment plant to accommodate wastewater flows in excess of amounts contracted with you. Additionally, with the interest expressed during our last comprehensive plan update in the Wyndham/Hylas area we would be interested in learning whether in fact this area could be served via your system. During previous studies, we estimated the acreage in the Hylas/Black Haw Branch watersheds to be 4,000 acres and the peak water demand to be 3.1 mgd. This area is currently not in our proposed service area and accordingly we have no specific plans to serve this area.

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Page Two

The attachment is our total projected water demands through the year 2040. As you are aware, our contract with the City of Richmond is for a maximum of 20 mgd. We project that we will exceed that amount around 2020, and would welcome the opportunity to discuss whether Henrico County might be able to provide additional water in that time period.

We believe that there may be certain benefits to future water connections in the Creighton Road and/or Route 360 area. Additionally, upgrading of the Route 1 connection may be beneficial. All of the connections would have to be considered in accordance with our existing contract with the City of Richmond as well as your agreement with the City. As you know, we are planning to rely on our Route 301 waterline as a major transmission line for Richmond water. Any of these other connections may be considered as possible improvements, to the delivery system and as ways to cooperatively work with you and the City to meet the regions needs. We would appreciate your thoughts as well as the thoughts of your consultants regarding the benefits of further study of the connections to supplement the Route 301 line, or to delay construction of later phases of the Richmond waterline upgrades.

Hanover County is currently working with Hazen and Sawyer and Timmons to develop a definitive recommendation for wastewater treatment. It is my understanding that representatives of this consulting group have talked with you regarding possible additional treatment capacity from Henrico. Based on our numerous discussions with you and Mr Hazelett we have been laboring under the assumption that additional treatment capacity beyond the 5.4 mgd contracted amount is not available. However, if there is any possibility of allocating additional capacity to Hanover, we would be most interested in estimates of the costs and capacity limits. This is an alternative that we are interested in exploring and would appreciate input so that we may proceed with our wastewater planning.

The wastewater projections are calculated in conformance with our current contract and are based on a rolling 90 day average. Please do not hesitate to contact me to discuss our projected needs further should you have any questions.

We sincerely appreciate this opportunity to participate in water and wastewater planning for the mutual benefit of the two jurisdictions. This is one of many examples of regional cooperation that ultimately makes the area a better place to live. We also appreciate your cooperation regarding our Richmond water line and your involvement in your boards resolution supporting our efforts. Again, thank you very much for your cooperation.

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Page Three

We sincerely appreciate your continued assistance and your patience in awaiting this information. We would appreciate the opportunity to meet with you and your consultants to discuss these matters further.

Sincerely,

DEPARTMENT OF PUBLIC UTILITIES



Steven R. Lohr
Assistant County Administrator

/bjc

WATER AND WASTEWATER DEMAND PROJECTIONS
HANOVER COUNTY DEPARTMENT OF PUBLIC UTILITIES

Water Demands by Delivery Point (in gallons)

Year	Route 1		Route 33	
	Max. Day	Max. Hour	Max. Day	Max. Hour
1996	250,000	120,000	750,000	78,000
1997	250,000	120,000	750,000	78,000
1998	250,000	120,000	750,000	78,000
1999	250,000	120,000	750,000	78,000
2000	250,000	120,000	750,000	78,000
2001	250,000	120,000	750,000	78,000
2002	250,000	120,000	750,000	78,000
2003	250,000	120,000	750,000	78,000
2004	250,000	120,000	750,000	78,000
2005	250,000	120,000	750,000	78,000
2010	250,000	120,000	750,000	78,000
2015	250,000	120,000	750,000	78,000
2020	250,000	120,000	750,000	78,000
2025	250,000	120,000	750,000	78,000
2030	250,000	120,000	750,000	78,000
2035	250,000	120,000	750,000	78,000
2040	250,000	120,000	750,000	78,000

Wastewater Demand by Collection Point (in Gallons)

Year	Avg. 3 Highest Months	Peak Hour(2.5 times average)
1995	2.66	6.65
1996	3.11	7.77
1997	3.47	8.67
1998	3.76	9.40
1999	4.12	10.30
2000	4.48	11.20
2001	4.84	12.11
2002	5.28	13.19
2003	5.71	14.28
2004	6.22	15.54
2005	6.72	16.81
2006	7.30	18.25
2007	7.88	19.70
2008	8.17	20.42
2009	8.46	21.14
2010	8.75	21.87
2011	9.04	22.59
2012	9.40	23.49
2013	9.69	24.22
2014	10.05	25.12
2015	10.41	26.02
2016	10.77	26.93
2017	11.13	27.83
2018	11.49	28.74
2019	11.86	29.64
2020	12.29	30.72
2021	12.65	31.63
2022	13.08	32.71
2023	13.52	33.80
2024	14.02	35.06
2025	14.46	36.14
2026	14.96	37.41
2027	15.47	38.67
2028	15.97	39.94
2029	16.48	41.20
2030	17.06	42.65
2031	17.49	43.71
2032	17.92	44.81
2033	18.37	45.93
2034	18.83	47.08
2035	19.30	48.25
2036	19.78	49.46
2037	20.28	50.70
2038	20.79	51.96
2039	21.30	53.26
2040	21.84	54.59

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DEPUTY COUNTY ADMINISTRATOR

STERLING E. RIVES, II
COUNTY ATTORNEY

HANOVER COUNTY

P. O. BOX 470

HANOVER, VIRGINIA 23069-0470

February 14, 1997

Mr. Patrick J. Brady, Director
Department of Public Utilities
County of Henrico
P.O. Box 27032
Richmond, Virginia 23273

Dear Pat:

Thank you for the opportunity to discuss our long-term water and wastewater needs. As we stated, we believe our long-term water needs are being met with our Richmond contract and our wastewater needs will be resolved with your contract and our Totopotomoy Wastewater Treatment Plant. However, we would be interested in identifying alternatives which might be available to meet longer-term or unexpected needs. The following are our suggested alternatives of the volumes, the time-frames and point of delivery that we would like considered in your modeling process:

Water Projections

YEAR
(In MGD's)

<u>Delivery Point</u>	<u>2003</u>	<u>2010</u>	<u>2020</u>	<u>2030</u>	<u>2040</u>
Creighton Road option 1	5.0	10.0	10.0	10.0	10.0
Creighton Road option 2			5.0	10.0	10.0
Rt. 360	5.0	10.0	10.0	10.0	10.0
Rt. 1			5.0	10.0	10.0
Rt. 33			5.0	10.0	10.0
Hylas/Black Flaw Area	2.0	2.0	2.0	2.0	2.0

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Mr. Patrick J. Brady, Director
Page Two
February 14, 1997

Wastewater

Option 1:

Cost benefits to Hanover of Hanover treating all wastewater generated in Hanover (i.e. return 5.4 mgd capacity to Henrico).

Option 2:

Cost of Henrico treating Hanover wastewater (no immediate plan to permit and build Totopotomoy Wastewater Treatment plant). (See attached projections).

Option 3:

Cost of Henrico treating an additional 1.8 mgd (total 7.2 mgd) at Henrico WWTP.

Option 4:

Cost of Henrico treating an additional 1.8 mgd on a short-term basis so that Hanover could delay construction of the Totopotomoy Wastewater Treatment Plant. Under this option, Hanover would be obligated to have a permit for construction of the plant.

Additionally, we would appreciate your evaluation of the Hylas/Black Haw Branch watersheds for wastewater service as discussed in our January 16, 1996 letter.

We appreciate your willingness to work with us in our water and wastewater planning. Please feel free to contact me if you need any additional information or if I can be of assistance. We look forward to our next meeting in early March.

Very truly yours,

DEPARTMENT OF PUBLIC UTILITIES



Steven R. Lohr
Assistant County Administrator

/bjc

cc: John F. Berry, County Administrator

000945

WASTEWATER DEMAND PROJECTIONS
HANOVER COUNTY DEPARTMENT OF PUBLIC UTILITIES

Wastewater Demand (in million gallons per day)

Year	Avg. 3 Highest Months	(growth rt.)	Peak Hour(2.5 times average)
1995	2.88	16.85%	6.65
1996	3.11	11.83%	7.77
1997	3.47	8.33%	8.67
1998	3.78	9.82%	9.40
1999	4.12	8.77%	10.30
2000	4.48	8.08%	11.20
2001	4.84	8.96%	12.11
2002	5.28	8.22%	13.19
2003	5.71	8.88%	14.28
2004	6.22	8.14%	15.54
2005	6.72	8.60%	16.81
2006	7.30	7.92%	18.25
2007	7.88	3.87%	19.70
2008	8.17	3.54%	20.42
2009	8.48	3.42%	21.14
2010	8.75	3.31%	21.87
2011	9.04	4.00%	22.59
2012	9.40	3.08%	23.49
2013	9.69	3.73%	24.22
2014	10.05	3.60%	25.12
2015	10.41	3.47%	26.02
2016	10.77	3.38%	26.93
2017	11.13	3.25%	27.83
2018	11.49	3.14%	28.74
2019	11.86	3.68%	29.84
2020	12.29	2.94%	30.72
2021	12.65	3.43%	31.83
2022	13.08	3.31%	32.71
2023	13.52	3.74%	33.80
2024	14.02	3.09%	35.08
2025	14.46	3.50%	36.14
2026	14.96	3.38%	37.41
2027	15.47	3.27%	38.67
2028	15.97	3.17%	39.84
2029	16.48	3.51%	41.20
2030	17.08	2.50%	42.65
2031	17.49	2.50%	43.71
2032	17.92	2.50%	44.81
2033	18.37	2.50%	45.93
2034	18.83	2.50%	47.08
2035	19.30	2.50%	48.25
2036	19.78	2.50%	49.48
2037	20.28	2.50%	50.70
2038	20.79	2.50%	51.98
2039	21.30	2.50%	53.26
2040	21.84		54.59

000946



June 27, 1997

REF 30 1397

000947

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HANOVER COUNTY

P. O. BOX 470
HANOVER, VIRGINIA 23060-0470

JACK BERRY
COUNTY ADMINISTRATOR

RICHARD R. JOHNSON
DEPUTY COUNTY ADMINISTRATOR

STEARNS E. RIVES, II
COUNTY ATTORNEY

July 18, 1997

Mr. Virgil R. Hazelett P.E., County Manager
County of Henrico
P.O. Box 27032
Richmond, Virginia 23273

Dear Virgil:

As we have discussed, Hanover County is currently involved in the permitting process for our proposed Totopotomoy Wastewater Treatment Plant. Hanover has previously utilized up to 3.7 million gallons per day (mgd) of Henrico wastewater treatment capacity and has recently had this capacity increased to 5.4 mgd.

On many occasions in the past we have discussed with you and other Henrico officials the potential for additional capacity at the Henrico plant. Thus far, Henrico has been unable to commit to meeting Hanover's future needs. Communications in 1995, 1996 and 1997 have continued to confirm the lack of available capacity in the Henrico plant for Hanover. Based on all of these discussions and the various consultants who have also discussed the issue with you, we have proceeded with our plans to construct the Totopotomoy plant.

As we continue our efforts to meet our wastewater capacity needs, we request an additional response to the following questions:

1. Is Henrico willing to make a commitment to Hanover to provide permanent wastewater treatment capacity in accordance with the following schedule?

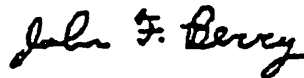
<u>Year</u>	<u>Additional Capacity(mgd)</u>	<u>Total Capacity(mgd)</u>
2002	5.0	10.4
2012	5.0	15.4
2027	10.0	25.4
2047	10.0	35.4

000948

2. Is Henrico willing to commit to provide any additional capacity that Hanover may need (beyond the schedule outlined above) to serve new industries and/or to meet unforeseen growth needs during the next 20 year time horizon?
3. If additional capacity is available, under what financial terms would such capacity be provided?

We appreciate the continued cooperation of Henrico in working with us as we solve the long-term wastewater needs of our County. Presently, we have a Conditional Use Permit pending before the Hanover Planning Commission. A formal response is needed from Henrico prior to the August 12 Commission meeting in order to address citizen suggestions that we forego our plant in favor of using yours. Thank you for your assistance.

Sincerely,



John F. Berry
County Administrator

000949

COMMONWEALTH OF VIRGINIA
COUNTY OF HENRICO

July 22, 1997

Virgil R. Hazelett, P.E.
County Manager

Mr. John F. Berry
County Administrator
County of Hanover
Hanover Court House
Hanover, VA 23069

Dear Jack:

I have reviewed your letter of July 18, 1997, concerning Hanover County's projected wastewater treatment requirements. As your letter noted, the capacity allocated to Hanover in the Henrico Regional Wastewater Treatment Facility increased from 3.7 to 5.4 million gallons per day (mgd) on July 1, 1997, as a result of the wastewater treatment facility expansion from 30 to 45 mgd. No additional treatment capacity in the 45 mgd facility is available for allocation to Hanover.

As you know, an update to the Henrico water and wastewater master plan is now being completed. The projected Henrico wastewater treatment needs will require expansion of the Henrico Regional Wastewater Treatment Facility beyond the 60 mgd originally contemplated at the Deep Bottom site. Prior to recommending allocation of additional treatment capacity to Hanover, I must be confident that Henrico's own future needs can be met.

An engineering study of the facility will be needed to develop a plan for addition of treatment capacity beyond 60 mgd. Since the Henrico discharge is mass limited, I am concerned that the discharge allocation may not be adequate to meet Henrico's long-term needs. Obviously, the additional allocation of capacity to Hanover would reduce the discharge capacity available for Henrico, and thus increase my concerns about meeting our own needs.

In addition to treatment capacity, flow from Hanover in excess of 5.4 mgd was not included in the design of the regional wastewater transport system. Additional pumping, piping and storage capacity would likely be needed to serve Hanover.

I cannot say that Henrico will not consider Hanover's request in the next treatment facility expansion design study. However, I have serious reservations about allocating substantial capacity to Hanover when there is uncertainty concerning the future discharge limits at the Henrico Regional Wastewater Treatment Facility. Furthermore, I cannot commit to providing the permanent wastewater treatment capacity you requested, nor can I reserve capacity for your unforeseen needs. Since the Henrico expansion study has not been conducted, it is premature to discuss financial terms.

000950

Mr. John F. Berry

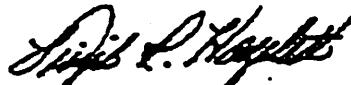
Page 2

July 22, 1997

Based on current information, I would not be in a position to recommend allocating our limited treatment capacity to Hanover. Therefore, I believe it would be prudent for Hanover to consider other alternatives to meet Hanover's long-term needs.

If you have any questions, please contact me.

Sincerely,



Virgil R. Hazelett, P.E.
County Manager

cc: Deputy County Manager for Community Operations .
Director of Public Utilities

000951

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HANOVER COUNTY

P. O. BOX 470

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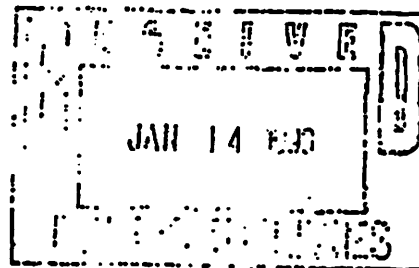
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CECL R. HARRIS, JR.
DEPUTY COUNTY ADMINISTRATOR

STERLING E. RIVES, III
COUNTY ATTORNEY

November 23, 1998

Mr. William B. Ellis
Attorney
McSweeney, Burtch & Crump
P. O. Box 1463
Richmond, VA 23218



Dear Mr. Ellis,

I am writing in response to your letter dated October 27, 1998, regarding the County's consideration of placing a wastewater treatment plant discharge line and outfall on the property of your clients, Mr. Henry R. Broaddus and Mrs. Frances B. Crutchfield. In this letter you conclude that the County has proposed to return its discharge to the original Conditional Use Permit (CUP) site without identifying any advantages of the original CUP location over an alternative downstream site. Further, you conclude from the information that you have on hand that County employees have done this for the purpose of harassing and intimidating Mr. Broaddus and Mrs. Crutchfield, as well as for the purpose of coercing and punishing them. Your conclusions are incorrect.

For over a year the County had been involved in the preliminary analysis of alternatives with the property owners. This had been followed by over three months of unsuccessful attempts to obtain authorization to enter the property for the purpose of performing the final site assessment work. It is correct that preliminary indications showed the downstream site was marginally better with regard to water quality and impacts on the undeveloped Broaddus property. What you are not considering is that this site also appeared to be more expensive to construct, would have added a lengthy process to amend the Conditional Use Permit, and would have brought the discharge very close to a number of developed residential properties.

In hopes of reaching some agreement with the owners, however, the County proposed that this site be given further consideration. In recent letters, news reports and personal conversations with the County, Mr. Broaddus made it clear that no

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Mr. William B. Ellis
Page 2
November 23, 1998

further negotiations were going to occur since he was still opposed to agreeing to any location of the outfall on this property. Further, as a result of the lapse of time in trying to initiate meaningful negotiations, the critical schedule for completion of this project was being jeopardized. The County, therefore, returned to the site already approved in the Conditional Use Permit public hearing process.

I hope that this explanation is responsive to your concerns regarding the County's actions with respect to locating an outfall for discharge of treated sewage on your client's property. I further suggest that a face to face discussion between County representatives and your clients could still prove fruitful in possibly bringing this matter to a conclusion which would be in both the County's and your clients' best interests.

Sincerely,



Richard R. Johnson
County Administrator

RRJ/ba

000953

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HANOVER COUNTY

P. O. BOX 470
HANOVER, VIRGINIA 23069-0470

JACK BERRY
COUNTY ADMINISTRATOR

RICHARD R. JOHNSON
DEPUTY COUNTY ADMINISTRATOR

STERLING E. RIVES, II
COUNTY ATTORNEY

July 11, 1997

Mr. John Hodges
Director of Planning
Hanover County
P. O. Box 470
Hanover, Virginia 23069

RE: Totopotomoy Wastewater Treatment Plant CUP Application

Dear Mr. Hodges:

The following information is presented in response to the questions presented by Mr. Joe O'Connor in his letter to you dated July 6, 1997 (copy attached). Following are Mr. O'Connor's questions followed by a response.

1. **1990 Citizens Advisory Committee**
 - a) **Will the P.C. receive a copy of the final committee report?**
 - b) **Outline the follow up the staff performed on the committee's recommendations.**
 - c) **Which other localities were contacted for a Regional Facility.**
- a) **The Planning Commission will receive a copy of the Citizen's Committee "Draft Final Report." This draft report was presented to the Board of Supervisors on August 8, 1990. To the best of our knowledge, the report was never finalized. We talked with two members of the Committee and were told that to the best of their recollection the report was never finalized. A copy of the "Draft Final Report" will be included in a package being prepared for members of the Planning Commission and the Board of Supervisors.**
- b) **A copy of a letter that was published in the Mechanicsville Local on July 2, 1997 is attached which addresses the actions that have been taken in response to the Committee's recommendations.**
- c) **Over the past ten years, Hanover County has had numerous discussions with Henrico County, the City of Richmond, and the City of Newport News on regional solutions for meeting the wastewater needs of the area. Communications with these localities are on-**

Mr. John Hodges
July 11, 1997
Page 2 of 5

going with discussions occurring within the past few months. Even after the CUP for the wastewater treatment plant is approved, or initial phases of the wastewater plant are constructed, it will be critical that these communications continue to ensure that the wastewater needs of Hanover County are met in the best possible manner as future conditions dictate.

Attached is a draft copy of a letter on "Regional Solutions" that we plan to send to the Mechanicsville Local for publishing that addresses many of the issues associated with a regional solution.

2. What are the factors that make the site off Pole Green Road the recommended site?
 - a) Urban Phasing Plan?
 - If Plant is moved closer to the river, will it cause more land to be opened for Phased Development?
 - b) How does Henrico keep the Varina area from developing with its plant located James River at the eastern end of the county?

Timmons, in conjunction with Hazen and Sawyer, completed a detailed siting study for the County which explains, in detail, the factors that were utilized in selecting the proposed site. A copy of this study was forwarded to members of the Board of Supervisors and the Planning Commission for their consideration in March. Additional copies can be made available.

In general, the siting study identified six sites to evaluate in detail and ranked the six sites based on the following criteria; acreage, history, availability, environmental concerns, soils and topography, location, neighborhood impacts, and acquisition cost. The site proposed for the wastewater treatment plant was rated the best site.

- a) A letter written by yourself to be published in the Mechanicsville local addresses this question. A copy of the letter which was sent to the Mechanicsville Local is attached.
- b) One of the reasons the Varina area of Henrico has not developed is because utilities are not currently available. Henrico has not designated a portion of the County to remain rural. If a developer wanted to construct the necessary utilities, development could occur.

The Varina area is a prime example of development following the availability of utilities. This is why locating the plant close to the Urban Service Area is so important if growth is to be managed in eastern Hanover.

- 3) How does this Wastewater Treatment Plant affect the County's Sewer Infrastructure Plan?
 - What areas will be served by this Plant? When first opened? At total build out?

Mr. John Hodges

July 11, 1997

Page 3 of 5

- Can the same results be reached with a Regional Facility?

Wastewater treatment capacity is a critical element of the County's sewer infrastructure plan. Without additional treatment capacity, future development in the Urban Service Area will be severely limited. In order to meet the future needs of the County, additional sewer capacity must be provided. There are many ways this capacity could be provided. Based on the many studies that have been completed and the alternatives currently available to the County, construction of a wastewater treatment plant in the general vicinity of Totopotomoy Creek between Routes 643 and 615 is the best solution for meeting the County's immediate and long term wastewater treatment needs.

When first opened the proposed plant is anticipated to serve the Totopotomoy, Stoney Run and Lickinghole drainage basins. The plant has been sized to be able to serve additional areas to the west of the Stoney Run basin in the Upper Chickahominy basin and a portion of the Lower Chickahominy basin which is currently pumped to Henrico County for treatment. The ultimate service area for the proposed plant is approximately 55 square miles.

Yes, if available, a regional facility could serve the needs of the County. At least one major pump station would be required in the vicinity of the proposed wastewater treatment plant to pump sewage to a regional facility.

4. The Plant is currently designed without scrubbers.

- What will be the criteria the County uses to determine when and if scrubbers are installed?**
- How long will it take from the decision to install scrubbers until they are fully operational?**

The plant is not designed at this point. Only a conceptual design has been completed. A final decision about whether to include scrubbers in the initial design of the plant will be made during the detailed design phase of the project. Based on Hazen and Sawyer's experience with other plants and the County's experience with its plants, we are not anticipating that scrubbers will be necessary. Attached is a letter from Hazen and Sawyer summarizing their thoughts on odor generation at the plant and the need for scrubbers.

Once in operation, complaints, if any, about the plant will be monitored and shared with the Board of Supervisor's. If odor complaints are received, corrective actions will be taken by the County. Depending on the source of the odors, the installation of scrubbers may be appropriate. Scrubbers could be installed within six to nine months if it is determined that they are required.

000956

Mr. John Hodges
July 11, 1997
Page 4 of 5

5. What are the County's plans for dealing with failures at the Plant?
- Minor?
 - Catastrophic?
 - a) What risk can we identify with a Plant Failure? Health, environmental, etc.?

Attached is a memo from Hazen and Sawyer describing the measures that the facility will have incorporated into its design to deal with potential failures of equipment, machinery and power. In general, protection against these types of "minor" failures are the same as are taken with a pump station, redundancy of equipment and facilities, and having trained, professional staff operating the facility to prevent failures.

Catastrophic failures at wastewater treatment plants can occur, but unless physical facilities at a plant are destroyed through an unpredictable act of nature, war, terrorism, etc., a plant can normally be brought back on-line within a short period of time.

It should be noted that, although not subject to biological upsets like a wastewater treatment plant, pump stations and force mains, which are currently located through-out the County and the Totopotomoy basin, are just as likely to have "minor" or "catastrophic" failures in equipment, machinery, power and structures as wastewater treatment plants. Failures of pump stations and force mains present generally the same risks of failure as wastewater treatment plants. The results of such failures are also similar, the discharge of untreated or under-treated sewage to the environment.

If untreated sewage were to be discharged, one would reasonably expect that the discharge would only occur for a short duration. Because of this, there should not be any long term risks associated with such a failure. Although they should be avoided, small releases of untreated sewage to the environment pose a small risk. If a large amount of untreated wastewater were discharged, a short term lowering of the dissolved oxygen concentration and other water quality problems in the receiving water body could be expected. Public warnings not to swim or drink the water would need to be made. Although there may be some short term damage to the receiving water body, the water body would be expected to recover naturally after the discharge of untreated sewage is terminated.

Many older plants, that serve systems with combined sanitary and storm sewers, are designed to discharge untreated sewage when large rainfalls occur that exceed the capacity of the plant. In fact, this occurs regularly at the City of Richmond plant which discharges untreated wastewater into the James River during heavy rainfalls. Also, the City of Richmond plant is located in the flood plain of the James River and becomes submerged during larger floods in the James.

000957

Mr. John Hodges

July 11, 1997

Page 5 of 5

Hanover County does not have a combined sewer system and the Totopotomoy Wastewater Treatment Plant will not be designed with the intent of allowing the discharge of untreated sewage. All state and federal regulations will be complied with to ensure that the proposed plant has adequate safeguards to protect the environment to the greatest extent practical.

- 6) What is the status of the land negotiations at the discharge point?
- Do we have a willing seller?

We have had several conversations with the owner of the land at the discharge point, Mr. Henry Broaddus. Mr. Broaddus has been very consistent in stating that he does not wish to see the discharge located on his property.

The County intends to continue discussion with Mr. Broaddus to see if an agreement can be obtained about the location of the discharge. We hope to discuss other possible discharge locations on his property that may be more agreeable to him. We also will continue our investigations into other appropriate and economical discharge points. Based on the information currently available to the County, the proposed discharge on Mr. Broaddus' property is the best alternative available. This discharge location is in the proper area of the river, downstream of Route 360, impacts as few land owners as possible, and is the most economical of the locations considered. In order to proceed with the Virginia Pollutant Discharge Elimination Permit process, a discharge location must be identified. We hope to come to a satisfactory agreement for all parties involved.

It is hoped the above responses adequately address Mr. O'Connor's questions. If there should be any additional questions or if additional information is required, please feel free to contact me. Your assistance with this important project is appreciated.

Sincerely,
DEPARTMENT OF PUBLIC UTILITIES



Steven R. Lohr
Assistant County Administrator for Public
Utilities and Public Works

xc: Mr. Jack Berry

000958

Mr. O'Connor's Letter

000959

July 8, 1997

John,

The following is a list of questions for the Totopotomoy Wastewater Treatment Plant.

1. 1990 Citizens Advisory Committee
 - a) Will the P.C. receive a copy of the final committee report?
 - b) Outline the follow up the staff performed on the committee's recommendations.
 - c) Which other localities were contacted for a Regional Facility?
2. What are the factors that make the site off Pole Green Road the recommended site?
 - a) Urban Phasing Plan ?
 - If Plant is moved closer to the river, will it cause more land to be opened for Phased Development?
 - b) How does Henrico keep the Varina area from developing with its plant located James River at the eastern end of the county?
3. How does this Wastewater Treatment Plant affect the County's Sewer Infrastructure Plan?
 - What areas will be served by this Plant? When first opened? At total build out?
 - Can the same results be reached with a Regional Facility?
4. The Plant is currently designed without scrubbers.
 - What will be the criteria the County uses to determine when and if scrubbers are installed?
 - How long will it take from the decision to install scrubbers until they are fully operational?
5. What are the County's plans for dealing with failures at the Plant?
 - Minor?
 - Catastrophic?
 - a) What risk can we identify with a Plant failure? Health, environmental, etc. ??
- 6) What is the status of the land negotiations at the discharge point?
 - Do we have a willing seller?

000960

John - I know there were other questions raised at the Public Hearing that you are already working on. Please add these to that list.

If you have any questions concerning the above list, please do not hesitate to call.

Thanks,

Joe O'Connor



Copies of Letters Submitted to Mechanicsville Local

000961

Response to Citizen's Committee Report

Hanover County is proposing to construct a modern wastewater treatment plant north of Pole Green Road just west of the new East End Park. The County has received many questions from Citizens about the proposed facility. This is the third in a series of columns aimed at answering some of the frequently asked questions about the project.

In August of 1990, a "Citizens Advisory Committee on Wastewater Alternatives" prepared a draft report which was presented to the Board of Supervisors. The report made seven specific recommendations. Several citizens have asked what steps the County has taken to implement the recommendations of this Committee. Following are the seven recommendations of the report followed by a status and a summary of the actions that the County has taken in response to the recommendations:

Recommendation 1:

Current sewage treatment capacity will probably be exceeded in the year 1997. Planning should be tailored toward bringing additional capacity on line by that date. The Board should insist on a "Wastewater Plan" from the County Administration by December 31, 1990.

Status:

Accomplished.

Specific Actions Taken:

In 1995, the County successfully negotiated a contract with Henrico County to formalize our rights to the initial 3.7 million gallons per day (mgd) of capacity and to ultimately increase our sewage capacity to 5.4 mgd. This additional capacity will be paid for in July 1997.

In July 1990, Black and Veatch completed the report "Hanover County, Virginia Wastewater Alternatives Study, Interim Report". In 1991 a draft, and in 1993 the final Executive Summary for this study were submitted to the County. This study outlined a plan for meeting the future wastewater treatment needs of the County.

Some of the conclusions of this study are:

1. "The only viable location for treated wastewater discharge (other than the James River via Henrico Regional WWTP) is the Pamunkey River."
2. "Discharge to the Chickahominy River via Newport News tertiary treatment is not viable."
2. "It is highly doubtful that Henrico County would accommodate wastewater flows exceeding 5.4 mgd from Hanover County. This is due to significantly increased costs for increased capacities and due to high growth needs for themselves."

000962

7/11/97

Response to Citizen's Committee Report

3. "A wastewater treatment plant in the Totopotomoy watershed makes the most sense for wastewater collection, disposal, and reuse. Also, sites are more available and the area is less congested. A plant site near Route 615 is more efficient than a site near Route 643. Sites further downstream of Route 615 are impractical due to very limited projected growth in these area(s)."

Recommendation 2:

Hanover County should immediately negotiate a formal wastewater treatment agreement with Henrico County as soon as possible for existing treatment requirements (3.7 MGD) and begin formal discussions for an additional 1.7 MGD capacity. The preferred option for additional capacity is to develop a multi-jurisdictional, bio-regional solution with adequate safeguards to protect Hanover County's interests.

Status:

Accomplished.

Specific Actions Taken:

Hanover has formalized its agreement with Henrico County and obtained an additional 1.7 mgd capacity for a total capacity of 5.4 mgd. This was all the capacity that could be negotiated from Henrico County. While making plans to construct its own wastewater treatment plant, Hanover County has continued to explore the regional option of obtaining even more capacity from Henrico County. To date, Henrico County has not indicated that it can commit to the additional capacity needed to meet Hanover County's future requirements.

Recommendation 3:

The method of sewage treatment for additional capacity, based on current technology, should be the conventional activated sludge process. Phosphorus and/or nitrogen removal may also be required, depending upon the receiving stream. Industrial reuse and land application of treated water should be incorporated into the planning and design of treatment facilities. In addition, a septage (material pumped out of septic tanks) disposal system should be provided for in the facility design.

Status:

Pending.

Specific Actions Taken:

The proposed Totopotomoy Wastewater Treatment Plant is planned to be an advanced activated sludge wastewater treatment plant with nutrient removal (phosphorus and nitrogen removal). The facility is planned to be designed to allow the reuse of the treated effluent, with minor modifications to the plant, for irrigation. However, there are no current plans to use the treated effluent in this manner. In addition, a septage disposal station is proposed to be located at the plant to treat septage removed from septic tanks.

000963

Response to Citizen's Committee Report

Recommendation 4:

Growth should continue to be managed through adherence to the comprehensive plan and periodic updates, zoning, and sub-division ordinances. Incentives should be instituted to support efficient utilization of wastewater treatment capacity. The incentives should direct growth into urban areas, slow growth in rural areas, and, maximize connections to the public system within the urban service areas.

Status:

Accomplished and on-going

Specific Actions Taken:

The County has continued to implement its phased growth management plan as set forth in the adopted Comprehensive Plan to concentrate growth in the Urban Service Area and maintain the rural character of areas outside of the urban service area. Significant Comprehensive Plan updates have occurred in 1982, 1988, and 1994, re-adopting this concept. Revised updates in the Zoning and Subdivision Ordinances have also occurred. Most recently, comprehensive rural strategies were adopted by the Board of Supervisors that substantially increased the lot size and reduced the density by over one-third in the A-1 district. The AR-6 and Rural Conservation Districts also help preserve the County's rural character through incentives for open space and design standards. A major component of the site selection criteria for the proposed wastewater treatment plant was adherence to the County's Comprehensive Plan which calls for a plant close to the urban service area so as to limit urban growth in the eastern portion of the County and keep Studley, Old Church, and Black Creek rural.

The County adopted a Comprehensive Water Conservation Plan in 1993. As part of this plan, the County instituted a water conservation rate which increased the charge for users of more than 15,000 gallons per bi-monthly billing period to encourage effective utilization of the County's resources. The County has encouraged existing residents and businesses to connect to public facilities when they become available by providing a 50 percent reduction in the capacity fee when water or sewer initially becomes available adjacent to a property.

Recommendation 5:

A County wide mandatory five year cycle of septic tank pumpout and the adoption of a user fee to cover the administrative costs should be considered. In addition, the County should consider establishing a minimum separation distance of 24" from the bottom of drainfield trenches to the seasonal water table. Based on current technology, any new septic systems that can not meet the 24" separation requirements should be of the Wisconsin Mound design.

Status:

Partially accomplished.

000964

Response to Citizen's Committee Report

Specific Actions Taken:

The County's Chesapeake Bay Ordinances, adopted in 1992, require that septic tanks in the County be pumped out every five years as recommended in the Citizens report. The Virginia Department of Health regulates the design and construction of drainfields and generally requires 12" of separation between drainfield trenches and the seasonal water table. This may be increased or decreased based on the percolation rate of the soil. The County has not adopted any ordinances requiring increased separations between drainfield trenches and the seasonal water table.

Recommendation 6:

The sewage treatment plant location that takes into consideration most of the objectives of this committee (cost, reuse, location, and, regional approaches) is one on the Chickahominy River. Discharge of Hanover County effluent in the Chickahominy is a form of water reuse, since it is eventually the water supply source for Newport News. Newport News is currently investigating increasing water withdrawals to meet short-term needs. They may be interested in cooperatively constructing, operating and maintaining advanced wastewater facilities for treatment of all of Hanover's wastewater, if the treated effluent is discharged into the Chickahominy increasing their water supply.

Status:

Investigated. Not feasible.

Specific Actions Taken:

In its 1990 draft report and 1993 final report, Black and Veatch states that in order to have a discharge to the Chickahominy River "In essence, Newport News would have to agree with reuse of Hanover County treated wastewater. The possibility was explored and initially appeared possible. However, Newport News is currently pursuing a water supply plan that would eliminate any need to reuse treated wastewater as a supplement to its water supplies. Accordingly they are not currently interested and approval for a discharge into the Chickahominy River is very doubtful." The County has had additional contacts with Newport News since the report was issued and the City's position has not changed.

The Hazen and Sawyer report "Water Reclamation Facilities Alternatives Development Study" dated December 1995 also evaluated the feasibility of a Chickahominy discharge and concluded that "Of the alternatives considered for receiving discharge from a new wastewater treatment plant in Hanover County, the Pamunkey River is the most viable alternative for both an initial plant of 5 mgd capacity and for future growth. ... The Chickahominy River has such stringent discharge limits imposed that it is not a likely alternative."

Recommendation 7:

Historically, water conservation efforts have shown that long-term real savings are difficult to document. It is felt that public education must be a component of any program. Water reuse can be a large water saving measure for industrial users. In

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Response to Citizen's Committee Report

addition, implementation of water rate schemes that encourage reuse and other forms of conservation are possible. The County should consider incentives to encourage reuse by businesses.

Status:

Accomplished and on-going.

Specific Actions Taken:

In April 1994 Hanover County's Building Code was amended to require the use of water conserving fixtures. The proposed Totopotomoy Wastewater treatment plant will be designed so that with minor modifications, the treated effluent from the facility could be used for irrigation purposes.

Also, as was mentioned earlier, the County instituted a water conservation rate which increased the charge for users of more than 15,000 gallons per bi-monthly billing period and the Board of Supervisors adopted a Comprehensive Water Conservation Plan in 1993 to encourage effective utilization of the County's resources.

The County has made much progress in the last seven years in evaluating and implementing the recommendations of the Citizen's committee. The proposed Totopotomoy Wastewater Treatment Plant is an important element in the County's overall plan to protect the character of Hanover while meeting the existing and future needs of its citizens. The County hopes to continue answering questions that its Citizens have about this important project in future columns in The Mechanicsville Local. All citizens are invited to contact the County if they have any questions or require additional information about the proposed wastewater treatment plant.

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Hanover County is proposing to construct a modern wastewater treatment plant north of Pole Green Road just west of the new East End Park. The County has received many questions from citizens about the proposed facility. This is another in a series of columns aimed at answering some of the frequently asked questions about the project.

Q. How would the Comprehensive Land Use Plan and the growth patterns in Hanover County be affected if the proposed wastewater treatment plant were to be moved downstream on Totopotomoy Creek to be closer to the Pamunkey River?

A. The Rural Point Road area, between Route 301 and Pole Green Road, has formed the northeastern boundary of the Urban Services Area since the adoption of the Comprehensive Plan in 1972. At this time, there are no plans to extend the Urban Services Area beyond this boundary towards the Pamunkey River. This is one of the key reasons that the County's Comprehensive Plan and utilities studies have consistently anticipated the siting of a wastewater treatment plant just outside of the Rural Point Road boundary in the vicinity of the Totopotomoy Creek. For the same reasons, the County has now acquired a site and filed a conditional use permit application for the construction of a plant in this area.

Some people have suggested that the location of the wastewater treatment plant should be moved downstream on the Totopotomoy to the Pamunkey River in order that the Urban Services Area might ultimately be expanded in this direction. Others have suggested that the plant be moved downstream to the Pamunkey, but that the boundaries of the Urban Services Area remain unchanged, although the relocation of the plant site to the River would make sewer service in the Totopotomoy watershed between Rural Point Road and the Pamunkey River financially and technically feasible.

Unless it is anticipated that the Urban Services Area will be expanded beyond Rural Point Road along the Totopotomoy Creek watershed towards the Pamunkey River, the site of the new wastewater treatment plant should remain in the area

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where it is currently proposed. The most notable strength of the County's current Comprehensive Plan is that the General Land Use Plan, the Urban Development Phasing Plan and the Wastewater Facilities Plans are consistent, and each of these elements of the Comprehensive Plan supports the others.

If the treatment plant were to be moved downstream on the Totopotomoy Creek to the Pamunkey River, the sewer facilities infrastructure would be inconsistent with the County's Land Use and Phased Urban Development plans. The result ultimately would be pressure to expand the Urban Development Plan into this area where sewer service would be technically and financially feasible. Clearly, the County will be better situated to defend its efforts to maintain the rural character of this area against future legal challenges if the utilities infrastructure remains consistent with the Urban Development Plan, as is the case in the County's current Comprehensive Plan.

Finally, the current plan of locating the treatment facility upstream on the Totopotomoy near Rural Point Road and with only an outfall located at the Pamunkey River better preserves the historic and scenic character of the properties situated along the Pamunkey River.

The proposed Totopotomoy Wastewater Treatment Plant is an important element in the County's overall plan to protect the character of Hanover while meeting the existing and future needs of its citizens. The County hopes to continue answering questions that its citizens have about this important project in future columns in The Mechanicsville Local. All citizens are invited to contact the County if they have any questions or require additional information about the proposed wastewater treatment plant.

John H. Hodges
Director of Planning
Hanover County, Virginia

000968

DRAFT

Is a Regional Solution, such as expansion of the Henrico Wastewater Treatment Plant, a viable wastewater solution for Hanover County?

Regional utility solutions often are viable solutions and Hanover County has a track record of supporting such regional cooperation. After many years of analyzing and reviewing internal solutions to the County's water needs, the County ultimately decided to enter into a contract with the City of Richmond for 20 million gallons of treated water per day. Under the water contract, Hanover has purchased and reserved capacity to meet its long term needs. The capacity can be called upon at any time that it is needed. This regional approach was selected after evaluating available alternatives, and was determined to be a better approach than constructing water supply facilities in Hanover.

In the case of wastewater, the County originally negotiated for 3.7 million gallons per day (mgd) of wastewater treatment capacity from Henrico County, and obtained an additional 1.7 mgd as a part of Henrico County's current 15 million gallon expansion effort from 30 mgd to 45 mgd. The wastewater agreement with Henrico was reached in 1995 after over 4 years of negotiations. In addition to negotiating for the additional 1.7 mgd, Hanover has had numerous discussions with the County of Henrico concerning additional wastewater treatment capacity and sent several letters requesting that Henrico inform the County if additional capacity is available and the cost and terms of any additional capacity. Unfortunately, as Henrico continues to expand their wastewater treatment plant, the cost escalates significantly and the amount of treatment capacity is, at this point, limited. Henrico is planning another plant expansion to accommodate their own

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growth needs. Henrico is only 40% built-out and will ultimately have to more than double their 45 mgd plant to accommodate their own residential and industrial growth. As a result, Henrico is unwilling to commit to meeting Hanover's long-term wastewater treatment needs.

In response to the most recent letter from Hanover exploring the potential of obtaining additional treatment capacity from Henrico, Mr. Virgil Hazelett, P.E., Henrico's County Manager, responded that "The projected Henrico wastewater treatment needs will require expansion of the Henrico Regional Wastewater Treatment Facility beyond the 60 mgd originally contemplated at the Deep Bottom site." He continues later that "Since the Henrico discharge is mass limited, I am concerned that the discharge allocation may not be adequate to meet Henrico's long-term needs. Obviously, the additional allocation of capacity to Hanover would reduce the discharge capacity available for Henrico, and thus increase my concerns about meeting our own needs. ... I cannot commit to providing the permanent wastewater treatment capacity you requested, nor can I reserve capacity for your unforeseen needs." Mr. Hazelett's letter concludes that "Based on current information, I would not be in a position to recommend allocating our limited treatment capacity to Hanover. Therefore, I believe it would be prudent for Hanover to consider other alternatives to meet Hanover's long-term needs."

At this time, a long term regional solution for wastewater treatment with Henrico County is not available. We cannot use this option in our projections with any degree of certainty

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and there is no way to determine costs for this option or to complete cost comparisons since there is no offer on the table from Henrico County.

Hanover has actively sought regional solutions to meet its wastewater treatment needs and will continue to consider any available cost effective regional alternatives that meet its future needs with certainty. However, with Hanover's existing wastewater treatment capacity projected to be exceeded in 2002 we must avoid delays and take action now to assure that capacity for present and future residential, commercial, and industrial customers will be available when needed. Hanover needs a certain solution now as we are rapidly approaching the point that new capacity will be needed. Since wastewater treatment plants take a long time to build, Hanover must move forward, rather than wait to see what others in the area may or may not do.

000971

Hazen and Sawyer Letters

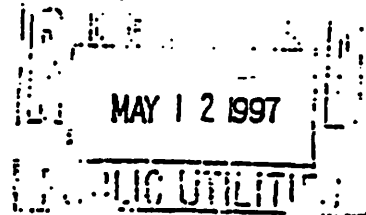
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HAZEN AND SAWYER
Environmental Engineers & Scientists

Hazen and Sawyer, P.C.
4011 WestChase Blvd.
Raleigh, NC 27607
919 833-7152
Fax: 919 833-1828

May 8, 1997

Mr. Steven P. Herzog, P.E.
Utility Engineer, Public Utilities
County of Hanover
PO Box 470
Hanover, Virginia 23609-0470



Re: Hanover County WWTP
Preliminary Engineering
H&S Job No. 2731

Dear Steve:

There have been several questions in recent weeks regarding the issue of potential odors at the proposed Totopotomoy Wastewater Treatment Plant. We thought it may be helpful to the County to identify a number of pertinent facts based on our experience on other similar projects.

As we are all aware, there is a potential for off-site detection of odors from the treatment plant unless the plant is properly planned, designed, operated, and maintained. The proposed Totopotomoy Wastewater Treatment Plant is planned to be an advanced biological nutrient removal treatment facility and will be located on a large tract of County property. There will be a minimum buffer distance from the treatment plant property line to any of the treatment plant tankage of 400 feet.

Whether or not odor control facilities are to be provided in the initial project is a judgment call that will have to be made by Hanover County. Providing such facilities can be costly and is often not required. Also, constructing facilities that are not needed can result in higher user rates and excessive debt. We offer our professional opinion based on similar experience at other facilities, the characteristics of this particular wastewater, and the anticipated travel time in the sewer collection system prior to entering the treatment plant as follows:

- The vast majority of wastewater treatment plants situated in rural and large-lot suburban settings such as the Totopotomoy plant do not have odor control facilities.

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— Zen P. Herzog, P.E.
y 8, 1997
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- Raw wastewater odor potential is dependent upon the source of the wastewater; domestic wastewater is normally less odorous than many highly industrial wastes. For the initial treatment plant operations, this factor is in Hanover County's favor in that the industrial component of the wastewater is very small at this point. However, it is anticipated that eventually a major industrial concern may locate in Hanover County and that this industry could be a major contributor to the Totopotomoy plant. Depending on the character of this industrial wastewater, the resulting odors could vary from no impact to a significant impact. Based on the types of industry likely to locate in Hanover County, i.e., computer chip manufacturers, etc., we do not anticipate that the resulting industrial waste would be an odor source.
- We understand that a portion of the wastewater to be directed to this plant will be pumped from other drainage basins with a fairly lengthy time of travel to reach the Totopotomoy plant. A long time of travel in the sewer collection system is more conducive to generation of odors in the trunk sewer and at the plant influent than a collection system with relatively short detention times. The County currently experiences such odor generation in the collection system and is treating these odors by chemical addition at the remote pump stations. Chemical treatment, such as is currently practiced, is generally very effective at controlling odors at the trunk sewers and also at the influent to the treatment plant. It is recommended that this practice be continued.

Based on these factors, it is probable that the Totopotomoy Wastewater treatment Plant will not require construction of odor control facilities in the initial construction. The Virginia Department of Health recommends, along with the 400' buffer, that cultivated tree windbreaks installed in the buffer zone are an effective means of limiting the travel of odors off of the treatment plant site. One of the reasons this site was selected is that it has an existing dense tree buffer on three sides. The County may want to consider additional plantings on the one open side of the site.

There is a varying degree of need for odor control at the various process units in a wastewater treatment plant. The areas most likely to generate odors are the influent pump station area (pump station wet well, bar screens, and grit removal facilities) and the sludge treatment facilities. It is also possible for odors to be generated at the primary settling tanks and even from the aeration tanks. We anticipate that the current practice of chemical addition at the remote pump stations

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MEMORANDUM

Date: July 9, 1997

FOR: Steve Herzog
FROM: Ron Taylor
SUBJECT: Totopotomoy WWTP Failure Potential
H&S Job No. 2731

QUESTION:

What provisions will the WWTP have for a minor process failure? What provisions are made for handling a catastrophic failure at the plant?

RESPONSE:

The Totopotomoy Wastewater Treatment Plant will be designed to provide a very high degree of treatment reliability. The plant will meet or exceed the Virginia Department of Health's strictest reliability requirements (Treatment Works Reliability Class I). The facility will be manned 24 hours per day and will be operated by licensed wastewater treatment plant operators (Class I). The Totopotomoy plant will be designed with redundancy of all critical process units providing, at a minimum, two treatment trains for each treatment process. This allows a single process unit to be taken out of service for maintenance and repairs while remaining units continue to treat the wastewater to the same high standards. Redundancy of process equipment is also provided such that stand-by units are available for use while normal duty equipment is off-line for maintenance. Sufficient spare parts to ensure continuous operability of essential unit operations and equipment will be kept at the plant facilities and a regular program of preventive maintenance will be conducted to assure reliable operations. The Totopotomoy plant will be provided with two separate and independent sources of electric power for continuous equipment operation. An alarm system will be provided to monitor the status of all equipment whose failure could result in a violation of effluent limitations thus allowing the operations staff to take immediate corrective action.

With the level of reliability provided in the design of the plant, virtually the only type of

HAZEN AND SAWYER, P.C.

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MEMORANDUM**Steve Herzog****Page 2**

problem that could be anticipated to potentially become catastrophic in terms of effluent quality is a biological upset. Such an event, though rare, could be caused by constituents in the influent wastewater that are toxic to the bio-organisms in the treatment plant. The County will conduct an industrial pretreatment monitoring program that prohibits discharge of certain compounds into the wastewater collection system at concentrations that could cause such an upset. Instrumentation for monitoring influent parameters will be included to provide the operators early detection of the occurrence of such an event so that appropriate responsive measures can be taken to prevent a plant upset. If such a discharge did occur, the redundancy of process trains would allow operations staff to respond by shifting flow to a single train to protect the majority of the biological treatment system from potential negative impacts. In the rare instances when such plant upsets do occur and the biological system is greatly impacted, the normal course of action is to "re-seed" the treatment plant with a population of healthy biological organisms from another treatment plant. This action can usually restore a wastewater treatment facility to stable operation within a short period of time.

HAZEN AND SAWYER, P.C.

000976

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DEPARTMENT OF PUBLIC UTILITIES

Hanover County
P.O. Box 470
Hanover, Virginia 23069-0470

John F. Berry
County Administrator

Richard R. Johnson
Deputy County Administrator

Sterling E. Rives, III
County Attorney

Steven R. Lohr
Assistant County Administrator
Public Utilities & Public Works

Telephone Numbers:

(804) 730-6019

(804) 537-6019

FAX: 537-6245

MEMORANDUM

TO: John H. Hodges, Director of Planning

FROM: Steven R. Lohr, Assistant County Administrator, Public Utilities and Public Works

DATE: July 15, 1997 *Steve*

RE: Totopotomoy Wastewater Treatment Plant CUP Application

COPIES: John F. Berry

The following is presented in response to the Planning Commission's request for additional information as presented in the attached letter dated June 6, 1997. Following are the questions followed by a response:

1. A cost breakdown for the construction and operation of the wastewater treatment plant.

Attached is a memo from Hazen and Sawyer, the County's consultant for the wastewater treatment plant, concerning the construction and operations costs for the plant.

2. A report of the effort by Hanover County to reach an agreement with other jurisdictions for a regional facility.

Over the past ten years, Hanover County has had numerous discussions with Henrico County, the City of Richmond, and the City of Newport News on regional solutions for meeting the wastewater needs of the area. Communications with these localities is on-going with discussions occurring within the past few months.

Attached is a draft copy of a letter on "Regional Solutions" that we plan to send to the Mechanicsville Local for publishing that addresses many of the issues associated with a regional solution and copies of letters that were recently sent to Henrico County concerning the availability of additional capacity.

3. A review of the Citizen Advisory Report from 1990, with their recommendations.

Attached is a copy of the Citizen's Committee "Draft Final Report" and a letter that was published in the Mechanicsville Local on July 2, 1997 which addresses the actions that have been taken in response to the Committee's recommendations. This draft report was presented to the Board of Supervisors on August 8, 1990. To the best of our knowledge, the report was never finalized. We talked with two members of the Committee who confirmed this.

4. Copies of the studies/consultants reports that were referenced by the County Staff and citizens.

Attached is a copy of a summary of known reports concerning wastewater treatment that have been prepared for the County. Copies of individual studies and reports can be made available.

5. Response from Henry R. Broaddus in regard to use of land and location of outfall line.

We have had several conversations with the owner of the land at the discharge point, Mr. Henry Broaddus. Mr. Broaddus, has been very consistent in stating that he does not wish to see the discharge located on his property.

The County intends to continue discussions with Mr. Broaddus to see if an agreement can be obtained about the location of the discharge. We hope to discuss other possible discharge locations on his property that may be more agreeable to him. We also will continue our investigations into other appropriate and economical discharge points. Based on the information currently available to the County, the proposed discharge on Mr. Broaddus' property is the best alternative available. This discharge location is in the proper area of the river, downstream of Route 360, impacts as few land owners as possible, and is the most economical of the locations considered. In order to proceed with the Virginia Pollutant Discharge Elimination Permit process, a discharge location must be identified. We hope to come to a satisfactory agreement for all parties involved.

It is hoped the above responses adequately address the Planning Commission's questions. If there should be any additional questions or if additional information is required, please feel free to contact me. Your assistance with this important project is appreciated.

000978

Copy of Planning Commission Letter

000379

June 6, 1997

RE: CUP-14-97; CUP-15-97; CUP-16-97

John,

The Planning Commission asked for the following information regarding the above CUPs:

1. A cost breakdown for the construction and operation of the wastewater treatment plant.
2. A report of the effort by Hanover County to reach an agreement with other jurisdictions for a regional facility.
3. A review of the Citizen Advisory Report from 1990, with their recommendations.
4. Copies of the studies/consultants reports that were referenced by the County staff and citizens.

Response from Henry R. Broaddus in regard to use of land and location of outfall line.

CC: Jack Berry
Steve Lohr
Bob Setliff

000380

Hazen and Sawyer Memo

000381

MEMORANDUM

Date: July 8, 1997

FOR: Steve Herzog
FROM: Ron Taylor
SUBJECT: Totopotomoy WWTP Cost Analysis
H&S Job No. 2731

QUESTION:

Analyze cost of a County plant versus typical cost of advanced wastewater treatment, including operating costs for 2 mgd, 5 mgd and 20 mgd. Show dollar costs of initial facility and future expansions.

RESPONSE:

The Totopotomoy Wastewater Treatment Plant will initially be constructed as a 5 mgd capacity advanced wastewater treatment plant with an ultimate expansion capacity to 30 mgd. The initial design will incorporate facilities that can also serve the plant's needs as the plant is expanded such as laboratory and administrative buildings. As appropriate, some of the treatment facilities will be sized for future flow conditions beyond 5 MGD where there is an economic advantage to the County to do so. Due to these considerations it is anticipated that the initial plant design will be somewhat more expensive to construct than subsequent expansion phases. A typical advanced plant construction cost can vary from approximately \$3.00 per gallon of capacity to \$8.00 per gallon depending on effluent quality requirements, site conditions, etc. The preliminary cost estimate for construction of the 5 mgd Totopotomoy Plant and effluent outfall line is \$25,200,000, or \$5.04 per gallon of capacity. The cost per gallon of capacity will drop as the plant is expanded to a future total cost per gallon of approximately \$4.00 per gallon.

The operating cost of the proposed Totopotomoy plant is also anticipated to be within the normally accepted range of treatment costs. The annual cost of operation when the plant is placed into operation is expected to be approximately \$609,000, or \$834 per

HAZEN AND SAWYER, P.C.

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HANOVER COUNTY

P. O. BOX 470

HANOVER, VIRGINIA 23069-0470

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DEPUTY COUNTY ADMINISTRATOR

JOHN H. HODGES
DEPUTY COUNTY ADMINISTRATOR

STERLING E. RIVES, III
COUNTY ATTORNEY

PHONE 804-537-0019
FAX 804-537-0245

February 4, 1999

Mr. Allan Brockenbrough, II, P.E.
Environmental Engineer Senior
Department of Environmental Quality
Piedmont Regional Office
4949-A Cox Road
Glen Allen, VA 23060



Re: Wastewater Treatment Plant – VPDES Permit VA0089915

Dear Mr. Brockenbrough:

We wish to submit this information as a follow-up to the public hearing conducted on January 19, 1999. We realize that most of the comments made were not related to water quality or the draft permit and therefore should not significantly influence the decision to issue the permit. However, we still feel it is important to respond and correct the statements since they are part of the public record. In order to be as brief as possible, we have not responded to every statement but rather to the reoccurring themes.

Research and Studies -- there were allegations made that the project was not adequately researched, that the County was rushing into a decision and that there was a lack of citizen involvement.

The record clearly indicates that this project has been well researched and has a very long history that includes extensive public involvement. Attached are a listing of all of the studies conducted, chronology of public hearings and meetings, and the recommendations of the Citizen's Advisory Committee on Wastewater Alternatives. In addition, after the public hearing, we provided you a letter from Gray and Pape discussing the archaeological survey and the report from Creek Laboratory dealing with the Freshwater Mussel Fauna.

010308

Mr. Allan Brockenbrough, II, P.E.
February 4, 1999
Page 2

Regional Alternatives – it was stated that Hanover did not seriously consider a regional solution and that Henrico's offer to allow Hanover to participate in their plant expansion was declined.

Attached is a summary of the events that occurred along with the actual letters that were exchanged between the localities. On several occasions Henrico did request that Hanover provide wastewater flow projections so that they could be included in their planning processes. Hanover did provide the projections and requested that Henrico commit to serving Hanover's long term needs. Although Henrico was able to provide a small increase in capacity, Virgil Hazlet's July 22, 1997 letter specifically stated that Henrico would not commit to serving Hanover's long term wastewater treatment needs and recommended Hanover consider other alternatives.

Landfill Operation – allegations were made that Hanover has not properly managed the landfill therefore the VPDES permit should be denied.

We do not believe this statement is relevant and therefore have not addressed it in this response. A more relevant comparison would be to Hanover's operation of the three (3) existing wastewater facilities. These facilities are operated in a professional manner and are in full compliance with permit requirements. We believe this comparison clearly demonstrates Hanover's ability and commitment to operating the new wastewater treatment plant in a responsible manner.

Possibility of Plant Upset or Failure – several speakers asked about the potential of a problem occurring at the plant which would result in the discharge of untreated sewerage at the discharge site.

The attached July 9, 1997 memo from Ron Taylor of Hazen and Sawyer details the safeguards and redundant features planned for the wastewater treatment plant.

Outfall Location – there was an allegation made that the County selected the proposed location in an attempt to intimidate the property owner.

The attached November 23, 1998 letter from Richard Johnson to the property owner's attorney provides the reasons why the County selected the proposed location.

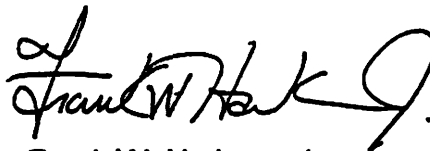
Also enclosed are two (2) informational packages that were prepared in response to questions raised during the County's Conditional Use Permit process. As you can see, most of the questions raised during the January 19, 1999 Public Hearing had been raised and addressed in the past.

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Mr. Allan Brockenbrough, II, P.E.
February 4, 1999
Page 3

Thank you for the opportunity to provide these comments. Please do not hesitate to call if you need any additional information.

Sincerely,
DEPARTMENT OF PUBLIC UTILITIES

A handwritten signature in black ink, appearing to read "Frank W. Harksen, Jr.", written in a cursive style.

Frank W. Harksen, Jr.
Director

Cc: Steve Herzog w/o enclosure

000910

MEMORANDUM

Date: July 9, 1997

FOR: Steve Herzog
FROM: Ron Taylor
SUBJECT: Totopotomoy WWTP Failure Potential
H&S Job No. 2731

QUESTION:

What provisions will the WWTP have for a minor process failure? What provisions are made for handling a catastrophic failure at the plant?

RESPONSE:

The Totopotomoy Wastewater Treatment Plant will be designed to provide a very high degree of treatment reliability. The plant will meet or exceed the Virginia Department of Health's strictest reliability requirements (Treatment Works Reliability Class I). The facility will be manned 24 hours per day and will be operated by licensed wastewater treatment plant operators (Class I). The Totopotomoy plant will be designed with redundancy of all critical process units providing, at a minimum, two treatment trains for each treatment process. This allows a single process unit to be taken out of service for maintenance and repairs while remaining units continue to treat the wastewater to the same high standards. Redundancy of process equipment is also provided such that stand-by units are available for use while normal duty equipment is off-line for maintenance. Sufficient spare parts to ensure continuous operability of essential unit operations and equipment will be kept at the plant facilities and a regular program of preventive maintenance will be conducted to assure reliable operations. The Totopotomoy plant will be provided with two separate and independent sources of electric power for continuous equipment operation. An alarm system will be provided to monitor the status of all equipment whose failure could result in a violation of effluent limitations thus allowing the operations staff to take immediate corrective action.

With the level of reliability provided in the design of the plant, virtually the only type of

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HAZEN AND SAWYER, P.C.

-1066-

MEMORANDUM**Steve Herzog****Page 2**

problem that could be anticipated to potentially become catastrophic in terms of effluent quality is a biological upset. Such an event, though rare, could be caused by constituents in the influent wastewater that are toxic to the bio-organisms in the treatment plant. The County will conduct an industrial pretreatment monitoring program that prohibits discharge of certain compounds into the wastewater collection system at concentrations that could cause such an upset. Instrumentation for monitoring influent parameters will be included to provide the operators early detection of the occurrence of such an event so that appropriate responsive measures can be taken to prevent a plant upset. If such a discharge did occur, the redundancy of process trains would allow operations staff to respond by shifting flow to a single train to protect the majority of the biological treatment system from potential negative impacts. In the rare instances when such plant upsets do occur and the biological system is greatly impacted, the normal course of action is to "re-seed" the treatment plant with a population of healthy biological organisms from another treatment plant. This action can usually restore a wastewater treatment facility to stable operation within a short period of time.

HAZEN AND SAWYER, P.C.

0000002

Totopotomoy WWTP Project History - Related Studies

Hanover County, Virginia Master Plan for County Sewerage Facilities

R. Stuart Royer and Associates

January 1968

Report - Supplement No. 1 Hanover County, Virginia Master Plan for County Sewerage Facilities

R. Stuart Royer and Associates

February 1970

Richmond Regional Sewerage Plan Area Wide Plan for Long Range Development

McGaughy, Marshall and McMillan for Richmond Regional Planning Commission

1970

Hanover County, Virginia Phase I Sewerage Improvements

R. Stuart Royer and Associates

April 1973

The Hanover County Facilities Plan, Phase II, The Plan, Final Report

Bremner, Youngblood and Sharp

November 24, 1975

Expanded Scope and Investigation of Additional Alternatives for Facilities Planning, Hanover County, Virginia, Preliminary Draft

Bremner, Youngblood and Sharp

August 1978

Draft Environmental Impact Statement, Wastewater Treatment Facilities Planning for Hanover County Virginia, Phase II Area

Engineering Science for the United States Environmental Protection Agency

October 1978

Draft Environmental Impact Statement - Summary, Wastewater Treatment Facilities Planning for Hanover County Virginia, Phase II Area

United States Environmental Protection Agency

January 1979

Totopotomoy WWTP Project History - Related Studies

Draft Addendum Water Pollution Control Facilities Plan Phase 1 Extended

Patton Harris Rust and Guy

April 1981

Final Report Financing Alternatives for the Hanover County Phase I Extended Wastewater System Project

Peat, Marwick, Mitchell and Co.

June 1981

Final Environmental Impact Statement - Wastewater Treatment Facilities for the Town of Ashland and Hanover County, Virginia.

Engineering Science for U.S. EPA

August 1981

Hanover County, Virginia Current Situation and Future Situation Study Tasks Wastewater Treatment Alternative Study (Draft)

Resource International for Black and Veatch

April 7, 1989

Hanover County, Virginia Wastewater Treatment Alternatives Study, Presentation to Citizens Advisory Group

Black and Veatch

July 10, 1989

Growth and Wastewater Requirements for Hanover County

Citizens Advisory Committee Subcommittee

January 8, 1990

Hanover County, Virginia Wastewater Alternatives Study Interim Report

Black and Veatch

July 1990

This study looked at previous studies that had been prepared for the County, existing conditions in the County, and the future needs of the County. It provided a comprehensive overview of the County's wastewater needs and made recommendations to meet those needs. This study re-established the need for treatment other than that which could be provided by Henrico County. Recommended pursuing additional capacity, from 3.7 to 5.4 mgd, with Henrico to

Totopotomoy WWTP Project History - Related Studies

meet immediate needs. Recommended discussions with Newport News to determine if they would participate in construction and operation of Chickahominy WWTP, if Newport News did not want to participate, recommended the WWTP be located in the Totopotomoy region at either 643 or 615. ::

Recommendations on Waste Water Alternatives for Hanover County (Draft Final Report)

Citizens Advisory Committee

August 1990

Made seven recommendations for the County to meet its wastewater treatment needs.

Hanover County, Virginia Wastewater Alternatives Study Executive Summary

Black and Veatch

Draft February 1991, Final July 1993

Discussed the fact that Chickahominy discharge was not feasible because Newport News was not interested in participating. Recommended obtaining additional capacity from Henrico County (from 3.7 to 5.4 mgd), and constructing a WWTP in the Totopotomoy watershed near either Route 615 or Route 643.

Wastewater Flow Projection Update

Whitman, Requardt and Associates

January 7, 1994

Reexamined wastewater flow projections to determine if projections in Black and Veatch report were still valid. Determined that in general they were and recommended that the County begin work on siting a new wastewater treatment plant no later than July 1995.

Water Reclamation Facilities Alternatives Development Study

Hazen and Sawyer

December 1995

Evaluated wastewater treatment alternatives and treated effluent disposal alternatives. Recommends discharge to Pamunkey River.

000915

Totopotomoy WWTP Project History - Related Studies

\$18,000,000 County of Hanover, Virginia Water and Sewer System Revenue Bonds
Craigie Incorporated and Davenport and Co. of Virginia
January 1, 1996

Official statement for bond offering. Financial analysis includes construction of wastewater treatment plant in 2001.

Site Selection Study for Proposed Wastewater Treatment Plant

Timmons in association with Hazen and Sawyer
March 3, 1997

Evaluated potential plant sites and discharge locations. Recommends Tate property for WWTP.

Level I Environmental Site Assessment for the Tate Property

Timmons for Hanover County
March 20, 1997

Environmental assessment of Tate property that was completed prior to site purchase. Purpose is to identify environmental features that might affect the use of the property.

Environmental Review of Conditional Use Permit Application - Totopotomoy Wastewater Treatment Plant Hanover County, Virginia

Rust Environment and Infrastructure for Hanover County
May 1997

Reviews environmental impacts of WWTP.

000916

Planning Background

- Wastewater Treatment Plant on Totopotomoy Creek was recognized in the County's First Comprehensive Plan (1972)
- Original proposed location (now Pine Slash Subdivision) was within a mile from the current proposed site
- Since 1972, the Urban Service Area boundary has been in the vicinity of the Rural Point Road Bridge over Totopotomoy Creek (reiterated in Growth Management Studies, 1978, and Plan Amendments since 1982)
- 2012 Plan Update (adopted 1994) shows Wastewater Treatment Plant in vicinity of proposed site with outfall to Pamunkey River

Planning Impact

- Proposed WWTP site is the “best fit” with the adopted Comprehensive Plan

Alternative sites are either:

- Located within the Urban Service Area, affecting historic properties and higher residential densities; or
- Located closer to the Pamunkey River, potentially more than doubling the Mechanicsville Urban Service Area and adversely affecting valuable historic farming areas

Planning Impact

- Sewer lines (above the plant) have a potential to increase development density. The proposed site keeps the balance achieved in the current Plan between urban and rural
- Regardless of the densities and land use established for the Rural Point Area in the Comprehensive Plan Update, the plant will be needed to accommodate commercial and industrial development in the I-295/95 Corridors

Background

Current Available Capacity

	<u>Hanover</u>
Share of Henrico's 30 MGD Plant	3.7 MGD
Share of Henrico's 15 MGD Addition	1.7 MGD
Share of Henrico's Future Expansions	<u>0 MGD</u>
	<u>5.4 MGD</u>

000920

Background

Black & Veatch, 1989

Findings

- Pamunkey River only viable discharge point
- Wastewater Treatment Plant Should be Located in Totopotomoy Watershed Near Rt. 643 and Rt. 615

Background

Whitman Requardt , 1994

Findings

- Black and Veatch Study findings remain valid
- Wastewater flow projections indicate Hanover's allocation of Henrico treatment capacity (5.4 mgd) to be exceeded around 2003

Background

Hazen & Sawyer, 1996

Findings

- A Pamunkey River discharge is the most suitable alternative for future development of a wastewater treatment plant
- A conventional advanced wastewater treatment plant with nutrient removal will most reliably and economically meet the wastewater needs of Hanover County

Presentations To The Board of Supervisors/Citizens

- January 12, 1994 - Water/Wastewater Alternatives Update
- January 18, 1995 - Water/Wastewater Alternatives Update

Presentations

- March 31, 1995 - Award of Wastewater Plant Engineering Contract to Hazen and Sawyer
- January 24, 1996 - Presentation of Water Reclamation Facilities Alternatives Development Study

000925

MEMORANDUM

Steve Herzog

Page 2

million gallons treated assuming an initial influent flow of 2 mgd. When the plant reaches the 5 mgd design capacity the operating costs are anticipated to rise to \$978,000 per year which equates to a lower cost of \$536 per million gallons treated. By the time the plant is expanded to 20 mgd and is operating at that capacity, the annual operating cost will have risen to approximately \$3,169,000. At this point, the cost of operations will have fallen to approximately \$434 per million gallons treated. This compares very favorably with a survey of operational costs of other advanced treatment plants which varied from \$572 to \$702 per million gallons treated depending on the process configuration, operational efficiency, and how close the plant was to operating at its capacity.

HAZEN AND SAWYER, P.C.

000983

Copies of Letters Submitted to Mechanicsville Local

000384

DRAFT

Is a Regional Solution, such as expansion of the Henrico Wastewater Treatment Plant, a viable wastewater solution for Hanover County?

Regional utility solutions often are viable solutions and Hanover County has a track record of supporting such regional cooperation. After many years of analyzing and reviewing internal solutions to the County's water needs, the County ultimately decided to enter into a contract with the City of Richmond for 20 million gallons of treated water per day. Under the water contract, Hanover has purchased and reserved capacity to meet its long term needs. The capacity can be called upon at any time that it is needed. This regional approach was selected after evaluating available alternatives, and was determined to be a better approach than constructing water supply facilities in Hanover.

In the case of wastewater, the County originally negotiated for 3.7 million gallons per day (mgd) of wastewater treatment capacity from Henrico County, and obtained an additional 1.7 mgd as a part of Henrico County's current 15 million gallon expansion effort from 30 mgd to 45 mgd. The wastewater agreement with Henrico was reached in 1995 after over 4 years of negotiations. In addition to negotiating for the additional 1.7 mgd, Hanover has had numerous discussions with the County of Henrico concerning additional wastewater treatment capacity and sent several letters requesting that Henrico inform the County if additional capacity is available and the cost and terms of any additional capacity. Unfortunately, as Henrico continues to expand their wastewater treatment plant, the cost escalates significantly and the amount of treatment capacity is, at this point, limited. Henrico is planning another plant expansion to accommodate their own

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DRAFT

growth needs. Henrico is only 40% built-out and will ultimately have to more than double their 45 mgd plant to accommodate their own residential and industrial growth. As a result, Henrico is unwilling to commit to meeting Hanover's long-term wastewater treatment needs.

In response to the most recent letter from Hanover exploring the potential of obtaining additional treatment capacity from Henrico, Mr. Virgil Hazelett, P.E., Henrico's County Manager, responded that "The projected Henrico wastewater treatment needs will require expansion of the Henrico Regional Wastewater Treatment Facility beyond the 60 mgd originally contemplated at the Deep Bottom site." He continues later that "Since the Henrico discharge is mass limited, I am concerned that the discharge allocation may not be adequate to meet Henrico's long-term needs. Obviously, the additional allocation of capacity to Hanover would reduce the discharge capacity available for Henrico, and thus increase my concerns about meeting our own needs. ... I cannot commit to providing the permanent wastewater treatment capacity you requested, nor can I reserve capacity for your unforeseen needs." Mr. Hazelett's letter concludes that "Based on current information, I would not be in a position to recommend allocating our limited treatment capacity to Hanover. Therefore, I believe it would be prudent for Hanover to consider other alternatives to meet Hanover's long-term needs."

At this time, a long term regional solution for wastewater treatment with Henrico County is not available. We cannot use this option in our projections with any degree of certainty

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DRAFT

and there is no way to determine costs for this option or to complete cost comparisons since there is no offer on the table from Henrico County.

Hanover has actively sought regional solutions to meet its wastewater treatment needs and will continue to consider any available cost effective regional alternatives that meet its future needs with certainty. However, with Hanover's existing wastewater treatment capacity projected to be exceeded in 2002 we must avoid delays and take action now to assure that capacity for present and future residential, commercial, and industrial customers will be available when needed. Hanover needs a certain solution now as we are rapidly approaching the point that new capacity will be needed. Since wastewater treatment plants take a long time to build, Hanover must move forward, rather than wait to see what others in the area may or may not do.

Response to Citizen's Committee Report

Hanover County is proposing to construct a modern wastewater treatment plant north of Pole Green Road just west of the new East End Park. The County has received many questions from Citizens about the proposed facility. This is the third in a series of columns aimed at answering some of the frequently asked questions about the project.

In August of 1990, a "Citizens Advisory Committee on Wastewater Alternatives" prepared a draft report which was presented to the Board of Supervisors. The report made seven specific recommendations. Several citizens have asked what steps the County has taken to implement the recommendations of this Committee. Following are the seven recommendations of the report followed by a status and a summary of the actions that the County has taken in response to the recommendations:

Recommendation 1:

Current sewage treatment capacity will probably be exceeded in the year 1997. Planning should be tailored toward bringing additional capacity on line by that date. The Board should insist on a "Wastewater Plan" from the County Administration by December 31, 1990.

Status:

Accomplished.

Specific Actions Taken:

In 1995, the County successfully negotiated a contract with Henrico County to formalize our rights to the initial 3.7 million gallons per day (mgd) of capacity and to ultimately increase our sewage capacity to 5.4 mgd. This additional capacity will be paid for in July 1997.

In July 1990, Black and Veatch completed the report "Hanover County, Virginia Wastewater Alternatives Study, Interim Report". In 1991 a draft, and in 1993 the final Executive Summary for this study were submitted to the County. This study outlined a plan for meeting the future wastewater treatment needs of the County.

Some of the conclusions of this study are:

1. "The only viable location for treated wastewater discharge (other than the James River via Henrico Regional WWTP) is the Pamunkey River."
2. "Discharge to the Chickahominy River via Newport News tertiary treatment is not viable."
2. "It is highly doubtful that Henrico County would accommodate wastewater flows exceeding 5.4 mgd from Hanover County. This is due to significantly increased costs for increased capacities and due to high growth needs for themselves."

Response to Citizen's Committee Report

3. "A wastewater treatment plant in the Totopotomoy watershed makes the most sense for wastewater collection, disposal, and reuse. Also, sites are more available and the area is less congested. A plant site near Route 615 is more efficient than a site near Route 643. Sites further downstream of Route 615 are impractical due to very limited projected growth in these area(s)."

Recommendation 2:

Hanover County should immediately negotiate a formal wastewater treatment agreement with Henrico County as soon as possible for existing treatment requirements (3.7 MGD) and begin formal discussions for an additional 1.7 MGD capacity. The preferred option for additional capacity is to develop a multi-jurisdictional, bio-regional solution with adequate safeguards to protect Hanover County's interests.

Status:

Accomplished.

Specific Actions Taken:

Hanover has formalized its agreement with Henrico County and obtained an additional 1.7 mgd capacity for a total capacity of 5.4 mgd. This was all the capacity that could be negotiated from Henrico County. While making plans to construct its own wastewater treatment plant, Hanover County has continued to explore the regional option of obtaining even more capacity from Henrico County. To date, Henrico County has not indicated that it can commit to the additional capacity needed to meet Hanover County's future requirements.

Recommendation 3:

The method of sewage treatment for additional capacity, based on current technology, should be the conventional activated sludge process. Phosphorus and/or nitrogen removal may also be required, depending upon the receiving stream. Industrial reuse and land application of treated water should be incorporated into the planning and design of treatment facilities. In addition, a septage (material pumped out of septic tanks) disposal system should be provided for in the facility design.

Status:

Pending.

Specific Actions Taken:

The proposed Totopotomoy Wastewater Treatment Plant is planned to be an advanced activated sludge wastewater treatment plant with nutrient removal (phosphorus and nitrogen removal). The facility is planned to be designed to allow the reuse of the treated effluent, with minor modifications to the plant, for irrigation. However, there are no current plans to use the treated effluent in this manner. In addition, a septage disposal station is proposed to be located at the plant to treat septage removed from septic tanks.

000989

Response to Citizen's Committee Report

Recommendation 4:

Growth should continue to be managed through adherence to the comprehensive plan and periodic updates, zoning, and sub-division ordinances. Incentives should be instituted to support efficient utilization of wastewater treatment capacity. The incentives should direct growth into urban areas, slow growth in rural areas, and, maximize connections to the public system within the urban service areas.

Status:

Accomplished and on-going

Specific Actions Taken:

The County has continued to implement its phased growth management plan as set forth in the adopted Comprehensive Plan to concentrate growth in the Urban Service Area and maintain the rural character of areas outside of the urban service area. Significant Comprehensive Plan updates have occurred in 1982, 1988, and 1994, re-adopting this concept. Revised updates in the Zoning and Subdivision Ordinances have also occurred. Most recently, comprehensive rural strategies were adopted by the Board of Supervisors that substantially increased the lot size and reduced the density by over one-third in the A-1 district. The AR-6 and Rural Conservation Districts also help preserve the County's rural character through incentives for open space and design standards. A major component of the site selection criteria for the proposed wastewater treatment plant was adherence to the County's Comprehensive Plan which calls for a plant close to the urban service area so as to limit urban growth in the eastern portion of the County and keep Studley, Old Church, and Black Creek rural.

The County adopted a Comprehensive Water Conservation Plan in 1993. As part of this plan, the County instituted a water conservation rate which increased the charge for users of more than 15,000 gallons per bi-monthly billing period to encourage effective utilization of the County's resources. The County has encouraged existing residents and businesses to connect to public facilities when they become available by providing a 50 percent reduction in the capacity fee when water or sewer initially becomes available adjacent to a property.

Recommendation 5:

A County wide mandatory five year cycle of septic tank pumpout and the adoption of a user fee to cover the administrative costs should be considered. In addition, the County should consider establishing a minimum separation distance of 24" from the bottom of drainfield trenches to the seasonal water table. Based on current technology, any new septic systems that can not meet the 24" separation requirements should be of the Wisconsin Mound design.

Status:

Partially accomplished.

000290

Response to Citizen's Committee Report

Specific Actions Taken:

The County's Chesapeake Bay Ordinances, adopted in 1992, require that septic tanks in the County be pumped out every five years as recommended in the Citizens report. The Virginia Department of Health regulates the design and construction of drainfields and generally requires 12" of separation between drainfield trenches and the seasonal water table. This may be increased or decreased based on the percolation rate of the soil. The County has not adopted any ordinances requiring increased separations between drainfield trenches and the seasonal water table.

Recommendation 6:

The sewage treatment plant location that takes into consideration most of the objectives of this committee (cost, reuse, location, and, regional approaches) is one on the Chickahominy River. Discharge of Hanover County effluent in the Chickahominy is a form of water reuse, since it is eventually the water supply source for Newport News. Newport News is currently investigating increasing water withdrawals to meet short-term needs. They may be interested in cooperatively constructing, operating and maintaining advanced wastewater facilities for treatment of all of Hanover County's wastewater, if the treated effluent is discharged into the Chickahominy increasing their water supply.

Status:

Investigated. Not feasible.

Specific Actions Taken:

In its 1990 draft report and 1993 final report, Black and Veatch states that in order to have a discharge to the Chickahominy River "In essence, Newport News would have to agree with reuse of Hanover County treated wastewater. The possibility was explored and initially appeared possible. However, Newport News is currently pursuing a water supply plan that would eliminate any need to reuse treated wastewater as a supplement to its water supplies. Accordingly they are not currently interested and approval for a discharge into the Chickahominy River is very doubtful." The County has had additional contacts with Newport News since the report was issued and the City's position has not changed.

The Hazen and Sawyer report "Water Reclamation Facilities Alternatives Development Study" dated December 1995 also evaluated the feasibility of a Chickahominy discharge and concluded that "Of the alternatives considered for receiving discharge from a new wastewater treatment plant in Hanover County, the Pamunkey River is the most viable alternative for both an initial plant of 5 mgd capacity and for future growth. ... The Chickahominy River has such stringent discharge limits imposed that it is not a likely alternative."

Recommendation 7:

Historically, water conservation efforts have shown that long-term real savings are difficult to document. It is felt that public education must be a component of any program. Water reuse can be a large water saving measure for industrial users.

000991
7/11/97

Response to Citizen's Committee Report

addition, implementation of water rate schemes that encourage reuse and other forms of conservation are possible. The County should consider incentives to encourage reuse by businesses.

Status:

Accomplished and on-going.

Specific Actions Taken:

In April 1994 Hanover County's Building Code was amended to require the use of water conserving fixtures. The proposed Totopotomoy Wastewater treatment plant will be designed so that with minor modifications, the treated effluent from the facility could be used for irrigation purposes.

Also, as was mentioned earlier, the County instituted a water conservation rate which increased the charge for users of more than 15,000 gallons per bi-monthly billing period and the Board of Supervisors adopted a Comprehensive Water Conservation Plan in 1993 to encourage effective utilization of the County's resources.

The County has made much progress in the last seven years in evaluating and implementing the recommendations of the Citizen's committee. The proposed Totopotomoy Wastewater Treatment Plant is an important element in the County's overall plan to protect the character of Hanover while meeting the existing and future needs of its citizens. The County hopes to continue answering questions that its Citizens have about this important project in future columns in The Mechanicsville Local. All citizens are invited to contact the County if they have any questions or require additional information about the proposed wastewater treatment plant.

000392

Henrico Letters

000893

BOARD OF SUPERVISORS

WILLIAM T. BOLLING, CHAIRMAN
CHICKAHOMINY DISTRICT

R. J. KLOTZ, JR., VICE CHAIRMAN
HENRY DISTRICT

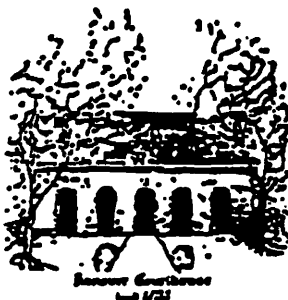
WILLIAM C. FRAZIER
SOUTH ANNA DISTRICT

RICHARD S. GILLIS, JR.
ASHLAND DISTRICT

AUBREY M. STANLEY, JR.
BEAVERDAM DISTRICT

ELTON J. WADE, SR.
COLD HARBOR DISTRICT

J. T. "JACK" WARD
MECHANICSVILLE DISTRICT



HANOVER COUNTY

P. O. BOX 470

HANOVER, VIRGINIA 23069-0470

January 16, 1996

JOHN F. BERRY
COUNTY ADMINISTRATOR

RICHARD R. JOHNSON
DEPUTY COUNTY ADMINISTRATOR

STERLING E. RIVES, III
COUNTY ATTORNEY

Mr. Patrick J. Brady, Director
Department of Public Utilities
P.O. Box 27032
Richmond, VA 23273

Dear Pat:

Thank you for advising us of the proposed update on your water and wastewater facilities plan. We appreciate the opportunity to be included in the planning phase of this important project. During our recent contract negotiations we were advised that no additional water or wastewater capacity was available to Hanover County, and that discussions of additional water capacity could not be held until your new water treatment plant was constructed. We have been utilizing the information provided in Mr. Hazelett's letter of April 2, 1993, and thus have not been planning for increased utilization of your infrastructure. However, we are most interested in exploring all possibilities for providing water and wastewater services to our citizens in the most efficient and effective manner possible. We would appreciate your thoughts regarding any changes which have occurred in your ability to offer us these additional services.

We apologize for the delay in responding to this request, however, as mentioned above our planning has been focused on other alternatives. Also, as we have discussed, we have been very involved with our Richmond waterline project and the related financing as well as our water reclamation facility alternatives study. We appreciate your patience.

Attached you will find our updated water and wastewater demand projections. The water demands are based on our current plan to utilize our Richmond contract for water needs. We currently anticipate constructing a wastewater treatment plant to accommodate wastewater flows in excess of amounts contracted with you. Additionally, with the interest expressed during our last comprehensive plan update in the Wyndham/Hylas area we would be interested in learning whether in fact this area could be served via your system. During previous studies, we estimated the acreage in the Hylas/Black Haw Branch watersheds to be 4,000 acres and the peak water demand to be 3.1 mgd. This area is currently not in our proposed service area and accordingly we have no specific plans to serve this area.

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Page Two

The attachment is our total projected water demands through the year 2040. As you are aware, our contract with the City of Richmond is for a maximum of 20 mgd. We project that we will exceed that amount around 2020, and would welcome the opportunity to discuss whether Henrico County might be able to provide additional water in that time period.

We believe that there may be certain benefits to future water connections in the Creighton Road and/or Route 360 area. Additionally, upgrading of the Route 1 connection may be beneficial. All of the connections would have to be considered in accordance with our existing contract with the City of Richmond as well as your agreement with the City. As you know, we are planning to rely on our Route 301 waterline as a major transmission line for Richmond water. Any of these other connections may be considered as possible improvements, to the delivery system and as ways to cooperatively work with you and the City to meet the regions needs. We would appreciate your thoughts as well as the thoughts of your consultants regarding the benefits of further study of the connections to supplement the Route 301 line, or to delay construction of later phases of the Richmond waterline upgrades.

Hanover County is currently working with Hazen and Sawyer and Timmons to develop a definitive recommendation for wastewater treatment. It is my understanding that representatives of this consulting group have talked with you regarding possible additional treatment capacity from Henrico. Based on our numerous discussions with you and Mr Hazelett we have been laboring under the assumption that additional treatment capacity beyond the 5.4 mgd contracted amount is not available. However, if there is any possibility of allocating additional capacity to Hanover, we would be most interested in estimates of the costs and capacity limits. This is an alternative that we are interested in exploring and would appreciate input so that we may proceed with our wastewater planning.

The wastewater projections are calculated in conformance with our current contract and are based on a rolling 90 day average. Please do not hesitate to contact me to discuss our projected needs further should you have any questions.

We sincerely appreciate this opportunity to participate in water and wastewater planning for the mutual benefit of the two jurisdictions. This is one of many examples of regional cooperation that ultimately makes the area a better place to live. We also appreciate your cooperation regarding our Richmond water line and your involvement in your boards resolution supporting our efforts. Again, thank you very much for your cooperation.

000995

Page Three

We sincerely appreciate your continued assistance and your patience in awaiting this information. We would appreciate the opportunity to meet with you and your consultants to discuss these matters further.

Sincerely,

DEPARTMENT OF PUBLIC UTILITIES



Steven R. Lohr
Assistant County Administrator

/bjc

000295

WATER AND WASTEWATER DEMAND PROJECTIONS
HANOVER COUNTY DEPARTMENT OF PUBLIC UTILITIES

Water Demands by Delivery Point (in gallons)

Year	Route 1		Route 33	
	Max. Day	Max. Hour	Max. Day	Max. Hour
1996	250,000	120,000	750,000	78,000
1997	250,000	120,000	750,000	78,000
1998	250,000	120,000	750,000	78,000
1999	250,000	120,000	750,000	78,000
2000	250,000	120,000	750,000	78,000
2001	250,000	120,000	750,000	78,000
2002	250,000	120,000	750,000	78,000
2003	250,000	120,000	750,000	78,000
2004	250,000	120,000	750,000	78,000
2005	250,000	120,000	750,000	78,000
2010	250,000	120,000	750,000	78,000
2015	250,000	120,000	750,000	78,000
2020	250,000	120,000	750,000	78,000
2025	250,000	120,000	750,000	78,000
2030	250,000	120,000	750,000	78,000
2035	250,000	120,000	750,000	78,000
2040	250,000	120,000	750,000	78,000

Wastewater Demand by Collection Point (in Gallons)

Year	Avg. 3 Highest Months	Peak Hour(2.5 times average)-
1995	2.66	6.65
1996	3.11	7.77
1997	3.47	8.67
1998	3.78	9.40
1999	4.12	10.30
2000	4.48	11.20
2001	4.84	12.11
2002	5.28	13.19
2003	5.71	14.28
2004	6.22	15.54
2005	6.72	16.81
2006	7.30	18.25
2007	7.88	19.70
2008	8.17	20.42
2009	8.46	21.14
2010	8.75	21.87
2011	9.04	22.59
2012	9.40	23.49
2013	9.69	24.22
2014	10.05	25.12
2015	10.41	26.02
2016	10.77	26.93
2017	11.13	27.83
2018	11.49	28.74
2019	11.86	29.64
2020	12.29	30.72
2021	12.65	31.63
2022	13.08	32.71
2023	13.52	33.80
2024	14.02	35.06
2025	14.46	36.14
2026	14.96	37.41
2027	15.47	38.67
2028	15.97	39.94
2029	16.46	41.20
2030	17.06	42.65
2031	17.49	43.71
2032	17.92	44.81
2033	18.37	45.93
2034	18.83	47.08
2035	19.30	48.25
2036	19.78	49.48
2037	20.28	50.70
2038	20.79	51.96
2039	21.30	53.26
2040	21.84	54.59

000997



COMMONWEALTH OF VIRGINIA
COUNTY OF HENRICO

DEPARTMENT OF PUBLIC UTILITIES

December 21, 1995

PATRICK J. BRADY
DIRECTOR
(804) 672-4317

DEC 22 1995

Mr. Steven R. Lohr, Director
Department of Public Utilities
County of Hanover
P.O. Box 470
Hanover, Virginia 23069-0470

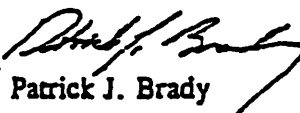
Dear Mr. Lohr:

Reference my letter of September 22, 1995, copy attached, which requested that you provide water and sewer flow projections by December 1, 1995.

Our Facilities Plan Study is underway and we request again that you provide the referenced information.

Please call me or Mr. Keith Snively, at 672-4601, if you or your staff have any questions.

Sincerely,


Patrick J. Brady

Attachment

000998

September 22, 1995

Mr. Steven R. Lohr, Director
Department of Public Utilities
County of Hanover
P.O. Box 470
Hanover, Virginia 23069-0470

Dear Mr. Lohr:

This is to advise that we are initiating an update to our Water and Wastewater Facilities Plans to provide for both a short and long term plan. This Facilities Plan will provide a detailed plan for water and sewer improvements through approximately Year 2010 and conceptual plan through the Year 2040.

In order to produce an accurate plan, it is essential to obtain updated projections from Hanover County so that the impact of your demands for water and sewer can be determined. Although long term projections will not be easy to obtain, they are critical to enable us to adequately and economically plan and schedule improvements. Once water and sewer system requirements necessary to supply your requested demands are determined, we can discuss the specific service requirements in accordance with our current Water and Wastewater Agreements. Failure to address your projected demands in this study could result in higher costs or an inability to provide capacity in future years.


Please provide projections for each service connection to the Henrico system on a yearly basis until the Year 2005. Thereafter, provide each projection on a 5 year basis until the Year 2040. The following information is required for each location and time period:

1. For water, the maximum day demand for a 24 hour period.
2. For water, the maximum hour demand.
3. For sewer, the average daily flow for the three highest consecutive months.
4. For sewer, the peak flow rate which is by State regulation the higher of 2.5 times the average daily flow or the observed peaking factor.

In order to promptly proceed with our study, we request that you provide the above information by December 1, 1995.

Please call me or Mr. Keith Snively, at 672-4601, if you or your staff have any questions.

Sincerely,


Patrick J. Brady

bc: Reading File
KES/cra

000000

December 19, 1995

Mr. Patrick J. Brady, Director
Department of Public Utilities
P.O. Box 27032
Richmond, VA 23273

Dear Pat:

Thank you for advising us of the proposed update on your water and wastewater facilities plan. We appreciate the opportunity to be included in the planning phase of this important project. During our recent contract negotiations we were advised that no additional water or wastewater capacity was available to Hanover County, and that discussions of additional water capacity could not be held until your new water treatment plant was constructed. We would appreciate your thoughts regarding any changes which have occurred in your ability to offer us additional service.

Attached you will find our updated water and wastewater demand projections in the format you requested. You will note that the water demand projections exceed the currently contracted capacity, however as you are performing a long term facility needs study, we felt it appropriate to address future potential increases at both the Rt. 1 and Rt. 33 withdrawal points. Additionally, with the growth the County is experiencing in the Wyndham/Hylas area we would be interested in discussing the possibility of studying the feasibility of serving this area via your system. For the purposes of your study we estimate the withdrawal needs of this area at 1 million gallons per day in addition to the current withdrawals at Route 33 and Route 1. The final attachment is our total projected water demands through the year 2040. As you are aware, our contract with the City of Richmond is for a maximum of 20 mgd. We project that we will exceed that amount around 2020, and would welcome the opportunity to discuss whether Henrico County might be able to provide additional water in that time period.

The wastewater projections are in conformance with our current contract and are based on a rolling 90 day average. Please do not hesitate to contact me to discuss our projected needs further should you have any questions.

Sincerely,
Department of Public Utilities

Steven R. Lohr
Assistant County Administrator

001001

WATER AND WASTEWATER DEMAND PROJECTIONS
HANOVER COUNTY DEPARTMENT OF PUBLIC UTILITIES

Water Demands by Delivery Point (in gallons)

Year	Route 1		Route 33	
	Max. Day	Max. Hour	Max. Day	Max. Hour
1996	250,000	120,000	750,000	78,000
1997	250,000	120,000	750,000	78,000
1998	250,000	120,000	750,000	78,000
1999	250,000	120,000	750,000	78,000
2000	250,000	120,000	750,000	78,000
2001	250,000	120,000	750,000	78,000
2002	250,000	120,000	750,000	78,000
2003	250,000	120,000	750,000	78,000
2004	250,000	120,000	750,000	78,000
2005	250,000	120,000	750,000	78,000
2010	250,000	120,000	750,000	78,000
2015	250,000	120,000	750,000	78,000
2020	250,000	120,000	750,000	78,000
2025	250,000	120,000	750,000	78,000
2030	250,000	120,000	750,000	78,000
2035	250,000	120,000	750,000	78,000
2040	250,000	120,000	750,000	78,000

Wastewater Demand by Collection Point (in Gallons)

Year	Avg. 3 Highest Months	Peak Hour(2.5 times average)	(growth rt.)
1996	2.66	6.65	16.85%
1997	3.11	7.77	11.63%
1998	3.47	8.67	8.33%
1999	3.76	9.40	9.62%
2000	4.12	10.30	8.77%
2001	4.46	11.20	8.06%
2002	4.84	12.11	8.96%
2003	5.28	13.19	8.22%
2004	5.71	14.28	8.86%
2005	6.22	15.54	8.14%
2006	6.72	16.81	8.60%
2007	7.30	18.25	7.92%
2008	7.88	19.70	3.67%
2009	8.17	20.42	3.54%
2010	8.46	21.14	3.42%
2011	8.75	21.87	3.31%
2012	9.04	22.59	4.00%
2013	9.40	23.49	3.08%
2014	9.69	24.22	3.73%
2015	10.05	25.12	3.60%
2016	10.41	26.02	3.47%
2017	10.77	26.93	3.36%
2018	11.13	27.83	3.25%
2019	11.49	28.74	3.14%
2020	11.86	29.64	3.66%
2021	12.29	30.72	2.94%
2022	12.65	31.63	3.43%
2023	13.06	32.71	3.31%
2024	13.52	33.80	3.74%
2025	14.02	35.06	3.09%
2026	14.46	36.14	3.50%
2027	14.96	37.41	3.38%
2028	15.47	38.67	3.27%
2029	15.97	39.94	3.17%
2030	16.48	41.20	3.51%
2031	17.06	42.65	2.90%
2032	17.49	43.71	2.50%
2033	17.92	44.81	2.50%
2034	18.37	45.93	2.50%
2035	18.83	47.08	2.50%
2036	19.30	48.25	2.50%
2037	19.78	49.46	2.50%
2038	20.28	50.70	2.50%
2039	20.79	51.96	2.50%
2040	21.30	53.26	2.50%
	21.84	54.59	2.50%

BOARD OF SUPERVISORS**J. T. "JACK" WARD, CHAIRMAN**
MECHANICSVILLE DISTRICT**AUBREY M. STANLEY, JR., VICE-CHAIRMAN**
BEAVERDAM DISTRICT**TIMOTHY E. ERNST**
ASHLAND DISTRICT**TOM GILES**
CHICKAHOMINY DISTRICT**JOHN E. GORDON, JR.**
SOUTH ANNA DISTRICT**R. J. KLOTZ, JR.**
HENRY DISTRICT**ELTON J. WADE, SR.**
COLD HARBOR DISTRICT**HANOVER COUNTY****P. O. BOX 470****HANOVER, VIRGINIA 23063-0470****February 14, 1997****JACK BERRY**
COUNTY ADMINISTRATOR**RICHARD R. JOHNSON**
DEPUTY COUNTY ADMINISTRATOR**STERLING E. RIVES, II**
COUNTY ATTORNEY

Mr. Patrick J. Brady, Director
Department of Public Utilities
County of Henrico
P.O. Box 27032
Richmond, Virginia 23273

Dear Pat:

Thank you for the opportunity to discuss our long-term water and wastewater needs. As we stated, we believe our long-term water needs are being met with our Richmond contract and our wastewater needs will be resolved with your contract and our Totopotomoy Wastewater Treatment Plant. However, we would be interested in identifying alternatives which might be available to meet longer-term or unexpected needs. The following are our suggested alternatives of the volumes, the time-frames and point of delivery that we would like considered in your modeling process:

Water Projections

YEAR
(In MGD's)

<u>Delivery Point</u>	<u>2003</u>	<u>2010</u>	<u>2020</u>	<u>2030</u>	<u>2040</u>
Creighton Road option 1	5.0	10.0	10.0	10.0	10.0
Creighton Road option 2			5.0	10.0	10.0
Rt. 360	5.0	10.0	10.0	10.0	10.0
Rt. 1			5.0	10.0	10.0
Rt. 33			5.0	10.0	10.0
Hylas/Black Haw Area	2.0	2.0	2.0	2.0	2.0

001003

Mr. Patrick J. Brady, Director
Page Two
February 14, 1997

Wastewater

Option 1:

Cost benefits to Hanover of Hanover treating all wastewater generated in Hanover (i.e. return 5.4 mgd capacity to Henrico).

Option 2:

Cost of Henrico treating Hanover wastewater (no immediate plan to permit and build Totopotomoy Wastewater Treatment plant). (See attached projections).

Option 3:

Cost of Henrico treating an additional 1.8 mgd (total 7.2 mgd) at Henrico WWTP.

Option 4:

Cost of Henrico treating an additional 1.8 mgd on a short-term basis so that Hanover could delay construction of the Totopotomoy Wastewater Treatment Plant. Under this option, Hanover would be obligated to have a permit for construction of the plant.

Additionally, we would appreciate your evaluation of the Hylas/Black Haw Branch watersheds for wastewater service as discussed in our January 16, 1996 letter.

We appreciate your willingness to work with us in our water and wastewater planning. Please feel free to contact me if you need any additional information or if I can be of assistance. We look forward to our next meeting in early March.

Very truly yours,

DEPARTMENT OF PUBLIC UTILITIES



Steven R. Lohr
Assistant County Administrator

/bjc

cc: John F. Berry, County Administrator

001004

WASTEWATER DEMAND PROJECTIONS
HANOVER COUNTY DEPARTMENT OF PUBLIC UTILITIES

Wastewater Demand (in million gallons per day)

Year	Avg. 3 Highest Months	(growth rt.)	Peak Hour(2.5 times average)
1995	2.68	10.85%	6.65
1996	3.11	11.63%	7.77
1997	3.47	8.33%	8.67
1998	3.78	9.62%	9.40
1999	4.12	8.77%	10.30
2000	4.48	8.06%	11.20
2001	4.84	8.96%	12.11
2002	5.28	8.22%	13.19
2003	5.71	8.68%	14.28
2004	6.22	8.14%	15.54
2005	6.72	8.80%	16.81
2006	7.30	7.92%	18.25
2007	7.88	3.87%	19.70
2008	8.17	3.54%	20.42
2009	8.48	3.42%	21.14
2010	8.75	3.31%	21.87
2011	9.04	4.00%	22.89
2012	9.40	3.08%	23.49
2013	9.69	3.73%	24.22
2014	10.05	3.60%	25.12
2015	10.41	3.47%	26.02
2016	10.77	3.38%	26.93
2017	11.13	3.25%	27.83
2018	11.49	3.14%	28.74
2019	11.88	3.68%	29.64
2020	12.29	2.94%	30.72
2021	12.65	3.43%	31.83
2022	13.08	3.31%	32.71
2023	13.52	3.74%	33.80
2024	14.02	3.09%	35.08
2025	14.48	3.50%	36.14
2026	14.96	3.38%	37.41
2027	15.47	3.27%	38.67
2028	15.97	3.17%	39.94
2029	16.48	3.51%	41.20
2030	17.06	2.50%	42.65
2031	17.49	2.50%	43.71
2032	17.92	2.50%	44.81
2033	18.37	2.50%	45.93
2034	18.83	2.50%	47.08
2035	19.30	2.50%	48.25
2036	19.78	2.50%	49.46
2037	20.28	2.50%	50.70
2038	20.79	2.50%	51.96
2039	21.30	2.50%	53.26
2040	21.84		54.59

001005

BOARD OF SUPERVISORS

J. T. "JACK" WARD, CHAIRMAN
MECHANICSVILLE DISTRICT

AUBREY M. STANLEY, JR., VICE-CHAIRMAN
BEAVERDAM DISTRICT

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CHOCOMONT DISTRICT

JOHN E. GORDON, JR.
SOUTH ANNA DISTRICT

R. J. KLOTZ, JR.
HENRY DISTRICT

ELTON J. WADE, SR.
COLD HARBOR DISTRICT



HANOVER COUNTY

P. O. BOX 470
HANOVER, VIRGINIA 23060-0470

JACK BERRY
COUNTY ADMINISTRATOR

RICHARD R. JOHNSON
DEPUTY COUNTY ADMINISTRATOR

STEALING E. RIVER, II
COUNTY ATTORNEY

July 18, 1997

Mr. Virgil R. Hazelett P.E., County Manager
County of Henrico
P.O. Box 27032
Richmond, Virginia 23273

Dear Virgil:

As we have discussed, Hanover County is currently involved in the permitting process for our proposed Totopotomoy Wastewater Treatment Plant. Hanover has previously utilized up to 3.7 million gallons per day (mgd) of Henrico wastewater treatment capacity and has recently had this capacity increased to 5.4 mgd.

On many occasions in the past we have discussed with you and other Henrico officials the potential for additional capacity at the Henrico plant. Thus far, Henrico has been unable to commit to meeting Hanover's future needs. Communications in 1995, 1996 and 1997 have continued to confirm the lack of available capacity in the Henrico plant for Hanover. Based on all of these discussions and the various consultants who have also discussed the issue with you, we have proceeded with our plans to construct the Totopotomoy plant.

As we continue our efforts to meet our wastewater capacity needs, we request an additional response to the following questions:

1. Is Henrico willing to make a commitment to Hanover to provide permanent wastewater treatment capacity in accordance with the following schedule?

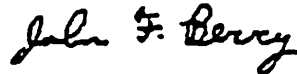
<u>Year</u>	<u>Additional Capacity(mgd)</u>	<u>Total Capacity(mgd)</u>
2002	5.0	10.4
2012	5.0	15.4
2027	10.0	25.4
2047	10.0	35.4

001006

2. Is Henrico willing to commit to provide any additional capacity that Hanover may need (beyond the schedule outlined above) to serve new industries and/or to meet unforeseen growth needs during the next 20 year time horizon?
3. If additional capacity is available, under what financial terms would such capacity be provided?

We appreciate the continued cooperation of Henrico in working with us as we solve the long-term wastewater needs of our County. Presently, we have a Conditional Use Permit pending before the Hanover Planning Commission. A formal response is needed from Henrico prior to the August 12 Commission meeting in order to address citizen suggestions that we forego our plant in favor of using yours. Thank you for your assistance.

Sincerely,



John F. Berry
County Administrator

001007



COMMONWEALTH OF VIRGINIA

COUNTY OF HENRICO

July 22, 1997

Virgil R. Hazlett, P.E.
County Manager

Mr. John F. Berry
County Administrator
County of Hanover
Hanover Court House
Hanover, VA 23069

Dear Jack:

I have reviewed your letter of July 18, 1997, concerning Hanover County's projected wastewater treatment requirements. As your letter noted, the capacity allocated to Hanover in the Henrico Regional Wastewater Treatment Facility increased from 3.7 to 5.4 million gallons per day (mgd) on July 1, 1997 as a result of the wastewater treatment facility expansion from 30 to 45 mgd. No additional treatment capacity in the 45 mgd facility is available for allocation to Hanover.

As you know, an update to the Henrico water and wastewater master plan is now being completed. The projected Henrico wastewater treatment needs will require expansion of the Henrico Regional Wastewater Treatment Facility beyond the 60 mgd originally contemplated at the Deep Bottom site. Prior to recommending allocation of additional treatment capacity to Hanover, I must be confident that Henrico's own future needs can be met.

An engineering study of the facility will be needed to develop a plan for addition of treatment capacity beyond 60 mgd. Since the Henrico discharge is mass limited, I am concerned that the discharge allocation may not be adequate to meet Henrico's long-term needs. Obviously, the additional allocation of capacity to Hanover would reduce the discharge capacity available for Henrico, and thus increase my concerns about meeting our own needs.

In addition to treatment capacity, flow from Hanover in excess of 5.4 mgd was not included in the design of the regional wastewater transport system. Additional pumping, piping and storage capacity would likely be needed to serve Hanover.

I cannot say that Henrico will not consider Hanover's request in the next treatment facility expansion design study. However, I have serious reservations about allocating substantial capacity to Hanover when there is uncertainty concerning the future discharge limits at the Henrico Regional Wastewater Treatment Facility. Furthermore, I cannot commit to providing the permanent wastewater treatment capacity you requested, nor can I reserve capacity for your unforeseen needs. Since the Henrico expansion study has not been conducted, it is premature to discuss financial terms.

001008

Mr. John F. Berry

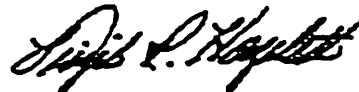
Page 2

July 22, 1997

Based on current information, I would not be in a position to recommend allocating our limited treatment capacity to Hanover. Therefore, I believe it would be prudent for Hanover to consider other alternatives to meet Hanover's long-term needs.

If you have any questions, please contact me.

Sincerely,



Virgil R. Hazlett, P.E.
County Manager

cc: Deputy County Manager for Community Operations,
Director of Public Utilities

001009

Summary of Related Report and Studies

001010

Totopotomoy WWTP Project History - Related Studies

Hanover County, Virginia Master Plan for County Sewerage Facilities

R. Stuart Royer and Associates

January 1968

Report - Supplement No. 1 Hanover County, Virginia Master Plan for County Sewerage Facilities

R. Stuart Royer and Associates

February 1970

Richmond Regional Sewerage Plan Area Wide Plan for Long Range Development

McGaughy, Marshall and McMillan for Richmond Regional Planning Commission

1970

Hanover County, Virginia Phase I Sewerage Improvements

R. Stuart Royer and Associates

April 1973

The Hanover County Facilities Plan, Phase II, The Plan, Final Report

Bremner, Youngblood and Sharp

November 24, 1975

Expanded Scope and Investigation of Additional Alternatives for Facilities Planning, Hanover County, Virginia, Preliminary Draft

Bremner, Youngblood and Sharp

August 1978

Draft Environmental Impact Statement, Wastewater Treatment Facilities Planning for Hanover County Virginia, Phase II Area

Engineering Science for the United States Environmental Protection Agency

October 1978

Draft Environmental Impact Statement - Summary, Wastewater Treatment Facilities Planning for Hanover County Virginia, Phase II Area

United States Environmental Protection Agency

January 1979

001013

Totopotomoy WWTP Project History - Related Studies

Draft Addendum Water Pollution Control Facilities Plan Phase 1 Extended

Patton Harris Rust and Guy

April 1981

Final Report Financing Alternatives for the Hanover County Phase I Extended Wastewater System Project

Peat, Marwick, Mitchell and Co.

June 1981

Final Environmental Impact Statement - Wastewater Treatment Facilities for the Town of Ashland and Hanover County, Virginia.

Engineering Science for U.S. EPA

August 1981

Hanover County, Virginia Current Situation and Future Situation Study Tasks Wastewater Treatment Alternative Study (Draft)

Resource International for Black and Veatch

April 7, 1989

Hanover County, Virginia Wastewater Treatment Alternatives Study, Presentation to Citizens Advisory Group

Black and Veatch

July 10, 1989

Growth and Wastewater Requirements for Hanover County

Citizens Advisory Committee Subcommittee

January 8, 1990

Hanover County, Virginia Wastewater Alternatives Study Interim Report

Black and Veatch

July 1990

This study looked at previous studies that had been prepared for the County, existing conditions in the County, and the future needs of the County. It provided a comprehensive overview of the County's wastewater needs and made recommendations to meet those needs. This study re-established the need for treatment other than that which could be provided by Henrico County. Recommended pursuing additional capacity, from 3.7 to 5.4 mgd, with Henrico to

001012

Totopotomoy WWTP Project History - Related Studies

meet immediate needs. Recommended discussions with Newport News to determine if they would participate in construction and operation of Chickahominy WWTP, if Newport News did not want to participate, recommended the WWTP be located in the Totopotomoy region at either 643 or 615.

Recommendations on Waste Water Alternatives for Hanover County (Draft Final Report)

Citizens Advisory Committee

August 1990

Made seven recommendations for the County to meet its wastewater treatment needs.

Hanover County, Virginia Wastewater Alternatives Study Executive Summary

Black and Veatch

Draft February 1991, Final July 1993

Discussed the fact that Chickahominy discharge was not feasible because Newport News was not interested in participating. Recommended obtaining additional capacity from Henrico County (from 3.7 to 5.4 mgd), and constructing a WWTP in the Totopotomoy watershed near either Route 615 or Route 643.

Wastewater Flow Projection Update

Whitman, Requardt and Associates

January 7, 1994

Reexamined wastewater flow projections to determine if projections in Black and Veatch report were still valid. Determined that in general they were and recommended that the County begin work on siting a new wastewater treatment plant no later than July 1995.

Water Reclamation Facilities Alternatives Development Study

Hazen and Sawyer

December 1995

Evaluated wastewater treatment alternatives and treated effluent disposal alternatives. Recommends discharge to Pamunkey River.

001013

Totopotomoy WWTP Project History - Related Studies

\$18,000,000 County of Hanover, Virginia Water and Sewer System Revenue Bonds
Craigie Incorporated and Davenport and Co. of Virginia
January 1, 1996

Official statement for bond offering. Financial analysis includes construction of wastewater treatment plant in 2001.

Site Selection Study for Proposed Wastewater Treatment Plant

Timmons in association with Hazen and Sawyer
March 3, 1997

Evaluated potential plant sites and discharge locations. Recommends Tate property for WWTP.

Level I Environmental Site Assessment for the Tate Property

Timmons for Hanover County
March 20, 1997

Environmental assessment of Tate property that was completed prior to site purchase. Purpose is to identify environmental features that might affect the use of the property.

Environmental Review of Conditional Use Permit Application - Totopotomoy Wastewater Treatment Plant Hanover County, Virginia

Rust Environment and Infrastructure for Hanover County
May 1997

Reviews environmental impacts of WWTP.

00101A



COMMONWEALTH of VIRGINIA

RANDOLPH L. GORDON, M.D., M.P.H.
COMMISSIONER

Department of Health
Office of Water Programs

REPLY TO

EAST CENTRAL FIELD OFFICE
CLOVERLEAF OFFICE PARK
300 TURNER ROAD
RICHMOND, VIRGINIA 23225
PHONE: 674-2860; FAX 674-2815



SUBJECT: HANOVER COUNTY
Sewerage: Totopotomoy STW
VPDES Draft permit

June 3, 1998

Mr. J. R. Bell, Jr., Regulatory Services Supervisor
Department of Environmental Quality
Piedmont Regional Office
4949-A Cox Road
Glen Allen, Virginia 23060-6295

Dear Mr. Bell:

This office has reviewed the draft VPDES Permit No. VA0089915 for Totopotomoy Sewage Treatment Works (STW) in Hanover County. The permit establishes the same maximum effluent limits for the initial design flow of 5 MGD and the ultimate design flow of 10 MGD: 10 mg/l CBOD₅, 10 mg/l total suspended solids, 3.0 mg/l TKN (total kjeldahl nitrogen), and 2.0 mg/l total phosphorus. The pH is to be maintained between 6 – 9 and the dissolved oxygen above 5 mg/l. The monthly geometric mean for the fecal coliform limit in the treated effluent shall not exceed 200 N/100 ml.

The permit "pollutant concentration" limitations for any biosolids generated at the facilities during the first permit expiration period will include maximum and monthly average limits for: total arsenic, cadmium, copper, lead, mercury, molybdenum, nickel, selenium and zinc.

We understand that a sludge management plan (SMP) is being approved with the condition that a complete SMP is submitted and approved prior to implementation of the specific sludge use or disposal practices.

000124

Mr. J. R. Bell, Jr.
June 3, 1998
Page 2

The Division of Shellfish Sanitation does not anticipate that this discharge will have an adverse affect on the Virginia Shellfish areas.

There are no raw water intakes or known recreational water uses within five miles downstream of the existing discharge point. We have no objection to this treatment works being designated Reliability Class I. We also concur with the Class I licensed operator requirements at this facility. Therefore, we have no objections to the issuance of the VPDES permit for this STW.

If we can be of further assistance, please contact Susan E. Douglas at (804) 674-2890.

Sincerely,

A. E. Douglas

for W. S. Shaw, P.E.
Engineering Field Director
Office of Water Programs

cc: Mr. Gary A. Craft, P.E., Acting Director, Hanover DPU
Hanover County Health Department
VDH - Central Office, DWE, OEHS
VDH - Central Office, Division of Shellfish Sanitation

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000427



COMMONWEALTH of VIRGINIA

RANDOLPH L. GORDON, M.D., M.P.H.
COMMISSIONER

Department of Health Office of Water Programs

REPLY TO

EAST CENTRAL FIELD OFFICE
CLOVERLEAF OFFICE PARK
300 TURNER ROAD
RICHMOND, VIRGINIA 23225
PHONE: 674-2880; FAX 674-2815

SUBJECT: HANOVER COUNTY
Sewerage: Totopotomoy STW
VPDES Draft Permit

July 20, 1998

Mr. J. R. Bell, Jr., Regulatory Services Supervisor
Department of Environmental Quality
Piedmont Regional Office
4949-A Cox Road
Glen Allen, Virginia 23060-6295

Dear Mr. Bell:

This office has reviewed the 2nd and 3rd revised drafts of VPDES Permit No. VA0089915 for the Totopotomoy Sewage Treatment Works (STW) in Hanover County. The most significant revisions to the draft permit are: 1) the relaxation of TSS limits from 10 mg/l to 15 mg/l; 2) the inclusion of Special Condition No. 9, outlining requirements for sampling, analysis and reporting of biosolids land application; and 3) the changing of submittal dates for O&M Manuals and Pretreatment Program Study. We have no objections to the proposed revisions.

We note that the Fact Sheet has been revised to eliminate the primary clarifiers, and the tertiary filters are to be deferred as shown in the Process Flow Schematic. This has been discussed briefly with the consultant and will be pursued in the Preliminary Engineering phase of the project. However, I would like to reiterate that because of the phosphorus limit and the proposed use of ultraviolet disinfection, we are of the opinion that tertiary filters need to be included in the initial design.

If we can be of further assistance, please contact Susan E. Douglas at (804) 674-2890.

Sincerely,

W. S. Shaw, P.E.
Engineering Field Director
Office of Water Programs

cc: Mr. Gary A. Craft, P.E., Acting Director, Hanover DPU
Hanover County Health Department
VDH - Central Office, OEHS, DWE
VDH - Central Office, Division of Shellfish Sanitation
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7/24/98
I called and spoke w/ Susan Douglas. VDH has no objections to the permit as drafted. The issue of whether or not filters are required will be settled later.

ABJ

VDH VIRGINIA
DEPARTMENT
OF HEALTH
Protecting You and Your Environment

060618



UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION III
1650 Arch Street
Philadelphia, Pennsylvania 19103-2029

JUL 31 1998



M. Dale Phillips, Technical Services Administrator --
Technical Services Division
Virginia Department of Environmental Quality
629 East Main Street
Richmond, VA 23219



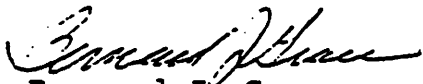
Re: VPDES Permit VA0089915
Totopotomoy WWTP

Dear Mr. Phillips:

According to our Memorandum of Understanding (MOU), the Environmental Protection Agency (EPA), Region III, has reviewed the referenced reissuance to the draft permit that we received from your Piedmont Regional Office on July 8, 1998. Based on our review, we have no objection to the issuance of the permit. Any changes made to the draft permit, other than the above mentioned modifications, will require additional EPA review prior to issuance.

If you have any questions, please contact me at (215) 814-5737.

Sincerely,


Bernard J. Grace
Environmental Engineer

9-0019



UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION III
1850 Arch Street
Philadelphia, Pennsylvania 19103-2029

November 6, 1998

M. Dale Phillips, Technical Services Administrator
Technical Services Division
Virginia Department of Environmental Quality
629 East Main Street
Richmond, VA 23219

Te J.R. Be V

Fem Op

Re: VPDES Permit VA0089915
Totopotomoy WWTP - Hanover County, VA

Dear Mr. Phillips:

According to our Memorandum of Understanding (MOU), the Environmental Protection Agency (EPA), Region III, has reviewed the referenced draft permit that we received from your Piedmont Regional Office on October 22, 1998. Based on our review, we have no objection to the issuance of the permit. Any changes made to the draft permit, other than the above mentioned modifications, will require EPA review prior to issuance.

If you have any questions, please contact Robert C. Singleton at (215) 814-5729.

Sincerely,

Robert C. Singleton

Robert C. Singleton III
Environmental Engineer

01-3663

Customer Service Hotline: 1-800-438-2474



Richmond Regional Planning District Commission

2104 West Laburnum Avenue, Suite 101
Richmond, Virginia 23227

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Town of
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MEMORANDUM



TO: Allan Brockenbrough, II
Department of Environmental Quality

FROM: Katherine Barrett *KB*
Executive Secretary

DATE: January 6, 1999

SUBJECT: ENVIRONMENTAL REVIEW AND COMMENT

Project Title: Totopotomoy Wastewater Treatment Plant, Hanover County

Description: Proposed VPDES Permit Issuance Public Notice (VA0089915)

CCN: VA98-0106-350-015-00085


- ☒ The RRPDC staff has no major concerns with this project.
- ☐ The RRPDC staff has no major concerns with this project; however, see attached comments.
- ☐ The RRPDC staff has major concerns (see attached comments) with the project as proposed; because it:

- ☐ duplicates an existing and programmed project;
- ☐ is inconsistent with adopted RRPDC plans and policies; and/or
- ☐ has potentially significant adverse impacts which require mitigation

Signature: *[Signature]*
James R. Hassinger
Executive Director

MEMORANDUM

TO: Jim Hassinger,
RRPDC Executive Director

FROM: John Fisher 
Environmental Analyst

DATE: January 5, 1999

SUBJECT: ENVIRONMENTAL REVIEW AND COMMENT

Project Title: Totopotomoy Wastewater Treatment Plant, Hanover County
Description: Proposed VPDES Permit Issuance Public Notice
Project Number: VA0089915

- ☒ The environmental section staff has reviewed the public notice and have no comments, corrections and/or changes to report.¹
- ☐ The environmental section staff has reviewed the public notice and have comments, corrections and/or changes to report. (See attached)

JEF/

001-791

¹ RRPDC staff discussed this permit issuance with Hanover County's Director of Public Utilities.



1998

COMMONWEALTH of VIRGINIA
DEPARTMENT OF ENVIRONMENTAL QUALITY

James S. G. Moore III
Director

PIEDMONT REGIONAL OFFICE
4949-A Cox Road
Glen Allen, Virginia 23060
(804) 527-5020
Fax (804) 527-5106
<http://www.deq.state.va.us>

Dennis H. Treacy
Director

Gerard Seeley, Jr.
Piedmont Regional Director

James S. G. Moore III
Director of Environmental Resources

December 9, 1998

Dr. James R. Hassinger, Executive Director
Richmond Regional Planning District
2104 W. Laburnum Ave., Suite 101
Richmond, VA 23227

RE: Proposed Issuance of VPDES Permit No. VA0089915
Totopotomoy Wastewater Treatment Plant - Hanover County

Dear Dr. Hassinger:

This letter transmits a copy of the public notice advertisement for the proposed issuance of a VPDES permit to Hanover County for the Totopotomoy WWTP and the associated public hearing to be held on January 19, 1999. This notice is being provided to you pursuant to Section 62.1-44.15:01 of the Code of Virginia. Public notice of this proposed action is also being published in the Herald Progress. The Department of Environmental Quality will be taking public comments on the proposed permit action until 4:00 p.m. on January 22, 1999. If you wish to comment on this proposed action, please respond to the Virginia Department of Environmental Quality at the above address.

If no response is received prior to close of the public comment period, it will be assumed that you have no objection to the proposed action. If you have any questions, please contact me at (804) 527-5027.

Sincerely,

Allan Brockenbrough, II, P.E.
Environmental Engineer Senior

AB/

Enclosure: Permit Public Notice

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HANOVER COUNTY

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RICHARD R. JOHNSON
COUNTY ADMINISTRATOR

CECIL R. HARRIS, JR.
DEPUTY COUNTY ADMINISTRATOR

JOHN H. HOOGES
DEPUTY COUNTY ADMINISTRATOR

STERLING E. RIVES, III
COUNTY ATTORNEY

PHONE 804-537-6019
FAX 804-537-6245

January 20, 1999

Mr. Allan Brockenbrough, II, P. E.
Environmental Engineer Senior
Department of Environmental Quality
Piedmont Regional Office
4949-A Cox Road
Glen Allen, Virginia 23060



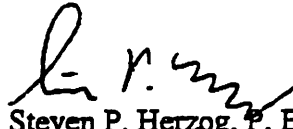
SUBJECT: Wastewater Treatment Plant - VPDES Permit VA0089915

Dear Mr. Brockenbrough:

At last night's Public Hearing on the draft VPDES permit many comments involved the potential for endangered mussels being located in the vicinity of the proposed discharge. Enclosed is a copy of a report dated January 12, 1999 titled "A Survey for Freshwater Mussel Fauna in the Pamunkey River Adjacent to a Proposed Outfall Structure Hanover County, Virginia", prepared by Philp H. Stevenson with Creek Laboratory, LLC. The County had this work completed in anticipation of making a joint permit application with the U. S. Corps of Engineers, Virginia Department of Environmental Quality, and Virginia Marine Resources Commission for construction of the proposed discharge. The summary of the report concludes that "no specimens of any protected mussel species were found" in the vicinity of the discharge. We request that this letter and report be placed in the record for the proposed VPDES permit.

As always, do not hesitate to call me at 537-6021 if I can be of any assistance.

Sincerely,
DEPARTMENT OF PUBLIC UTILITIES


Steven P. Herzog, P. E.
Utility Engineer

xc: Mr. Frank Harksen - Director, Department of Public Utilities
Mr. Ron Taylor - Hazen and Sawyer

0000829

**A Survey for Freshwater Mussel Fauna in the
Pamunkey River Adjacent to a Proposed Outfall Structure
Hanover County, Virginia**

Submitted to:
J.K. Timmons, Inc
711 N. Courthouse Road
Richmond, VA 23236

Submitted by:
Philip H. Stevenson
Creek Laboratory, LLC
P.O. Box 6623
Falls Church, Virginia 22040
(703) 533-7327
philstevenson@creeklab.com

January 12, 1999

000830

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Introduction

Hanover County, Virginia currently seeks to receive a permit to install an outfall structure in the Pamunkey River, Hanover County. Timmons, Inc., consultant for Hanover County, requested Philip H. Stevenson of Creek Laboratory to undertake a survey of the Pamunkey River to determine the presence of any protected species within the construction impact area and to recommend actions to conserve any such species found.

Methods

Pamunkey River was surveyed for the presence of rare freshwater mussels. Rare mussel species previously reported from the Pamunkey Basin include the dwarf wedgemussel (*Alasmodonta heterodon*), the green floater (*Lasmigona subviridis*), the yellow lance (*Elliptio lanceolata*) and the yellow lampmussel (*Lampsilis cariosa*) (Riddick, 1973). The area surveyed extended 200 meters upstream from the site of the proposed outfall structure, and 800 meters downstream from the site.

Figure 1 indicates the Pamunkey River survey area. This figure is derived from a selected portion of the U.S. Geological Survey topographic map of the Manquin, Virginia 7.5 minute quadrangle. The author added annotations to show the approximate site of relevant features.

Survey methods included waterscoping, handpicking, snorkeling, and SCUBA. Waterscoping was generally performed in water that was up to 0.5 meters deep or shallower. Unaided vision often sufficed to search very shallow water, under 0.2 meters deep. Underwater flashlights, a Princeton Tec Vortec headlamp and an Ikelite RCD handheld spotlight, were used to aid underwater searching. In addition, stream banks and bars were searched for middens of predated shells and shells deposited by flood. Stream bank searches provided 100% coverage of the shoreline in the survey area.

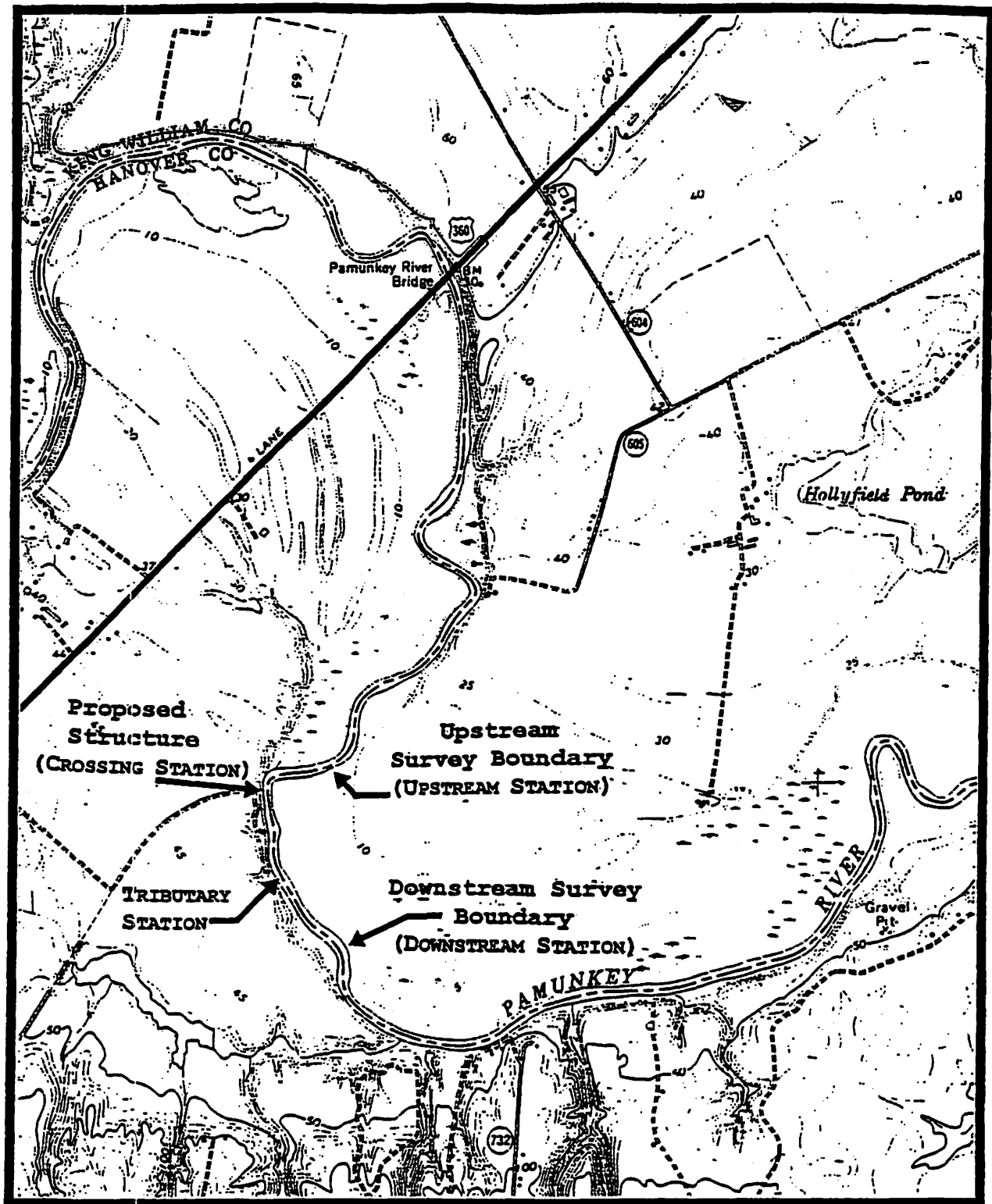


Figure 1. Survey Area and Survey Stations in the Pamunkey River, Hanover County, Virginia
(From U.S.G.S. Manquin, Va. 7.5 minute map; 1:24,000)

The Pamunkey River looks somewhat similar throughout the survey area. While some searching was performed over the entire survey area, I established four sampling stations to provide detailed information on specific sections of the river. Table 1 lists the sampling stations and their locations. At each sampling station, two methods of searching were followed.

Station Name	Location
Downstream Station	800 meters downstream from the proposed structure.
Tributary Station	340 meters downstream from the proposed structure, adjacent to an unnamed tributary.
Crossing Station	At site of proposed outfall structure, directly below existing powerline crossing
Upstream Station	200 meters upstream from the proposed structure
Table 1. Sampling Stations within the Survey Area, Pamunkey River, Hanover County, Virginia.	

The first method consisted of searching five 10 meter transects for mussels. The transect line was a measured yellow chain laid parallel to stream flow on the river bottom. All mussels visible within approximately one meter on either side of the transect were recorded. Each subsequent transect at a site was moved from 2 to 5 meters farther from shore than the last one. I consistently structured the transect arrangement such that a cross section from the first to the last transect would encompass midstream at any given station.

Upon transect searching completion, a timed search unconstrained by transect line using SCUBA and waterscopes was performed at each station. The focus was on finding as many mussels as possible, while also providing some minimal effort to

all habitats at a sampling station. A minimum of 30 minutes of time was used in timed searches. This method was specifically used after initial results indicated that mussels might occur preferentially in deep water in a relatively narrow band of coarse substrate; a search method applying spatially uniform effort might fail to sample this limited habitat area.

Field surveys were conducted on November 6, 7, 8, 18, and 20, 1998 by Philip H. Stevenson. Water visibility extended between 1.5 meters to 2 meters. Water levels appeared normal for the season and were not low as the tidal nature of the river here prevents much seasonal drop in water level. All SCUBA diving was done between 2 hours before peak low tide to 2 hours after peak low tide on generally sunny days in order to increase the ambient light level reaching the deepest channel bottom.

Observations

The survey found two mussel species, family Unionidae. Table 2 lists the species found and their federal and state status. No protected species of freshwater mussels were found.

Scientific Name	Common Name	Federal Status	State Status
<i>Anodonta cataracta</i>	eastern floater	None	None
<i>Elliptio complanata</i>	eastern elliptio	None	None

**Table 2. Mussel Species Found in the Pamunkey River,
Hanover/King William Counties, Virginia**

Table 3 reports the number of mussels overall and for both the upstream and downstream survey areas. Table 3 indicates

Survey Area	Mussels Found	Search Time (hrs)	CPUE
Downstream Station	6L/ 0R	1.0	6.0
Tributary Station	47L/ 5R	1.6	30
Crossing Station	7L/ 0R	1.1	6.3
Upstream Station	12L/1R	1.1	10
Bank Searches*	1L/25R	2.6	N/A
Waterscoping	0L/0R	0.9	0

Table 3. Mussel Distribution by Survey Area and Method in the Pamunkey River, Hanover/King William Counties, Virginia

F = Fresh-dead specimens, L = Live specimens, R = Relict shells. Relict shells means any shell not obviously fresh.

CPUE = Catch per unit effort, mussels/hour, calculated for live mussels only here.

* = includes search effort along banks of the entire survey area.

whether the given species was found as live specimens, fresh-dead, or relict shell. Fresh-dead specimens are those which have

soft tissue still attached to the shells. In contrast, relict shell contain no soft tissue and includes shells of differing intactness and likely widely varying age postmortem.

Table 3 indicates that there were moderate numbers of common native mussels in the survey area; however, the numbers varied considerably within the area. Numbers appeared lowest at Crossing Station and Downstream Station. The greatest abundance appeared at the Tributary Station.

In Table 3, the results reflect the cumulative totals for bank searching and summarize the results of all bank searching for the entire survey area. Specifically, mussel shells were found at four localized areas. Two shells were found at the bar bordering Downstream Station. 14 relict shells were found deposited on a narrow mud flat 50 to 100 meters upstream from Downstream Station. Three recently predated shells were found along the ascending-left side immediately downstream from Crossing Station. Lastly, a small shell midden and several relict shells were found on the ascending-right side upstream from Crossing Station.

Waterscoping and snorkel searches were performed adjacent to narrow mudflats upstream from Downstream Station in the extensive shallows opposite the boat ramp, and in the riprap adjacent to the boat ramp. The boat ramp lies roughly 100 meters downstream from Crossing Station. The results of these searches indicated few mussels, if any, occur in shallow waters or the steep mud/clay channel walls.

Corbicula was common throughout the entire survey area. The only detectable pattern was that this clam seemed far less common in thick mud or detritus as well as in the steep channel walls. Many middens of predated *Corbicula* shells were noted throughout the survey area indicating some considerable utilization of this resource by muskrats.

In other observations, I noted the presence of a moderate population of *Elimia virginica* snails. I also saw several shells of the viviparid snail, *Campeloma decisum*.

In the text which follows, I describe the overall survey area, then describe each sampling station and the associated sampling observations.

Pamunkey River

Pamunkey River is a slow flowing freshwater tidal stream. River width varies from 30 meters to 45 meters and has largely slow run habitat throughout with a few bankside pool-like areas.

Maximum water depth at any section across the river ranges from 3-5 meters deep. The deepest water is in the immediate vicinity of the construction site. Tidal variation appeared to be approximately one meter. All depths are referenced to low tide unless otherwise noted.

The creek substrate varied from soft mud/detritus to coarse gravel/cobble. No exposed bedrock occurred. Large, clean sand beds occurred at bends in the river. Exposed clay beds often formed a solid substrate along the channel walls. When present, gravel and cobbles, usually were well embedded in sand and generally had a moderate layer of silt/sand partially covering. This silt layer was generally well under one centimeter thick.

The general depth profile at low tide would be a very steeply sloped bank, circa 100 percent slope or more, leading down to depths of about 1.5 to 2 meters. Soft substrate would border the steep wall and grade to sand toward midstream. Progressively more gravel/pebbles and cobbles would occur as one approached the deepest part of the river at roughly midstream.

Typically, a narrow exposed mud or sand flat borders the river at low tide. This flat varies from under one meter to several meters wide, and is particularly wide in the larger

bends. Additionally, a large exposed flat/bar occurs opposite the boat ramp downstream from Crossing Station.

The stream profile is significantly altered in the bend areas as a large sand deposit with a shallow slope tends to occupy the inside of the bend. The deposit extends roughly two thirds across the channel, changing the depth profile such that the deepest part of the channel is much closer to the outside of the bend.

With minor exceptions, second-growth hardwood-floodplain forest bordered this stream throughout the survey area. The stream banks tend to be moderately high, between 1 to 2 meters, and usually well-vegetated. There are some logs in the creek on the outside of some of the bends. Logs are confined to the nearshore areas. Although the tree canopy does not cover the river, the stream is well-shaded, particularly along the shoreline. I observed no submerged aquatic vegetation.

The most significant disturbances noted in the survey area were an abandoned railroad bridge pier, a boat ramp, irrigation intake pipes, and some remnant wooden retaining walls along the banksides. The bridge pier lies about 50 to 60 meters downstream from the construction site. Its main influence seems to have been to collect a substantial snag of logs and to create the large depositional area in its downstream lee.

The intake pipes and boat ramp are slightly downstream from and across from the bridge pier. Neither structure seems to have much effect on the river. The ramp has associated with it some large cobbles placed as riprap for its stability.

The wooden retaining walls were observed at two sites. In both instances the walls were very low, relatively short (under five meters, and abut the bank. High tide covers these structures which appear to be fairly old and unmaintained.

Downstream Station

The Downstream Station lay in the middle of a short bend in the river. The river was roughly 40 meters wide with a maximum depth of about three meters. An extensive shallow flat was present along the inside of the bend on the ascending-left side. Proceeding across the stream, water depth increased slowly to approximately 1 meter midstream. At this point the slope increased rapidly reaching a maximum depth of about three meters. From the ascending-right side the stream dropped sharply, within five meters from shore, to maximum depth.

The substrate was largely sand as the sand flats extended well into midstream. Once the depth increased to over two meters deep, gravel and pebbles became significant portions of the substrate. Continuing toward the ascending-right side there were a number of logs where the substrate began to transition from sand/gravel to mud/detritus toward the nearshore area.

There are no noticeable impacts to this area, the surrounding land being uniformly second growth mixed forest. The banks along the ascending-right side tend to be very steep, roughly two meters high, whereas the ascending-left side has a very shallow bank, under 0.5 meters high, which borders a relatively wide mud-sand flat.

All mussels were found associated with the coarse substrate in deep water. The majority were found during timed searches in the deep channel. No mussels were visible among the logs along the ascending-right side, while a few mussels were seen in the transition area. Two shells were found while searching the exposed mud flat area.

Tributary Station

This survey station was located adjacent to an unnamed first order tributary that entered the river on the ascending-right side. The river was about 35 meters wide and had a maximum depth of 3 to 3.5 meters here. The stream had a narrow, steep shelf along either bank which rapidly dropped off to a depth of about 2 meters. A moderate slope then extended to midstream where the greatest depth was achieved. In the immediate vicinity of the tributary confluence a sand deposit extended roughly five meters into the stream and 5 meters upstream and downstream from the confluence. This deposit is exposed at low tide, and the edge toward midstream is extremely steep.

Substrate here varied by its position in the stream. Sand tended to be found extending from the deposit margin to roughly 10 meters from the shore. Progressively coarser particles are found in the substrate as one approaches midstream. There is a band about 3 to 4 meters wide at midstream that is largely composed of an equal mix of cobbles, pebbles, gravel, and sand. The substrate becomes mostly sand toward the ascending-right side, gradually becoming mud and sand about 6 to 8 meters from shore, where a number of logs are present.

The banks were generally steep and well-vegetated. Second-growth hardwoods were predominant to both sides. The only evidence of disturbance here was a rotting wooden structure that is present immediately downstream from the unnamed tributary. The structure appears to be some sort of rudimentary low retaining wall that is roughly 3 meters long and submerged at high tide. It is positioned at an acute angle to the shore with one end abutting the bank. It seems to act as a sand trap at the tributary confluence.

As noted in Table 3, more mussels were found at this site than any of the other sites. Relatively few mussels were found

during the transect searching since most of the transects were in the sandy substrate away from midstream. The search of the only transect placed in the rocky stream center produced the most mussels.

Finally, free searching produced many more mussels since effort could be concentrated on the rocky center area; however, investigation along the steeply sloped ascending-right side of the stream revealed very few mussels, and no mussels were located in the muddy area among the logs of the ascending-right side.

Crossing Station

This sampling station is located at an existing power line crossing of the Pamunkey River and is at the site of the proposed structure. This is the narrowest spot in the survey area, being roughly 30 meters wide. This also is the deepest sampling station, with depths of 4 meters occurring during peak low tide.

Both sides of the Pamunkey River at this point are bordered by a very narrow (under 1 meter), shallow (less than 0.5 meters deep) shoreline "flat" that drops sharply to deep water. Proceeding across the stream from the ascending-right side, the water depth dropped sharply to about 2 meters depth then more gradually to roughly 3 meters depth. The slope then continued downward at a gentle slope until the maximum depth was reached roughly 10 meters from the ascending-left side. The bottom then rose to a depth of 2 meters from which a near vertical rise then led to a very narrow shoreline flat.

The substrate here was generally a mud-clay flat and channel wall. At the base of the ascending-right side, substrate tends to be mud/detritus in the 5 to 10 meters closest to the shore. Although located in a bend area, there was no large sand deposit in the bend interior. Possibly this is due to the abruptness and narrowness of the bend and concomitant force of water in this

bend Significant recent leaf accumulations did cover the bottom in a relatively narrow band about 3 to 5 meters wide along this channel wall. This site was noted to have the least area of coarse substrate of any sampling station in the survey area.

Continuing toward midstream the bottom becomes progressively sandier. As one approaches the deepest part of the channel, significantly more pebbles and gravel are detectable; however, very little cobble is found here. A modest silt layer covered much of the coarser substrate area. The substrate then changes back to sand at the base of the mud/clay channel wall along the ascending-left side.

While agricultural lands do approach the Pamunkey River from the ascending-left side here, there is a wooded buffer all along the river on the steeply sloped banks there. The powerline crossing is the primary disturbance here. While the powerline right-of-way is cleared of trees, the ground is well-vegetated and there does not appear to be any excessive erosion.

This site yielded very few mussels. Four of 5 transects were in sand or mud. Those searches yielded no mussels. Only a few mussels were found in the one transect that lay over coarser substrate. Free searching the bottom also produced the fewest mussels of any similar such search.

Upstream Station

Upstream Station is located at the upstream boundary of the survey area. The Pamunkey river here is roughly 45 meters wide with a maximum depth of 3 meters.

The river here gently slopes to the maximum depth from a wide mud flat along the ascending-left side. The water becomes shallower: roughly 10 meters from shore where a very substantial sand bar occurs. The water depth is 0.5 meters at its shallowest over the sand bar. As one proceeds toward the ascending-right

side, the water depth gradually increases to 3 meters deep in the deepest part of the channel. The deepest channel here is roughly 35 meters from the ascending-left shore, i.e. only 10 meters from the ascending-right shore. The bottom rises only slightly until close to the ascending-right shore, where a nearly vertical wall rises abruptly to the surface.

Transect searching here yielded only 1 mussel, in the deepest transect. Searches of the 3 transects closest to the ascending-left side produced no mussels. All mussels were found in the deepest water where there was a muddy gravel-sand substrate. This site was remarkable in the degree of muddiness of the substrate where the mussels occurred; elsewhere, mussels seemed to prefer far less muddy substrate. Possibly the extensive degree to which the sand deposit occupies the channel forces the mussels to a more marginal habitat.

Discussion

Pamunkey River contains populations of two common mussel species in the project area. Given the greater numbers of species found by Riddick(1973) in nearby areas upstream from the survey area, it seems that either the species numbers have declined or this area is not particularly productive. Riddick reported only 1 mussel species, *Elliptio complanata*, in both sampling stations downstream of U.S. Route 360 (Riddick, 1973). Given the few species found, the results of this survey of an area similarly located in the Pamunkey River downstream of U.S. Route 360 may reflect an inherent ecological limitation on the freshwater mussel fauna in freshwater tidal rivers.

Both mussel species found in the survey area tolerate a wide range of conditions. Presence of these mussels is a threshold indicator of potential for rarer mussels; however, these species often occur in habitats unaccompanied by rarer species.

Corbicula fluminea generally is a negative or strongly negative indicator for rare mussels. I interpret their abundance as negative generally for native bivalves in this instance as I noted very few small specimens of native bivalves. A similar interpretations have been advanced by other researchers (Clarke, 1988; Sickel, 1973).

The protected species of most concern in the York basin would be the dwarf wedgemussel, *Alasmidonta heterodon*, a federally listed endangered species. It does not apparently occur in tidal situations; furthermore, the presence of *Corbicula* would be negative for the occurrence of *A. heterodon*.

Other rare species which have been recorded in the York basin are the yellow lance, *Elliptio lanceolata*, and the yellow lampmussel, *Lampsilis cariosa*. The yellow lance has not been recorded from tidewater. The yellow lampmussel seems more likely of the two to occur in the survey area, but the mussel habitats in this area seem to be relatively poor. It likely still occurs in other habitats within the York basin where localized conditions are more conducive.

Riddick(1973) noted that the yellow lampmussel was a frequent species in predated shell piles. Given the prominence of such shell piles in the survey area, it seems likely that *Lampsilis cariosa* would turn up in a shell pile, if it occurred in the area at all. None were seen.

The last species of concern would be the green heelsplitter, *Lasmigona subviridis*. In 1973, Riddick(1973) recorded this species at the U.S.Route 360 bridge several miles upstream from the survey area. The comments regarding *A. heterodon* apply here also as this species is not reported from tidewater and, the presence of *Corbicula*, a potential competitor, argues against *L. subviridis* presence.

Finally, all the rare species discussed above have been reported to prefer generally clean swept substrates of sand or coarser particles (Clarke, 1981, 1985; Johnson, 1970; Michaelson, 1988). The silty nature of the substrate here suggest the absence of these rare species.

Summary

Two species of freshwater mussels found were *Anodonta cataracta* and *Elliptio complanata*. No specimens of any protected mussel species were found.

From consideration of general biological features and stream habitats of the Pamunkey River, I consider the survey area unlikely to be inhabited by any protected species. Those protected species known from the York Basin all seem to prefer habitats with characteristics not present in the survey area.

Given that the survey area contains few species and that the proposed construction site appears to be especially poor habitat, I believe the installation of the outfall structure in the Pamunkey river will have no adverse affects on any protected species.

References

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- Johnson, Richard I. 1970. The systematics and zoogeography of the Unionidae (Mollusca: Bivalvia) of the southern Atlantic slope region. Bulletin of the Museum of Comparative Zoology 140(6): 263-450.
- Michaelson, David L. 1993. Life History of the endangered dwarf wedgemussel, *Alasmidonta heterodon* (Lea 1829) (Pelecypoda: Unionidae), in the Tar River, North Carolina and Aquia Creek, Virginia. Unpublished MS Thesis. Virginia Polytechnic and State University. Blacksburg, Virginia. 122 pages.
- Riddick, Marceille B. 1973. Freshwater Mussels of the Pamunkey River System, Virginia. Unpublished Master's Thesis. Virginia Commonwealth University. Richmond, Virginia. 105 pages.
- Sickel, J.B. 1973. A new record of *Corbicula manilensis* (Phillipi) in the Southern Atlantic slope region of Georgia. The Nautilus 87 (1): 11-12.

Appendix I Nonstandard Terminology

The following terms of nonstandard usage may appear in the text.

ascending-right side - the side of the river to the right of an observer when standing instream facing upstream, i.e. the ascending direction.

ascending-left side - side of the river to the left of an observer when standing instream facing upstream, i.e. the ascending direction.

descending-right side - side of the river to the right of an observer when standing instream facing downstream, i.e. the descending direction. Note that the descending-right side and the ascending-right side are opposite sides of the river at a given point. Also, the descending-right side is the same as the ascending-left side for a given point.

descending-left side - side of the river to the left of an observer when standing instream facing downstream, i.e. the descending direction.



COMMONWEALTH of VIRGINIA

Department of Game and Inland Fisheries

James S. Gilmore, III
Governor

John Paul Woodley, Jr.
Secretary of Natural Resources

February 4, 1999

William L. Woodfin, Jr.
Director

Mr. Allan Brockenbrough
Virginia Department of Environmental Quality
Piedmont Regional Office
4949-A Cox Road
Glen Allen, Virginia 23060-6296

RE: Totopotomoy Creek Wastewater
Treatment Plant; Hanover County
Pamunkey River
ESSLOG# 12168

Dear Mr. Brockenbrough:

We have reviewed the draft National Pollutant Discharge Elimination System (VPDES) permit for the project referenced above, and offer the following comments under authority of Title 29.1 (Game, Inland Fisheries and Boating) of the Code of Virginia, and in accordance with Permit Regulation § 680-14-01.3.5. A copy of this letter is being provided to the U.S. Fish and Wildlife Service in accordance with the U.S. Fish and Wildlife Coordination Act (48 Stat. 401, as amended; 16 U.S.C. 661 et seq).

The applicant proposes to construct a wastewater treatment plant near Totopotomoy Creek with discharge into the Pamunkey River just downstream of State Route 360. The Phase I and II plants are designed for 5.0 and 10.0 million gallons/day, respectively, using ultraviolet disinfection. Our data indicate that there are no documented occurrences of *endangered* or *threatened* species at the project site. Spawning and nursery areas of anadromous fishes, such as striped bass, river herring, and American shad, have been documented at the project site; therefore, we support dissolved oxygen monitoring to prevent adverse impacts to these species. We also support the use of ultraviolet disinfection to reduce impacts to aquatic biota because chlorine can act as a chemical barrier to anadromous fish migration. We look forward to commenting on instream activity as this project enters the permit phase through the Department of Environmental Quality - Water Division, Virginia Marine Resources Commission, and the U.S. Army Corps of Engineers.

Thank you for the opportunity to comment on this proposed project. Please call me or Tom Wilcox at (804) 367-8999 if we may be of further assistance.

Sincerely,

Raymond T. Fernald, Manager
Environmental Services Section

RTF/TFW

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United States Department of the Interior

FISH AND WILDLIFE SERVICE

Ecological Services
P.O. Box 99
6669 Short Lane
Gloucester, Virginia 23061



March 11, 1999



Mr. Allan Brockenbrough
Department of Environmental Quality
Piedmont Regional Office
4949-A Cox Road
Glen Allen, Virginia 23060

Re: Totopotomoy Wastewater Treatment
Plant, Hanover County, Virginia

Dear Mr. Brockenbrough:

The U.S. Fish and Wildlife Service has received the freshwater mussel survey report dated January 12, 1999, conducted by Philip Stevenson for the referenced project. The survey was conducted to determine if the dwarf wedge mussel (*Alasmodonta heterodon*), federally listed endangered, green floater (*Lasmigona subviridis*), a species of concern, and any other rare mussels occur in the Pamunkey River in the vicinity of the proposed project. This letter is submitted in accordance with provision of the Endangered Species Act (87 Stat. 884, as amended; 16 U.S.C. 1531 et seq.).

The Service has reviewed the survey report and cannot concur with the findings of the report. On February 2, 1999, Dr. Richard Neves provided his comments on the survey and found it lacking in some aspects. The Service concurs with Dr. Neves' concerns which included the time-of-year that the survey was conducted and the level of effort spent sampling. The Virginia Department of Conservation and Recreation, Division of Natural Heritage has also indicated their concern about this survey report.

The Service recommends that another freshwater mussel survey be conducted for this project. The survey should be conducted in May or June, 1999 in the same area as the original survey. In addition, the Service recommends that the survey effort be two to three times greater than the effort put forth in the original survey. The attached list contains individuals that are qualified to conduct surveys for rare freshwater mussels. Please provide a copy of any additional survey reports related to this project to this office. If an additional survey will not be conducted, please inform this office.

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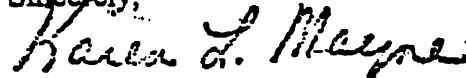
Mr. Allan Brockenbrough

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Until an additional survey is conducted and the Service, Dr. Neves, and the VDCR-DNH concurs with the findings, no state or federal permits should be issued for the proposed project to ensure compliance with the ESA.

If you have any questions or need further assistance, contact Cindy Schulz at (804) 693-6694, extension 127.

Sincerely,



Karen L. Mayne
Supervisor
Virginia Field Office

Enclosure

cc: Frances Broaddus-Crutchfield
Richard Neves, Virginia Tech
Chris Ludwig, VDRC-DNH
Cindy Kane, VAFO
Steven Herzog, Hanover County
Elaine Holley, Corps
Phil Stevenson, Creek Laboratory
Robert Singleton, EPA
William Ellis, McSweeney, Burtch, and Crump
Barbara Newlin

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**ATLANTIC SLOPE FRESHWATER MUSSELS
SURVEY CONTACTS**

Dr. Richard Neves
Department of Fish and Wildlife
Virginia Tech
Blacksburg, VA 24061-0321
(540) 231-5927

Virginia Dept. of Game and Inland Fisheries
2206 S. Main Street
Blacksburg, VA 24060
(540) 552-6992

Phil H. Stevenson
Creek Laboratory, LLC
P.O. Box 6623
Falls Church, VA 22040
(804) 342-0074

Dr. Tom Watters
Aquatic Ecology Lab
Ohio State University
1314 Kinnear Road
Columbus, OH 43212
(614) 292-6170

Dr. Arthur Bogan
N.C. State Museum of Natural Sciences
Raleigh, NC 27626
(919) 715-2606

Steve Roble
Virginia Dept. of Conservation and
Recreation
Division of Natural Heritage
217 Governor Street, 3rd Floor
Richmond, VA 23219
(804) 786-7951

Mr. John Alderman
Route 4, Box 518
Pittsboro, NC 27312
(919) 542-5331

Dr. Bill Adams
Corps of Engineers
P.O. Box 1890
Wilmington, NC 28402-1890

Dr. Gene Keferl
Department of Natural Sciences
Brunswick Junior College
3700 Altama Ave.
Brunswick, GA 31523
(912) 264-7233

Catherine M. Gatenby
Department of Biology
Virginia Tech
Blacksburg, VA 24061
(540) 231-5508
e-mail: cgatenby@vt.edu

Braven Beaty
Department of Fish and Wildlife
Virginia Tech
Blacksburg, VA 24061-0321
(540) 231-5320

Arthur Clarke
Ecosearch, Inc.
325 E. Bayview
Portland, TX 78374
(512) 643-6613

Inclusion of names on this list does not constitute endorsement by the U.S Fish and Wildlife Service or any other U.S. Government agency.

March 31, 1998

001536



UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION III
1650 Arch Street
Philadelphia, Pennsylvania 19103-2029

MAR 29 1999

M. Dale Phillips, Technical Services Administrator
Technical Services Division
Virginia Department of Environmental Quality
629 East Main Street
Richmond, VA 23219

Re: VPDES Permit VA0089915
Totopotomoy WWTP - Hanover County, VA

Dear Mr. Phillips:

According to our Memorandum of Understanding (MOU), the Environmental Protection Agency (EPA), Region III, has reviewed the referenced draft permit that we received from your Piedmont Regional Office on March 17, 1999. Based on our review, we have no objection to the issuance of the permit. Any changes made to the draft permit, other than the above mentioned modifications, will require EPA review prior to issuance.

While EPA has no objection to the issuance of this permit, the Agency has a concern for DEQ's consideration. The Service recommends that a second freshwater mussel survey be conducted prior issuance of this permit to ensure compliance with the Endangered Species Act. In the event that that survey provides evidence of endangered mussels in the receiving stream, we would hope that DEQ would reopen the permit and make any necessary modifications.

If you have any questions, please contact Robert C. Singleton at (215) 814-5729.

Sincerely,

Robert C. Singleton III
Environmental Engineer



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Customer Service Hotline: 1-800-438-2474



COMMONWEALTH of VIRGINIA
DEPARTMENT OF ENVIRONMENTAL QUALITY

James S. Gilmore, III
Governor

John Paul Woodley, Jr.
Secretary of Natural Resources

PIEDMONT REGIONAL OFFICE

4949-A Cox Road
Glen Allen, Virginia 23060
(804) 527-5020
Fax (804) 527-5106
<http://www.deq.state.va.us>

Dennis H. Treacy
Director

Gerard Seeley, Jr.
Piedmont Regional Director

April 27, 1999

Ms. Karen L. Mayne, Supervisor
Virginia Field Office
U. S. Fish and Wildlife Service
P. O. Box 99
6669 Short Lane
Gloucester, VA 23061

RE: VPDES Permit No. VA0089915
Totopotomoy WWTP - Hanover County

Dear Ms. Mayne:

This is in response to your March 11, 1999 letter concerning the proposed issuance of a VPDES permit for the Totopotomoy WWTP in Hanover County. Also on March 11th, the State Water Control Board voted to direct the staff to issue the VPDES permit with three modifications as recommended by the staff. The modifications have since been approved by USEPA. Please note that your letter was not received until five days after the Board's vote.

The high degree of treatment required by the permit, the use of an effluent diffuser, the conservative assumptions made in the effluent mixing analysis, and the use of UV light rather than chlorine for effluent disinfection all combine to make it highly unlikely for the discharge to have an impact should any endangered species exist in this reach of the Pamunkey River. It is our understanding, however, that the applicant does intend to perform a second mussel survey this spring in response to the concerns raised by Dr. Neves and in support of their application to the U.S. Army Corps of Engineers for a 401 permit for the construction of the outfall structure. By copy of this letter, we are requesting that Hanover County provide this office and USF&WS with a copy of the results of the second survey. In the event that any endangered species are found and documentation is provided which indicates that the VPDES permit is not protective of the species, then the permit may be modified in accordance with § 9 VAC 25-31-370 of the State Water Control Board's VPDES Permit Regulation.

Ms. Karen L. Mayne
U. S. Fish and Wildlife Service
April 27, 1999
Page 2

If you have any questions, please contact Mr. Allan Brockenbrough at (804) 527-5027.

Sincerely,



J. R. Bell, Jr.
Water Permits Supervisor

cc: Mr. Robert Singleton, EPA Region III
Mr. Frank W. Harksen, Jr., Hanover County
Mr. Chris Ludwig, VDCR-DNH

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United States Department of the Interior

FISH AND WILDLIFE SERVICE

Ecological Services
6669 Short Lane
Gloucester, Virginia 23061



May 11, 1999

Mr. Steven P. Herzog, P.E. Utility Engineer
Hanover County
P.O. Box 470
Hanover, Virginia 23069-0470



Re: VPDES permit VA0089915
Totopotomy WWTP
Hanover County, Virginia

Dear Mr. Herzog:

Pursuant to our telephone conversation the week of April 26, 1999, this letter is intended to provide you with the U.S. Fish and Wildlife Service's recommendations for an additional survey to be conducted for the dwarf wedge mussel (*Alasmidonta heterodon*) and its habitat in the vicinity of the influence of the proposed Totopotomy Wastewater Treatment Plant discharge to the Pamunkey River. A limited survey for freshwater mussel fauna and suitable habitat was conducted by a qualified surveyor in November 1998. Our review of the survey results indicate that freshwater mussels do occur in the area below the proposed discharge and suitable habitat exists. In order to ensure protection of any sensitive mussel species that may occur within the influence of the discharge and to ensure Hanover County's compliance with the federal Endangered Species Act (87 Stat. 884, as amended; 16 U.S.C. 1531 et seq.), the Service makes the following specific recommendations for a more definitive survey:

- 1) The instream area immediately in the vicinity of the proposed location of the discharge diffuser should be re-surveyed because there was significant leaf litter at the time of the original survey. Leaf litter may obscure the dwarf wedge mussel which is a relatively small freshwater mussel species, and under such conditions it could be inadvertently over-looked.
- 2) The original survey encompassed an area that extended 800 meters downstream below the proposed discharge location. The Service recommends surveying from this 800 meter location downstream, approximately every ½ kilometer to River Mile (RM) 48.8, Carters Landing (Pampatike). The same intensive techniques as previously used, free-search and transects, should be employed. Carter's Landing is the downstream location at which

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dissolved oxygen data collected by the Virginia Department of Environmental Quality (DEQ) in 1995, indicates that a naturally occurring dissolved oxygen sag occurs at levels below that set forth as the water quality standard. Carter's Landing is located nearly one mile below an area known as The Island, a large meandering wetland that borders the Pamunkey River. This wetland could be a contributing source of instream conditions that exert impacts measured as a dissolved oxygen sag at Carter's Landing. The Virginia DEQ has not yet undertaken an assessment of non-point source loadings to the river that may also contribute to a significant oxygen demand; and the U.S. Environmental Protection Agency intends to include the tidal Pamunkey River in its findings on section 303(d) Clean Water Act list of impaired (oxygen deficit) tidal waters in Virginia. Regarding the importance of dissolved oxygen to freshwater mussels, dwarf wedge mussels appear to require a dissolved oxygen of at least 5.0 milligrams per liter (mg/l) to thrive continuously (Dr. Richard Neves, pers. comm.) It is questionable, therefore, if this species would be found in a habitat that, otherwise suitable, had a dissolved oxygen level below 5.0 mg/l for extended periods of time throughout nearly half the year. The Virginia DEQ has determined that it would be difficult to determine the point at which a dissolved oxygen demand might be exerted by the discharge from this proposed facility. Under certain conditions, including those of low flow and/or in an already oxygen deficit environment, it is understood that an oxygen demand can be exerted potentially miles downstream of an organic (carbonaceous) discharge. A recently permitted wastewater treatment plant in Manquin Creek will also be contributing a biochemical oxygen demand to the river at RM 50, and the cumulative effects of the two discharges on the Pamunkey River have not been quantitatively addressed. For the above reasons pertaining to instream dissolved oxygen conditions, the Service recommends surveying for habitat and species occurrence downstream to Carter's Landing, the point at which a naturally occurring oxygen deficit may be a factor that would limit species occurrence. Above Carter's Landing, the species may occur and a survey would confirm occurrence. Suitable habitat substrate could be a potentially limiting factor for dwarf wedge mussel occurrence. Since the substrate is undetermined downstream of the area previously surveyed, the Service again recommends surveying every ½ kilometer downstream to Carter's Landing. However, beginning at the wetland area known as The Island (where Manquin Creek enters the mainstream at approximately RM 50) continuing downstream to RM 48.8 (Carter's Landing), a survey for suitable habitat should be conducted. In this area, if suitable habitat exists for the dwarf wedge mussel, an intensive survey (as described above) for the species should be conducted.

3) The Pamunkey River is tidally influenced upstream of the proposed discharge, the head of tide being at approximately RM 58 where Totopotomoy Creek enters the mainstream Pamunkey River. Regarding the influence of salinity, it is downstream at RM 34.17 (White House, railroad bridge crossing) where salinity is measured at levels approaching 1 part per thousand. Freshwater mussels appear unlikely to tolerate salinity even as low as 1 part per thousand. Salinity, therefore, would not be a limiting factor for mussel occurrence at Carter's Landing (RM 48.8) or points upstream thereof.

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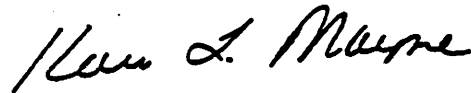
Mr. Steven P. Herzog

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The Service would like to stress that the importance of conducting this more extensive survey is to ensure that neither the Virginia DEQ, through its issuance of the Virginia Pollutant Discharge Elimination System permit, nor Hanover County as the permittee, engage in activities that may adversely affect a federally listed species. The section 9 of the federal Endangered Species Act specifically prohibits activities that constitute a direct violation of the Act or cause a violation of the Act. Please submit the results of the survey to this office for review and, inform this office if a further survey will not be conducted. The Service will be pleased to work with the county, if necessary, to ensure that federally listed mussels are not adversely affected by the project.

The Service appreciates the opportunity to work with Hanover County and the Commonwealth to ensure protection of sensitive aquatic species and habitat. If there are any questions, please contact Cindy Kane of this office at (804) 693-6694, extension 109.

Sincerely,



Karen L. Mayne
Supervisor
Virginia Field Office

cc:

Virginia Department of Environmental Quality, Glen Allen, VA

(ATTN: Mr. Allen Brockenbrough)

U.S. Environmental Protection Agency, Philadelphia, PA

(ATTN: Mr. Robert Koroncai)

Creek Laboratory, Falls Church, VA

(ATTN: Mr. Philip Stevenson)

001557



United States Department of the Interior

FISH AND WILDLIFE SERVICE

Ecological Services
6669 Short Lane
Gloucester, Virginia 23061



June 3, 1999

Mr. Philip Stevenson
Creek Laboratory
P.O. Box 6623
Falls Church, VA 22040



Re: VPDES permit VA0089915
Totopotomy WWTP
Hanover County, Virginia

Dear Mr. Stevenson:

Pursuant to our June 1, 1999 telephone conversation, and in response to your letter of June 1, 1999, this letter is intended to clarify the U.S. Fish and Wildlife Service's recommendations for an additional survey to be conducted for the dwarf wedge mussel (*Alasmidonta heterodon*) and its habitat in the vicinity of the influence of the proposed Totopotomy Wastewater Treatment Plant discharge to the Pamunkey River.

1) During the original survey, freshwater mussels and suitable habitat were found at the Downstream Station (described as 800 meters downstream of the proposed structure location). This station was surveyed for approximately one hour and 6 live mussels were found. Given the time of year of the original survey and the fact that the dwarf wedge mussels could have been overlooked in the substrate, this station should be re-surveyed for freshwater mussels at the increased level of effort per station (see Item 2 below). Pursuant to your June 1, 1999 letter, the new survey already includes a survey, at the increased level of effort, of the Upstream and Crossing Stations, which were obscured by leaf litter during the original survey. One additional station, Tributary Station was surveyed for more than 1.5 hours and 47 live freshwater mussels, though no dwarf wedge mussels, were found. It is the Service's opinion that the level of effort at that particular station was in accordance with the increased level of effort (see Item 2 below) and a re-survey is not necessary.

2) As detailed in your letter and determined during our telephone conversation June 1, 1999, increased level of effort includes five, 20 meter transects per station, and an increase in station search time from a minimum of 30 minutes per station to a minimum of 1.5 hours per station. In addition, the new survey design includes a number of survey

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Mr. Philip H. Stevenson

2

locations (as detailed in the Service's May 11, 1999 letter to Hanover County)
downstream of the proposed outfall.

If there are any questions, please contact Cindy Kane of this office at (804) 693-6694, extension 109.

Sincerely,



Karen L. Mayne

Acad - Supervisor
Virginia Field Office

cc:

Virginia Department of Environmental Quality, Glen Allen, VA
(ATTN: Mr. Allen Brockenbrough)
Dept. of Public Utilities, Hanover County, VA
(ATTN: Mr. Steven Herzog, Utility Engineer)

001566

HAZEN AND SAWYER
Environmental Engineers & Scientists

Hazen and Sawyer, P.C.
4011 WestChase Blvd.
Raleigh, NC 27607
919 833-7152
Fax 919 833-1828

August 30, 1999



Karen L. Mayne, Supervisor
U.S. Fish & Wildlife Service
Ecological Services
6669 Short Lane
Gloucester, VA 23061

Re: Pamunkey River Mussel Survey
Totopotomoy WWTP, Hanover County
H&S Job No. 2732


Dear Mrs. Mayne:

As requested in your March 11, 1999 letter to Allan Brockenbrough of the Department of Environmental Quality, and in your May 11, 1999 letter to Steve Herzog of Hanover County, the County has completed an additional mussel survey for the Pamunkey River in the vicinity of the proposed discharge for the Totopotomoy Wastewater Treatment Plant. A copy of the study titled "A Survey for Freshwater Mussel Fauna in Tidal Waters of the Pamunkey River, Hanover County, Virginia (VPDES permit VA0089915)" is enclosed for your use. The study determined that there are no rare, threatened or endangered Mussels in the survey area.

We look forward to your review of this study. If you have any questions or concerns, please contact me.

Very truly yours,

HAZEN AND SAWYER, P.C.


Ronald L. Taylor, P.E.
Senior Associate

RLT/jet
Enclosure

cc: Steve Herzog, Hanover County
Cindy Kane, USF&W (1 copy)
Allan Brockenbrough, DEQ (3 copies) ✓

001584

**A Survey for Freshwater Mussel Fauna in Tidal Waters of the
Pamunkey River, Hanover County, Virginia
(VPDES permit VA0089915)**

Submitted to:

**Timmons, Inc.
711 N. Courthouse Road
Richmond, VA 23236-4099**

**Submitted by:
Creek Laboratory, LLC
P.O. Box 6623
Falls Church, Virginia 22040
(703) 533-7327
philstevenson@creeklab.com**

August 19, 1999

Introduction

Hanover County currently seeks to receive permits related to construction and operation of a wastewater treatment plant with an outfall in the Pamunkey River, Hanover County, Virginia. The U.S. Fish and Wildlife Service requested Hanover County to undertake a survey for the federally listed-endangered dwarf wedgemussel (*Alasmodonta heterodon*) (Mayne, 1998). Philip H. Stevenson of Creek Laboratory, LLC undertook this survey of the Pamunkey River at the proposed discharge site and adjacent areas to determine the presence of protected freshwater mussel species which proposed activities may impact.

Methods

The overall survey area extended from 200 meters upstream of the proposed outfall structure downstream to the vicinity of Pampatike Landing(=Carter Landing), King William County, Virginia. The survey focused on the dwarf wedgemussel (*Alasmodonta heterodon*), a federally listed-endangered species.

Figure 1 indicates the survey area. This figure is derived from a selected portion of the U.S. Geological Survey topographic map of the Manquin, Va. 7.5 minute quadrangle. The author added annotations to show the approximate site of relevant features including sampling stations. Sampling stations and their approximate position are noted. Table 1 lists the sampling stations examined and their approximate river mile.

Survey design followed criteria outlined by U.S. Fish and Wildlife Service. (Mayne, 1999). Survey design involved two related objectives. One objective was to satisfy concerns regarding results of a 1998 construction impact survey in the immediate vicinity of the proposed construction site. The 1998 survey investigated four sampling stations in a river reach from 200 meters upstream of the proposed outfall structure to 800

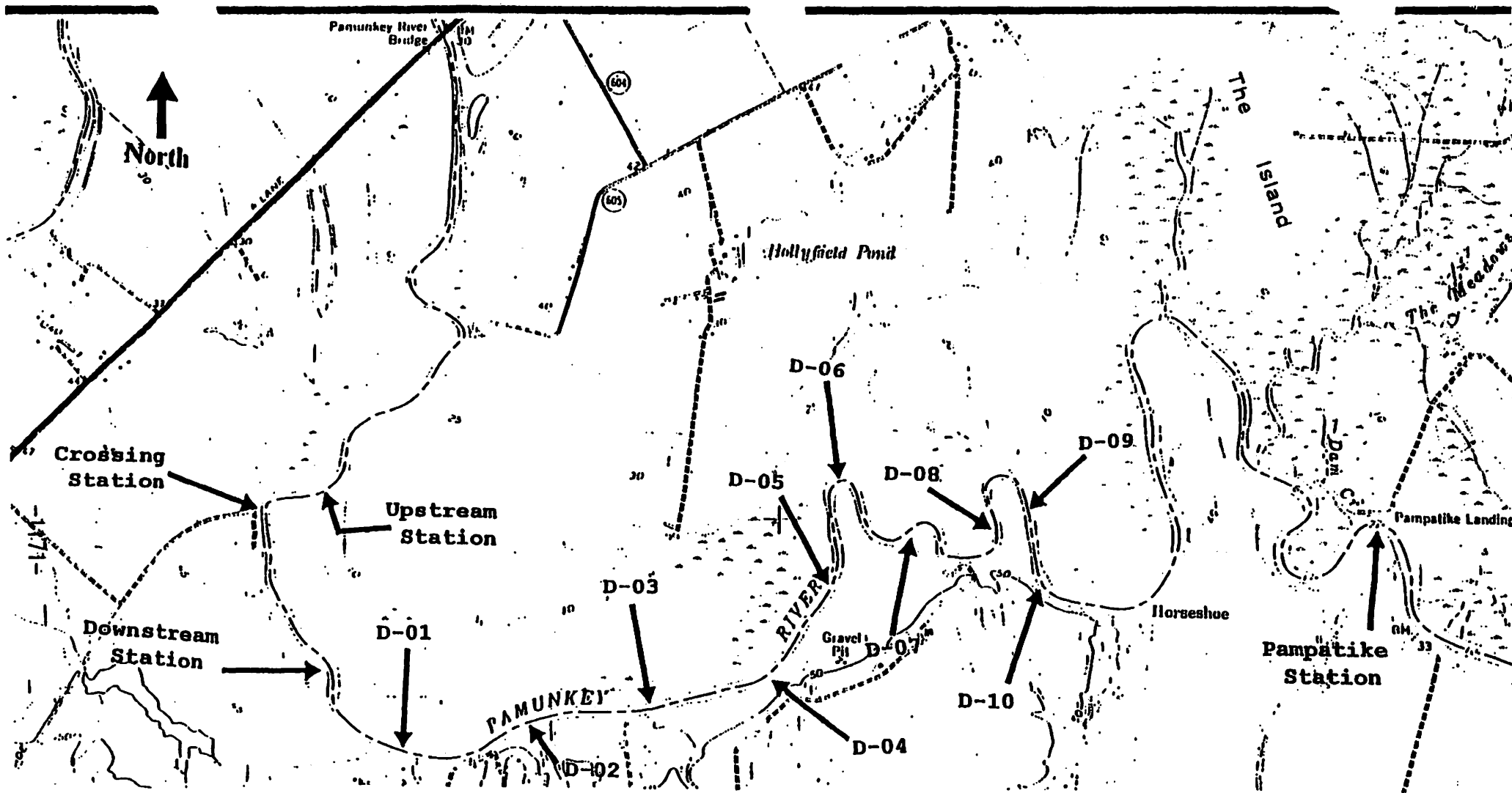


Figure 1. Survey Area in Tidal Section of the Pamunkey River, Hanover County, Virginia
(From Manquin, Va. U.S.G.S. 7.5 minute map; 1:24,000)

Station Identifier	River Mile	Locale
Upstream Station*	53.1	200 meters upstream of proposed
Crossing Station*	53.0	Proposed outfall location
Downstream Station*	52.5	800 meters downstream of proposed outfall
D-1	52.5	1300 meters downstream of proposed outfall
D-2	52.2	1800 meters downstream of proposed outfall
D-3	51.9	2300 meters downstream of proposed outfall
D-4	51.6	2800 meters downstream of proposed outfall
D-5	51.3	3300 meters downstream of proposed outfall
D-6	51.0	3800 meters downstream of proposed outfall
D-7	50.6	4300 meters downstream of proposed outfall
D-8	50.3	4800 meters downstream of proposed outfall
D-9	49.7	5300 meters downstream of proposed outfall
D-10	49.4	5800 meters downstream of proposed outfall
Pampatike Landing	48.8	9300 meters downstream of proposed outfall
<p>Table 1. Sampling station locations on the tidal Pamunkey River, Hanover County, Virginia.</p> <p>* Site also examined in 1998.</p>		

meters downstream of the structure site. Three of these sampling stations were to be re-examined.

The second study objective was to determine potential presence of *Alasmidonta heterodon* in the Pamunkey River in the region downstream of the proposed outfall to the limit of perceived possible water quality influences of the discharge. Sampling stations were to be investigated beginning 0.5 river kilometers downstream of the furthest downstream station examined in 1998. Potential sampling stations were spaced every 0.5 kilometers from that point downstream to the final station near Pampatike Landing, also known as Carter Landing.

The survey design incorporated a work modification rule. While sampling successive stations downstream from the outfall site, if habitat appeared to become inappropriate to the point that additional sampling was not warranted, no further stations would be examined. Regardless of habitat parameters, the station at Pampatike Landing would be examined for freshwater mussels.

Survey methods consisted principally of SCUBA diving. Two different search techniques were used at each sampling station, transect sampling and unconstrained sampling.

For transect sampling, five 20 meter transects were searched. Each transect consisted of a 20 meter length of chain with buoys marking each transect end. The transects were laid parallel to the flow of the river, with the ends of the transects forming a rough line perpendicular to the channel. Transects were spaced evenly across the river; however, some adjustment, typically slightly crowding toward midstream, would be made to account for large log piles or trees in the river.

For each transect, a meter wide swath would be searched centered on the transect. Search time for each transect would be recorded as well as the mussels encountered. Also recorded was water depth and substrate type.

After the completion of transect searching, unconstrained searching would be performed. This constituted searching for a time interval throughout the most appropriate habitats available. Generally, this searching concentrated in the 20 meter length of river wherein lay the transects; however, searching usually included some areas both upstream and downstream of the transects. During unconstrained searches, bankside areas typically avoided in transect sampling due to the presence of submerged timbers, would be examined as habitat warranted. For unconstrained searches, the number of mussels found and the search time expended was recorded.

Field surveys occurred on June 16, 17, 18, and 19, 1999. Philip H. Stevenson, Robert Pegram, Alan Hancock, and William Crafton conducted the field surveys. Water visibility varied from one to three meters during the survey, being dependent largely on water depth. Underwater lights were used to aid searching as needed. Water levels appeared to be normal for the season.

Observations

The survey found four mussel species, family Unionidae. Table 2 lists the bivalve species found and their federal and state status. No protected species of native freshwater mussel were found.

Scientific Name	Common Name	Federal Status	State Status
<i>Anodonta imbecilis</i>	alewife floater	None	None
<i>Elliptio angustata</i>	Atlantic spike	None	None
<i>Elliptio complanata</i>	eastern elliptio	None	None
<i>Leptodea ochracea</i>	tidewater mucket	None	None
<i>Corbicula fluminea</i> *	Asiatic clam	None	None

Table 2. Bivalve Species Found in Pamunkey River,
Hanover County, Virginia

* non-native clam

Table 3 reports the abundance of mussels for the sampling stations. Table 3 indicates whether the given species was found as live specimens or relict shell. Relict shell here means any shell not still containing soft tissue such as muscle tissues and includes shells of differing intactness and likely widely varying age postmortem.

Table 3 indicates that there is a moderate abundance of common native mussels in the tidal habitats of the Pamunkey River examined. Predominately one species, *E. complanata*, was found. Other species were found typically as solitary individuals or shells, all at sites near the downstream end of the overall survey area.

Mussels were found overwhelmingly in the relatively coarsest substrate available at any given site, muddy gravel among submerged logs. Very few live mussels were found in sand or mud substrates which represent the most commonly encountered substrates. The two sites at which the greatest number of mussels were found, D-08 and Downstream Station, both had relatively

	Transect Data		Unconstrained Search Data		Total		
Station Identifier	Mussels	Time	Mussels	Time	Mussels	Time	CPUE ^a
Upstream Station*	0L/11R	1.0	3L/10R	0.9	3L/21R	1.9	1.6
Crossing Station*	6L/9R	0.8	4L/8R	0.9	10L/17R	1.7	5.9
Downstream Station*	2L/1R	0.8	19L/6R	1.0	21L/7R	1.8	11.7
D-01	2L/2R	1.0	0L/0R	0.7	2L/2R	1.7	1.2
D-02	0L/0R	1.0	0L/0R	0.8	0L/0R	1.8	0.0
D-03	4L/10R	1.0	2L/5R	0.5	6L/15R	1.5	4.0
D-04	2L/4R	1.0	0L/3R	0.8	2L/7R	1.8	1.1
D-05	0L/5R	1.0	0L/5R	0.5	0L/10R	1.5	0.0
D-06	2L/2R	1.0	7L/10R	1.0	9L/12R	2.0	4.5
D-07	0L/0R	0.5	8L/2R	1.0	8L/2R	1.5	5.3
D-08	26L/6R	0.9	25L/8R	1.0	51L/14R	1.9	26.8
D-09	0L/7R	0.7	9L/6R	1.0	9L/13R ^b	1.7	5.3
D-10	1L/3R	0.7	13L/16R	1.0	14L/19R ^b	1.7	8.2
Pampatike Landing	5L/1R	1.0	2L/3R	0.6	7L/3R	1.6	4.4
Total	50L/61R	12.4	92L/82R	11.7	142L/143R	23.1	5.9

Table 3. Mussels observed by sampling station, tidal waters of the Pamunkey River, Hanover County, Virginia.

All observations are for *Elliptio complanata* unless otherwise noted.

- ^a - Catch per unit effort, calculated for live mussels only.
- ^b - includes 1 live *Leptodea ochracea*, 2 live *Anodonta implicata*.
- ^c - includes 1 live *Anodonta implicata*, 1 relict *Elliptio angustata*.

large amounts of coarser substrate present; however, Crossing Station, the site with the coarsest substrate, had a moderate mussel abundance. The other distributional pattern of note is that the stations from D-01 through D-05 had generally very low mussel abundance. These sites had substrates largely limited to sand or soft mud/silt/detritus.

Corbicula was present throughout the survey area. This introduced clam frequently occurred in areas in which mussels were usually not present, including soft mud of near the river banks. This clam was generally very uncommon or absent in the sand substrate which dominates midstream.

The habitat of this section of the Pamunkey River is described below. This description provides an overview of all general habitat parameters. Following the overview, specific sampling stations will be described in more detail as appropriate.

The Pamunkey River is freshwater tidal stream with a moderate tidal current. Stream width varied from 36 to 54 meters. Tidal variation was approximately 1.0 meter. Midstream water depth at low tide varied from 1.5 to 6 meters.

The river substrate can be typified as follows. Sand with a variable silt overlay occupies the midstream 40-60% of the river bed. As a rule, the sand substrate included a very minor amount of coarse particles such as gravel. Bankside areas were mud, detritus, or sometimes clay exposures.

A transition zone several meters wide often lay between the sandy midstream substrate and bankside areas. The zone generally consisted of a muddy gravel substrate found among logs. Gravel was found almost exclusively among logs, particularly from Downstream Station and sampling stations further downstream. Logs lay oriented roughly parallel to the current, and appear to act as "breakwaters" buffering the gravel from the current.

As one proceeds towards the bank from the logs, water depth decreased rapidly. Very soft substrates of mud, silt, and/or detritus typify bankside areas. Soft substrate extends 5-15 meters toward midstream.

Live mussels were found almost exclusively in the transition zone. Very rarely were live mussels found in the sand substrate of midstream. Transect search data reflects this. Transect searches, as opposed to unconstrained searches, generally are more representative of overall conditions, as transects sample a substrate in proportion to its representation in the river bed.

Unconstrained searches usually produced more live mussels as divers could search areas that observably contain coarser substrates such as gravel. Some transects did land in the transitions zone noted earlier and searches usually would produce live mussels. The largest number of live mussels from transect searches, at site D-08, resulted when there were several logs present midstream resulting in an uncommon abundance of gravel substrate present midstream.

The river banks tend to be moderately low, typically 1-2 meters high. Vegetation borders the creek throughout. The banks are either well-vegetated or composed of dense root mats where steeply cut. In a few locations, the river steeply cut uplands abutting the river producing very steep, bare banks 5-10 meters high. Trees shaded most bankside areas; however the canopy rarely reaches more than 10 meters toward midstream. No submerged aquatic vegetation was observed.

The most significant disturbances along the river are where several riparian landowners have removed most trees and replaced them with well-groomed lawns. Small docks and boat ramps were the other noted human disturbances.

Trees apparently fall frequently into the river. Crossing Station has a live tree fallen into the sampling station since

the November, 1998 survey. Also, one day while sampling a tree fell into the river in the interval between leaving the landing and returning and the end of the day. Numerous tree trunks and some live trees lie extending perpendicular into the river. Erosion appears to be very active in this stretch of the river.

In the text which follows, I describe the survey results for specific sampling stations.

The three furthest upstream sampling stations, as a group, had coarser substrate than the other sampling stations. Crossing Station, in particular, had a significant amount of cobble present toward the ascending left side, adjacent the sharply cut bank. Upstream Station had significant amounts of gravel mixed in with a the midstream sand substrate. Downstream Station differed in having a large amount of gravel deposited among logs along the ascending right side, a depositional pattern observed at downstream stations. Below Crossing Station, no sampling station was noted to have a substantial amount of gravel, except associated with fallen logs. No downstream stations had any significant amounts of cobbles.

Even though these upstream stations had some coarser substrate particles, the bankside areas were still dominated by soft mud and organic matter. In 1998, bankside portions of both Upstream Station's and Crossing Station's substrate were noted to be thickly covered by newly fallen leaves. During this survey those same areas were noted to have substrates of soft mud and detritus, as would be expected from a bankside eddy capable of depositing leaf fall in a tidal river.

The sampling stations D-01 through D-05 had a similar character. They define a relatively shallow reach of river, depth not exceeding 4 meters. The sites substrata was very uniform, with loose sand dominating the middle third of the river. The sand, having a thin silt layer midstream, became progressively

muddier toward either bank. Within 10 meters of the bank the substrate transitioned entirely to soft mud. *Corbicula* was generally the only bivalve present in the mud, with virtually no bivalves of any kind in the loose sand.

Stations D-06 to D-10 define a reach where substrates tended to show an initial increase in gravel present, which slowly decreased heading downstream until dropping out again at D-10. Gravel was always limited to areas near one bank and among fallen logs in deeper water. The midstream areas had the same general character as noted for the five immediately preceding upstream sites, i.e. an expanse of loose sand. The sand tended to be clean swept in midstream. The gravel substrate tended to be muddy but not deeply embedded.

D-10 was the station at which periodic sampling every 0.5 kilometer heading downstream terminated. This station was adjacent to a very steeply cut and bare bank, which appeared to be composed almost exclusively of clay. This is the general nature of the upland which abuts the river for roughly one kilometer here. Noting the preference for mussels to occupy only the transition zone gravel patches, this habitat becoming relatively scarce, and little apparent source material for such substrate from eroding uplands adjacent the river, I judged that the availability of potential habitat for *A. heterodon* was so remote that no more stations intervening between D-10 and the terminal station, Pampatike Landing, needed to be sampled.

Stations D-09 and D-10 both yielded additional species from the upstream stations. The live specimens were found in the gravel of the transition zone. One species, *Elliptio angustata*, was found at D-10 as a single, small valve.

Pampatike Station, the furthest downstream examined, has a substrate that consists of a loose sand dominating the middle of the river. An extensive mud/detritus bed extends well toward

midstream from the inside of the bend. Toward the outside of the bend, the sand includes a small fraction of gravel; however, just as gravel noticeably increases, the bottom begins to rise more sharply. This rise coincides with a soft clay exposure which leads to a soft mud/sand shoreline substrate. The few mussels found at this station were all found toward the outside of the bend.

Discussion

The Pamunkey River contains populations of four native mussel species in the survey area. These four species range widely in eastern North America. All occur both further south and north of the Pamunkey River. No evidence of the presence of *Alasmidonta heterodon* was found.

Presence of native mussels is a minimum threshold indicator of potential for *A. heterodon*, as this species never occurs outside the presence of other unionid species; however, all of these species often occur in habitats apparently unacceptable for dwarf wedgemussel. *Leptodea ochracea* may occur primarily in habitats unsuitable for *A. heterodon*. *Elliptio complanata* is one of the most widely ranging mussels in eastern North America, and frequently occurs in habitats inappropriate for rare fluviatile mussels.

Corbicula fluminea generally is a negative indicator for *A. heterodon*. I have previously not noted *A. heterodon* to occur sympatrically with *Corbicula*, and this exotic species seems to suppress other native bivalve populations as well. Similar interpretations have been advanced by other researchers (Boozer et al, 1979; Clarke, 1988; Sickel, 1973).

Stream substrate is largely inappropriate for mussels. As noted, mussels occur almost exclusively among the stablest substrates present. This result is predicted from the 1998 Pamunkey River survey in which mussels were found only in relatively coarse substrate (Stevenson, 1999).

The largest expanse of silt free substrate was loose sand; apparently unsuitable for all mussels. The sand is likely mechanically unsuitable to anchor mussels, resulting in displacement during high currents to areas of lower velocity. Also predation might occur more readily there.

The soft sediments of mud and detritus abutting the river banks is apparently unsuitable for mussels. The species found in this survey virtually never occurred there. *Alasmodonta heterodon* is noted to inhabit variable substrate, but is not noted to come from soft mud and detritus (Adams, 1990; Clarke, 1988; Counts, et al., 1991; Johnson, 1970; Michaelson, 1993; Neves, 1993; Ortmann, 1919; Stevenson, 1994; Strayer et al., 1997; U.S. Fish and Wildlife Service, 1993).

The tidal nature of the Pamunkey River seems to exert a pervasive influence here. The 1998 survey noted that midstream cobble deposits were muddy. The alternating directional flow probably allows more settling of fine silt among coarse midstream substrate as there is no unidirectional transport of particles downstream as in a nontidal river.

The tidal nature of the stream is also reflected in the species present. *Leptodea ochracea* is well-known to inhabit tidal waters (Adams, 1990; Johnson, 1970; Ortmann, 1919; Strayer et al., 1997). *Anodonta implicata* is also known from tidal areas (Johnson, 1970; Ortmann, 1919; Strayer et al., 1997). *Elliptio complanata* ranges widely, and I have frequently seen it in freshwater tidal areas in Virginia.

The fourth species reported, identified as *Elliptio angustata*, is a problematic species systematically and taxonomically and any analysis of its presence is difficult. I have found it in very soft mud previously and it seems to favor quieter waters (unpub. data). The single specimen found was represented by a small broken valve missing the posterior third of the shell, and another very similar recognized species, *Elliptio fisheriana*, with distinguishing characters present in the posterior part of the shell might occur here. I have found mussels identifiable as *E. fisheriana* in more variable habitats than *E. angustata*; however, those habitats have included mud

substrate. In any eventuality, the fourth species found does not indicate greater likelihood of any rare mussels being present, and its occurrence seems to agree with the independent observation of reduction of coarse substrate at station D-10.

Since its description in 1830, no definitive record of *Alasmidonta heterodon* occurring in tidal waters exists. (See (Adams, 1990; Clarke, 1981; Johnson, 1970; Ortmann, 1919; Strayer et al., 1997; U.S.F.W.S., 1993). Riddick's 1973 survey of the Pamunkey basin found dwarf wedgemussel only at the edge of the Piedmont well away from tidewater. Given the long history of this species and its distinctive shell characteristics, identification of specimens from tidal waters would have been expected by now. Adams, 1990, Johnson, 1970, Ortmann, 1919, and Strayer et al., 1997 all report records of tidal Unionidae, so the lack of records for dwarf wedgemussel is not biased simply by authors intended topical coverage. It appears that some factor associated with tidal freshwater prevents *A. heterodon* from occurring there.

The U.S. Fish and Wildlife Service noted an oxygen sag in the Pamunkey River adjacent Pampatike Landing (Mayne 1999). A value of 2.8 mg/liter was reported there; the STORET water quality database further reported a value of total dissolved oxygen as 3.9 mg/liter on September 11, 1996 at the Route 360 bridge over a mile upstream of the survey area. (Alling, 1999). Given the presence of substrate containing much organic matter throughout the survey area, natural dissolved oxygen levels could be problematic for the survival of dwarf wedgemussel in tidal freshwater here and elsewhere. This may explain the lack of records for *A. heterodon* in tidal waters over the 169 years of recorded knowledge of the species.

It is conceivable that conditions at the very border of tidewater, where conditions are more nearly like that of a nontidal stream might support dwarf wedgemussel. While such

situations might occur in the Pamunkey river, they would exist several miles upstream of the survey area at a minimum. The entire survey area has a strong tide which rises 0.8 to 1.0 meters high. The rising tide appears to last nearly six hours, i.e. it follows the periodic pattern expected on the coast. The tidal nature of the Pamunkey River in the survey area probably renders the habitats present there highly unsuitable to sustain *Alasmodonta heterodon*.

Summary

Four common and widespread species of native freshwater mussels, family Unionidae, were found. The species found are:

Anodonta imbecilis

Elliptio angustata

Elliptio complanata

Leptodea ochracea

No specimens of the dwarf wedgemussel, *Alasmodonta heterodon*, or any other federally or state listed endangered or threatened species were found.

From consideration of general biological features and stream habitats, I consider the Pamunkey River in the survey area to be highly unsuitable for *A. heterodon*. Furthermore, the complete lack of any literature records for the 169 years of recorded history of the dwarf wedgemussel noting its occurrence in tidal waters strongly argues against its potential occurrence in tidal waters here.

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Appendix I Nonstandard Terminology

The following terms of nonstandard usage may appear in the text.

ascending-right side - the side of the river to the right of an observer when standing instream facing upstream, i.e. facing the ascending direction.

ascending-left side - side of the river to the left of an observer when standing instream facing upstream, i.e. facing the ascending direction.

descending-right side - side of the river to the right of an observer when standing instream facing downstream, i.e. facing the descending direction. Note that the descending-right side and the ascending-right side are opposite sides of the river at a given point. Also, the descending-right side is the same as the ascending-left side for a given point.

descending-left side - side of the river to the left of an observer when standing instream facing downstream, i.e. facing the descending direction.



United States Department of the Interior
FISH AND WILDLIFE SERVICE

Ecological Services
6669 Short Lane
Gloucester, Virginia 23061



September 8, 1999



Mr. Ronald L. Taylor, P.E.
Hazen and Sawyer, P.C.
4011 WestChase Boulevard
Raleigh, North Carolina 27607

Re: Wastewater Treatment Plant
VPDES permit VA0089915,
Hanover County, Virginia

Dear Mr. Taylor:

This responds to the September 3, 1999 correspondence submitted as part of ongoing coordination with the U.S. Fish and Wildlife Service regarding the referenced project. In the Service's March 11, 1999 and May 11, 1999 letters, we indicated that the Pamunkey River should be re-surveyed during summer months in a more rigorous manner for appropriate habitat for the federally listed endangered dwarf wedge mussel (*Alasmidonta heterodon*) which may occur within the influence of the proposed wastewater discharge.

The Service has reviewed the freshwater mussel survey report performed by Creek Laboratory in conformance with additional requirements set forth by the Service. Based on the August 19, 1999 survey report, it is the opinion of the Service that appropriate habitat for this species does not occur at the project site and, therefore, this project is not likely to adversely affect the dwarf wedge mussel.

If project plans change or portions of the proposed project were not evaluated, it is the Service's recommendation that the changes and/or remainder of the project be submitted for our review. If

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Ronald L. Taylor, P.E.

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you have any questions or need further assistance, please contact Cindy Kane of this office at (804) 693-6694, extension 109.

Sincerely,



Karen L. Mayne
Supervisor
Virginia Field Office

cc:

Department of Public Utilities, Hanover County, VA

(ATTN: Mr. Steven Herzog, Utility Engineer)

Virginia Department of Environmental Quality, Glen Allen, VA

(ATTN: Mr. Allen Brockenbrough)

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COMMONWEALTH of VIRGINIA

DEPARTMENT OF ENVIRONMENTAL QUALITY

EXCERPT FROM THE PROCEEDINGS OF THE STATE WATER CONTROL BOARD AT ITS MEETING ON MARCH 11, 1999

MINUTE NO. 11 - Proposed Issuance of Permit No. VA0089915 Totopotomoy WWTP, Hanover County

Piedmont Regional Office Engineer Allan Brockenbrough made a presentation to the Board summarizing the issues raised during the public comment period and at the public hearing for the proposed VPDES permit. The permit would be issued to the County of Hanover for discharges of 5.0 and 10.0 MGD of treated wastewater from the Totopotomoy WWTP to the Pamunkey River. A public hearing on the proposed permit was held in Hanover Courthouse on January 19, 1999 with Mr. Van Auken serving as the hearing officer. Numerous issues were raised during the hearing and the public comment period. Issues included the existing low dissolved oxygen concentrations in the Pamunkey River; toxic impacts on anadromous fish and mussels; the possibility of rare, threatened or endangered mussels near the outfall; outfall location; temperature impacts; wetlands impacts due to construction and operation of utility lines; water supply impacts; and numerous issues unrelated to the VPDES permit.

After a lengthy discussion on the issues raised during the hearing and changes to the permit proposed by the staff, the following staff recommendation was made to the Board:

STAFF RECOMMENDATION

1. Direct the staff to issue VPDES Permit No. VA0089915 with the following modifications:
 - a. Decrease the Total Suspended Solids limitation to a monthly average of 10 mg/l and a weekly maximum of 15 mg/l.
 - b. Increase the minimum Dissolved Oxygen limitation from 5.0 mg/l to 6.5 mg/l.
 - c. Include the following special condition dealing with an in-stream macroinvertebrate study:

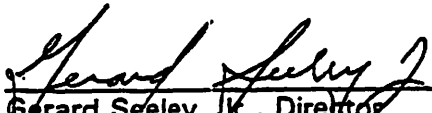
**EXCERPT FROM THE PROCEEDINGS OF THE STATE WATER CONTROL
BOARD AT ITS MEETING ON MARCH 11, 1999**

**MINUTE NO. 11 - Proposed Issuance of Permit No. VA0089915
Totopotomoy WWTP, Hanover County**

"The permittee shall perform an annual quantitative benthic macroinvertebrate study on the Pamunkey River to assess impacts of the Totopotomoy WWTP discharge. The study shall be conducted between August 15th and October 15th beginning in 2002. The study design, including sampling locations, survey methods, data analysis, etc. shall be submitted to and approved by DEQ Water Division staff prior to initiation of testing."

Board Decision

The Board voted 6-to-1 to approve the staff's recommendation with Ms. Jo Ann Kwong dissenting.


Gerard Seeley, Jr., Director
Piedmont Regional Office

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STATE WATER CONTROL BOARD
BOARD MEETING – MARCH 11, 1999
Discussion – Totopotomoy WWTP, Hanover County

Gerard Seeley:

The next issue concerns a draft permit for the County of Hanover's Totopotomoy Sewage Treatment Plant which was the subject of a Public Hearing about three weeks ago. I want to ask the permit writer, Mr. Allan Brockenbrough to come up and do the staff presentation. Mr. Vanauken chaired the Public Hearing we had at the County Courthouse. It was quite a spirited event. Hopefully, we can narrow it down. It's a complex permit; the issues are complex and hopefully we'll be able to sort through those for you. I assume that you all got the packages we sent out last week. Hopefully, they gave you an opportunity to get an idea of what the issues are.....Mr. Brockenbrough will try to guide you through those.

Allan Brockenbrough:

Good Morning Mr. Chairman, members of the Board. My name is Allan Brockenbrough. I'm the permit writer for the proposed Totopotomoy Wastewater Treatment Plant in Hanover Co. You have before you a very complex, major new permit for a major wastewater treatment facility on the Pamunkey River. It entails a lot of complex permitting issues. I trust you've had an opportunity to review the detailed briefing package provided last week. I'd like to summarize those issues for you. Feel free to interrupt me at any time with any questions you may have. We're also handing out a copy of viewgraphs and a little better map to help you visualize some of the areas that are of concern through this hearing and permitting process. Hanover County has wrestled with what to do for long term sewage capacity for many years now. They currently operate three wastewater treatment plants for the community of Hanover Courthouse, the Town of Ashland, and the vicinity of Doswell. The majority of their sewage is presently sent to Henrico County for treatment at the Henrico Regional Wastewater Treatment Facility. Beginning in 2003 the county believes that they will be exceeding their allocated capacity at the Henrico facility and has a need for additional sewage capacity. In the mid-80s they decided that a wastewater treatment plant on Totopotomoy Creek with a discharge to the Pamunkey River was the way they wanted to proceed. You've got a map there in front of you; the black and white map which shows the location of the treatment plant on Totopotomoy Creek and the discharge down on the Pamunkey. You've got another color map before you that has a little better detail on the receiving stream. Question arose about copies of maps, etc., by a member(s) of the board. (Not understood) The county applied to DEQ in April of 97 for a discharge permit for flows of 5 MGD and 10 MGD. There were numerous modifications to the application over the years, over the next year and a half. The application was considered complete in October of 98. Now, knowing that there was substantial public interest in the proposal the county officials requested, up front, that we authorize a public hearing for this permit. The hearing was authorized and held in Hanover Courthouse on January 19th of this year. Mr. Van Auken served as the Hearing Officer. About 65 individuals attended the hearing. We had comments from 18 to 20 individuals. We also received 25 to 30 written comments during the notice period. The detailed summary of the oral comments and written comments, also, is included in your briefing package. We've categorized and tried to prioritize the issues in terms of their applicability under the VPDES Permit Program. I'll summarize it for you, and address each for you. The primary concern that we saw, the number one issue, was dissolved oxygen (DO) in the Pamunkey River. We're located in a very sensitive section of the river in the very top of the estuary. Route 360 or slightly above

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360, is pretty much the upper end of the tidal action in the estuary. Below 360 for about a distance of 8 miles we've got pretty good water quality. When we get down in this area known as the "island" we have existing dissolved oxygen (DO) violations in the Pamunkey River; the staff believes due to the extensive marshes in the area. This one marsh right here in the island area covers roughly a square mile that is mud flat at low tide and submerged at high tide. And the Pamunkey from there on down.....we have another regional map on the back side of this.....is very much dominated by marshes. To orient yourselves, we're talking about it...here's 360; discharge location in here; 6 miles down to this first very large marsh; from there on out the Pamunkey River is dominated very much by extensive tidal marshes. And, like a lot of the rivers we have throughout the state with a lot of tidal marsh we often have suppressed dissolved oxygen (DO) levels as a result of the organic load in those marshes that's delivered to the river with every tidal cycle. We've had a policy, the DEQ, since 1987 for waters that are impacted by swamps or marshes..and that is that we apply limits of 10 mg/l CBOD5, total suspended solids (TSS); and 3 mg/l TKN. And it is our opinion that effluent treated to that degree is not hurt or further contribute to lower DO values in the receiving stream. That's such a high level of treatment that you can put as much of it as you want out there and it's not going to further suppress DO. You're pretty much talking about being close to background conditions. Those were the limits originally put in this permit. During the permitting process we did back off of the total suspended solids (TSS) limit to 15 mg/l at the request of the applicant. That meant some cost savings in terms of whether or not they would immediately need effluent filters at the facility. There's not a real direct correlation between suspended solids and DO in the river and we accommodated that. Since that time we have reevaluated that and due to the extent of the low DO values in this area of the estuary, we experienced low DO, roughly 30% of the time we'll violate the 5 mg/l daily average standard. Due to the extent of those low DO occurrences we think that we need to go back to the 10-10-3; the original 10-10-3 that was in the permit and restore that original 10 mg/l suspended solids limit. Not so much out of concern for suspended solids, but for the additional reliability it gets you on the oxygen demanding materials and on the CBOD. In order to meet 10-10-3, the Virginia Department of Health generally requires tertiary treatment effluent filters. Facilities we have in this region with effluent filters consistently put out BODs and total suspended solids in the 1-2-3-4 range, pretty much the background level that we have in the Pamunkey River. We've also gone and reevaluated the DO limit. We had a minimum DO limit of 5 mg/l which is the standard in this permit. As a result to the public comments and taking a closer look at the DO violations in the Pamunkey we've decided to increase that to 6.5 from 5.

Board Member (Mr. VanAuken):

At this point could you tell us approximately what the dissolved oxygen level would be when we get down around the island, along the creek?

Brockenbrough:

We have DO values in that area in the summer time in between 4 and 5 on a 24-hour average. On an instantaneous it may be down around 4 or even lower on an instantaneous value, but on a 24-hour average we violate the 5 roughly 30% of the time. It's upper 4s, mid 4s.

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Board Member (Mr. VanAuken):

That's the natural condition though.

Brockenbrough:

That's right. That's right. We have 6's, 6.5's up in this area during warm weather. The second issue that was brought up was toxic impacts and impacts on mussels and anadromous fish. It's a very important segment of river for anadromous fish spawning, a lot of striped bass, shad spawning throughout this whole, whole area. A lot of fry staging here all summer long waiting to go back out to open waters. We believe that the permit is protective of these organisms. We believe that our water quality standards are protective of endangered species and all the species we have in Virginia. We don't feel there'll be further degradation of DO to impact any of these species. With regard to toxics, there are a lot of conservative assumptions that have gone into the limits in this permit. There's mixing from the water that comes down the river. There's also tidal mixing. We have not given the applicant any credit for any tidal mixing in this section of the river. We've only given them credit for the mixing they get from the freshwater flow coming down the river. A very conservative assumption. We believe the water quality standards are protective. But, in response to the concerns about the impacts on organisms, we have proposed to add a study in the permit where the permittee or their consultants will go out and deploy an artificial substrate..usually milk crates in the river above and below the discharge once a year. Leave those in the stream and retrieve and study the macroinvertebrates that have colonized on that artificial strata to further define the extent of any impact. The third issue which is closely related to the first two is endangered species. This section of river is not designated in our water quality standards as containing endangered species. That doesn't mean that they're not there. It hasn't been designated. We do believe our standards and the permit are protective of endangered species. The species of concern is a mussel. Mussels are disappearing at an alarming rate all across the country. For the most part it isn't due to pollutants in the water column though. The primary factors that are resulting in the great decline of mussel population are mostly destruction of the habitat. They don't deal with shifting sediments. And, inadequate soil and erosion control measures have resulted in a lot of siltation, a lot of sifting sediments in a lot of these rivers that the mussels aren't able to adapt to. There are a lot of other reasons, including predation, introduction of exotic species such as zebra mussels and whatnot that out-compete them also. Were it included in our standards as containing endangered species, the only effect on the permit would be a hallogen ban. We would not allow the use of chlorine as a disinfectant. The county is not proposing to use chlorine disinfection. From the very beginning they've gone with ultraviolet disinfection, so, if there were any endangered species in that section there really would be no impact on the limits in the permit. The limits in the permit are protective. The county has gone out and done a survey in preparation of their application for a permit from the Corps of Engineers for construction of the outfall facility. Results of that survey are subject to a bit of debate and dispute by some of the opponents. But again, that doesn't have any impact on the limits in this permit and we'll leave those issues to the Corps and their evaluation of the 404 permit for construction of the outfall. The third, or, excuse me, the fourth major issue has been discharge

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location. I know you've received some correspondence on this. There's discussion in our summary. I'll walk you through a brief history. The discharge location is located on a very large, privately held farm known as Newcastle Farm. I believe it's roughly 900 acres. The county's original proposal was to discharge pretty much in the center of the farm. The farm, basically, runs from 360 down to this tributary, down here (pointing to map). Encompasses all of that open area. The county's original proposal was discharge here in the center of the farm. That's the location of a family-owned boat ramp and irrigation site where they withdraw water for their irrigation and use the river for fishing and swimming. Not wanting to have that at that location the family approached the county and asked them to evaluate some alternatives. The county evaluated an alternative at the top of the farm here at the 360 bridge and two alternatives; one about there (pointing to map) known as Downstream I, and one further down known as Downstream II. After evaluating those sites the county selected the Downstream II site and amended their application accordingly, and the permit was modified. The landowner made it clear that he was not interested in selling to the county under any circumstances. They were going to have to exercise their right of eminent domain. The county also determined at some point that this lower parcel, while on the same farm, was not on the same tax parcel. It was not included in their conditional use permit, local conditional use permit. Neighboring property owners had not been notified they didn't have their own zoning straight for that downstream site.

Board Member (JoAnn Kwong):

Could you explain that part if you will.....I didn't understand (Boardmember)

Brockenbrough:

They have to go through and rezone the property or issue a conditional use permit for the property to be able to construct that sewer line. And they had gone through that process before they came to us to apply for a permit. They determined that this farm was chopped up for tax purposes into several parcels and this lower parcel was not included in their permit. The end result was the county moved back to the original site.

Now, I know you've had some correspondence and whatnot and know that's been subject to a suit and a lot of discussion on intentions and what not.

Board Member (Karl F. Wenger):

Why do the owners of the farm object so, to this particular outfall if this was all done in advance and the conditional use permit was granted? Was it over their objections?

Brockenbrough:

Maybe, they can speak to that, but I would assume that it was over their objections. I believe they had pretty much indicated to the county all along they weren't interested in having an outfall on their property.

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John Marshall:

Allan, I can confirm that.

My name is John Marshall ...we represent the landowners and the conditional use permit was issued over their strenuous objections.

Brockenbrough:

The bottom line is DEQ normally does not pick discharge locations. The board, State Water Control Board has, on occasion, maybe changed a location if it was a driving water quality issue to make them make that change. That is pretty much a local land use issue. The applicant says what they want to do; they come to us with a location and we establish the standards and the permit conditions to protect water quality at that location.

Board Member (Mr. VanAuken):

I have a couple of questions for you here. The first thing, since you talk about the outfall locations, would you tell us, please, what is immediately below each of these two outfall locations?

Brockenbrough:

Approximately 50 yards below the proposed location is an irrigation pump for the farm. There's a boat ramp and an area that's been used by the family as a picnic-swimming area.

Board Member (Mr. VanAuken):

Used by the family, or used by the public, or only by the family (Question garbled somewhat)

Brockenbrough:

We've gotten some letters from Boy Scout troops and what not that use of the property as well. Down here you're getting.... you're at the property line for the most part, and you're getting into other neighboring properties. There are similar boat ramps, boat docks, hundred, hundred-fifty yards maybe below that downstream site.

Board Member (Mr. VanAuken):

Is there any swimming in there.....is that colony used for swimming in that area?

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Brockenbrough:

I don't have any firsthand knowledge of that. I'm sure there has been over the years, at some point. Whether or not there is right now, I don't know. We establish standards to protect the waters and maintain them as fishable and swimmable. Okay. We have a fecal coliform limit in that permit that should protect that use in the stream. That's not to say that you or me or any person that knew of a sewage discharge might not choose to swim there if they knew it was there. But the permit is designed to protect that use.

Board Member (Mr. VanAuken):

But, in reality, you could be discharging to still water and the people knew it was coming from the sewage treatment plant, they probably wouldn't swim right below it.

In doing your calculations for this, now, you're working with an area above 360 with a normal straight flow river and down below the area we're talking about we've got tidal river. In the area where we're talking about, you've got a combination. Am I correct in assuming that you have computer models that will help you with flat flow and other computer models that will help you with the tidal area but where you've got a combined effect that computer models don't work too well?

Brockenbrough:

It's certainly more difficult. There has been some modeling of the discharge. The outfall includes a diffuser that basically goes a third of the way across the river and has multiple ports to encourage very rapid mixing and assimilation into the stream. There has been some computer modeling of that. The modeling we've had a little bit of concern with and that's why we've have gone with the approach of just giving them credit for what's coming down the river. I suspect that were this facility to be built, permit issued, and facility built, that within a few short years we'd probably be looking at a dye-study to further pin down the degree of tidal mixing that maybe they'll get credit for in the future, as they grow.

Board Member (Mr. VanAuken):

The long and short of this is this is a lot more difficult than most cases to figure what's really going to happen here?

Brockenbrough:

Yes sir.

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Board Member (Karl F. Wenger):

If I recall correctly what I've read in here there are....some of the people who are objecting to this, point out that there are some alternatives that are as feasible as using a county treatment plant and so on. Is that correct?

Brockenbrough:

There were a lot of alternatives kicked around. One of those was whether or not Hanover County could have or should have negotiated for additional capacity with neighboring jurisdictions, City of Richmond, or County of Henrico. That's a local issue that we don't typically get involved with. The county's made the decision of how they want to proceed. It's our job to write a permit to protect the river for the project they've proposed.

Board Member (JoAnn Kwong):

Let me clarify something for my understanding. Personally, from what I know...I have problems with imposing costs on private landowners, for widespread public benefit, but, that's not really the issue before us.....is that correct? What you're saying is that the county, or, the city has made this decision and our sole job here, today, is to decide if we can grant that permit based on water quality.....(question completed/assisted by A. Brockenbrough as indicated below/next).

Brockenbrough:

Are we protecting the water quality?

Board Member (JoAnn Kwong):

So we....it's not really our position right now to be debating either alternatives, or alternative sites for the discharge, is that correct?

Brockenbrough:

It generally is not. We get a lot of issues thrown to us at Public Hearings that aren't really applicable to the VPDES Permitting process. Is the growth that the county wants, that the county's planning for good? You know. It's not a water quality issue, or a discharge permit issue, it's a local planning land use issue.

Board Member (JoAnn Kwong):

So, even if there are alternatives that we think would be better, we are only to address the question of whether the water quality will be impacted based on the standards that we have put. Is that the correct interpretation?

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Brockenbrough:

It's generally how we proceed. Maybe.....(interrupt)

Board Member (Hunter Craig):

Mr. Treacy, would you help us out...

Treacy:

That's generally the practice we've taken over the years. This is a long-standing practice. This ...as far as sighting a facility, I think Allan mentioned that in some instances where we believe that an impact to water quality is something that can't be handled without (muffled).....we have done that. And, often times, during the course of negotiating a permit we will talk about a number of alternatives with the applicant and we'll try to minimize the impact to water quality. However, once that decision is made the local governments have gotten their approvals, and the actual site is picked, then our focus becomes much more narrow, which is to examine water quality impacts in the receiving stream and to protect the uses of that stream.

Board Member (JoAnn Kwong):

So, given that, do you feel particularly confident that the permit we're talking about does not, or will not violate the water quality standards?

Brockenbrough:

No, we're applying the same standard to the receiving stream at either location. If a concentration of "x" of some pollutant is allowed in the receiving stream that same concentration will apply in the stream regardless of where they discharge. As a more practical matter the way this kind of plays out is in the long term this facility wants to grow to 30 MGD. At some point, way down the road, it is likely that additional controls will be necessary on some toxic parameter. If a level of "x" is required in the river at both locations, well that might be a level in the discharge of 10 lbs., here, it might be 10.4 lbs. here. It more affects the allocation that the permit has and the loading limits that are applied to the applicant. But we apply the same standard. The river has the same degree of protection at either location.

Board Member (James Couch):

The future is still not something that we have before us today (that's correct....Brockenbrough) because we don't know what the water quality standards will be 10 years from now. It may change at which time the permit is reissued and that would be most of those standards.

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Brockenbrough: That's correct.

Board Member (James Couch):

So, thinking what it may grow to is moot at this point. A question I would have is..you say this is a farm. What is the production of that farm. Is it a crop, or livestock?

Brockenbrough:

I believe it's mostly crop land. I don't know if a representative of.....

Board Member (James Couch):

Crop land with irrigation, you say, on it?

Brockenbrough:

Yes.

Board Member (James Couch):

And, there's a., is there any record of non-point pollution to this section of the stream, say, from 360 on down?

Brockenbrough:

We don't have a record, per se, of non-point pollution. There's a lot of, as you can see, all the white area, there's certainly a lot of agricultural use in this watershed.

Board Member (James Couch):

So, use for swimming and so forth, there may, also....by monitoring what is going on here may actually give people a better sense of what the quality of the water in that stream is supposed to be...(comments not audible)... would that be true?

Brockenbrough:

Yes, We're going to have monitoring. There's monitoring in the permit of the discharge. *(Exchange of comments.....as well as an indication of any affect).* The toxic impact will be monitored, also. *(Comment....which is not happening now.)* No, no we don't have a benthic work ongoing in this area.

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Board Member (James Couch):

And, that data would be available to anyone who'd want to pursue it, would it not. So, if I were inviting a family outing to swim there and some time in the future I could find out exactly what the quality of the water is....as opposed to historically, it's been fun to swim in.

Brockenbrough:

Yes, you're going to have effluent data and you're going to have data from their macroinvertebrate study. The permit doesn't include instream fecal monitoring.

Board Member (James Couch):

Right. Thank you.

Board Member (Preston Futrell):

What crops are grown on this farm and what tillage is used?

Marshall:

I can't answer that specific question. Sorry.

Brockenbrough:

Farms in the area, typically, are corn, soybean, wheat rotations, pretty much throughout that whole area.

Board Member (JoAnn Kwong):

The information we have refers several times or many times to stewardship that the landowners have taken....can you give me an idea ...are there specific practices that they can put in, placed on their land that are really great examples of private conservation?

Brockenbrough:

That's somewhat of a family tradition that goes back to the ownership of the farm by their ancestor, Edmund Ruffin, a very famous agriculturist in the 1800s who developed a lot of innovative practices 150 years ago and I think the owners have conveyed in their comments that they've taken that tradition of good stewardship very seriously, and good agricultural practices very seriously.

Board Member (JoAnn Kwong):

How do you see this playing in with their conservation tradition?

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Brockenbrough:

Well, they've expressed a concern of irrigating in that section of river right next to a discharge. We don't believe that that's going to be significant health threat whatsoever. The degree of treatment required in order to protect the river is much greater than that we would require to protect a crop if it wasn't being discharged. So, we don't see that as a significant threat. It's a matter of you know... I guess disrupting their use.

Board Member (JoAnn Kwong):

Well, I guess that's where I'm trying to get.....how will this visibly impact and change the land for the landowners in terms of either enjoyment of their property or their use.

Brockenbrough:

I guess after it's constructed there will be a small structure, I'm not sure how much land they're talking about taking right there at the river.....an acre?.....there will be a structure of some sort right there. There will be presumably an access road that county employees would have access through the center of a family farm to get to.

Board Member (James Couch):

This is going to a condemnation hearing?

Brockenbrough:

I don't know where that stands, but, presumably it will be.

Board Member (James Couch):

Actually, if it's not going to be needed or sold it would have to be condemned.....a process by which compensation would be decided ultimately by the court?

Board Member (Mr. VanAuken:)

I think there's a little more in this than just the use of the farm. This at one time apparently was a significant town and there's some archaeological significance in there, too. I have some other concerns....I'm concerned that the county switched their location back after deciding on the lower outfall. It is my understanding that the lower outfall will give a little better mixing, maybe not much, but a little advantage in mixing and what I like about it is getting below this site that apparently groups swim in. Our runs at the water meets swimming standards but the reality is that when you put that outfall in just above that dock, that people aren't going to swim there anymore. And, I think that's an important and beneficial use for the water.

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Brockenbrough:

Well, I think that would impact that use at that location. Very definitely. There are additional access points to the river all along here. The river is tidal. It does go back and forth.

Board Member (James Couch):

So, that's not the only swimming hole that's possible on the river.

Brockenbrough:

No sir.

Board Member (Lance High):

But at the standards that are written into the permit, in your professional judgment, they're protective of human healthis that correct?

Brockenbrough:

That's correct.

Board Member (Lance High):

I know there protective of propagation of fish, and shellfish as well?

Brockenbrough:

Yes.

Board Member (James Couch):

Did you say things on the....I guess it's the north side the up side of the river, that is also agricultural?

Brockenbrough:

Pretty much all of these white areas you see in here is agricultural.

Board Member (James Couch):

Does Hanover County have conservation zones?

Brockenbrough:

I believe they do through the Chesapeake Bay Act.

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Board Member (James Couch):

Is this not a part of it. Landowner has not chosen to put their land into the conservation zone.?

Brockenbrough:

In terms of a conservation easement to preserve it as open land....I don't know, maybe the representative of the landowner could tell you.

Board Member (James Couch):

I mean that's the way that if somebody wants to protect their land for a long period of time.

Brockenbrough:

I'm not sure...they also have coursted districts out there and I'm not sure of the status of this property. Are you aware of (interruption)

Marshall:

There are no easements at this time....conservation easements...(comments not audible). There are no conservation easements on the property at Newcastle.

Board Member (James Couch):

But the option has existed in the county to put land in such a district, is that correct?

Marshall:

Right, that would be an option.

Board Member:

Has been an option?

Marshall:

That's correct.

Board Member (Lance High):

At this time are there any other proposed discharges on this river? Other applicants?

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Brockenbrough:

We have a much smaller discharge in King William County under construction up here right now. That is on the order of magnitude of 25 or 40 thousand gallons per day with the same limits, 10-10-3 limits that would discharge to Monquin Creek which flows down through this island area and enters the river down here. So, we do have another proposal, much smaller scale, but the same standards apply to it.

Board Member (Mr. VanAuken):

At this point I have a question of our council. Does this board(?) have the authority to set the outfall location if they deem it important?

Love Field:

No. We have to talk about what you mean by important. I think I concur with the....that your powers that describe it to you where this board finds that location of outfall (comments not audible)

Board Member (JoAnn Kwong):

Could you speak up please, Deborah?

Love Field:

That you impress matters such as the location of the outfall in terms of its impact on water quality as opposed to just some sort of generic importance.

Board Member (Mr. VanAuken):

Well okay.....if the outfall location affects the beneficial use of the water, when does the board have the authority to set the outfall location?

Love Field:

The board has the authority to protect water quality and to propose permit conditions to do that.

Board Member (James Couch):

What I think we need to remember is the water that the standards are geared to; not somebody's psychological perception of that water. If the water has met the quality standards maybe that because of other issues, a person chooses not to use it. I don't think we can get into that area.

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Board Member (Lance High):

What will be the first flow out of this pipe? What's the magnitude of it?

Brockenbrough:

Their plans are to initially build a 5 MGD facility. I don't know at that time whether they'll just take the flows over their allocation from Henrico or whether they'll go ahead and take all their flows they're sending to Henrico and send them to this location, or what. But, initially, they will build a 5 MGD facility. They also have a permit limits for 10 MGD. I guess the staging of that depends on their growth patterns and economic development and what not.

Board Member (JoAnn Kwong):

So, the smaller one that you mention the 25 to 40 thousand gallon per day....that's not sufficient measure for the area, it's just one of several things that will be done? It could not be in place of this to meet the new....

Brockenbrough:

That is for an area of King William County off the map out 360 here....to serve an industrial development client, I think, that's gone out in that area in a very small little village area. It's nothing on the scale of what we're talking about in Hanover.

Board Member (Karl Wenger):

Did you say that the treatment level would be tertiary?

Brockenbrough:

Generally, with 10-10-3, the....(interruption)

Board Member (Karl Wenger):

This is potable water, is it not, strictly speaking?

Brockenbrough:

I wouldn't drink it....I've had plenty people claim that you could but I haven't seen anyone do it yet. (laughter) But, yes, it's pretty close, you know... your actual... you design for 10-10-3 under peak loading worse case scenarios. Under regular conditions, especially under dry weather conditions when you have critical conditions in the river a lot of these plants typically are putting out 2, 3, 4 mg/l. Pretty close to background in the river.

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Board Member (Karl Wenger):

Well, that's what they use for drinking water in Europe, except that everybody drinks beer.
(laughter)

Board Member (Lance High):

With respect to the dwarf wedge mussel, that's the mussel that's federally protected. ...do you have any studies that will show that this discharge will protect that particular mussel?

Brockenbrough:

I don't know that we have a study on that particular mussel. There are hundreds of varieties of mussels. We did review some toxicity data for mussels in reviewing these limits, and, for the most part, our water quality standards are very protective of mussels. Mussels are being impacted by other, other impacts of developmentsiltation, predation, other non-native species moving into an area, zebra mussels, out competing, you know....that sort of thing.

Board Member (Lance High):

Do we know for a fact that the dwarf wedge mussel is in the location of the proposed outfall?

Brockenbrough:

No, we do not. It has been found in the past in this basin. In 73 there was a VCU Masters student that did a survey here at the bridge and I believe she found two fairly common species and two rare species. They are rare, threatened, and endangered designations. The endangered species, the dwarf wedge mussel was found on the South Anna River in the same watershed, but 50 some odd miles upriver at Route 54, west of Ashland. We've got two or three additional issues that have come up. Do you want me to proceed?

Board Member (Hunter Craig):

Please.

Brockenbrough:

Okay. The next is wetlands impacts and the impact of construction of sewer lines and the construction of the outfall in the river. That's really beyond the scope of what we've considered in this permit which has been the affect of the discharge on the receiving stream. The applicant will have to go to the Corps of Engineers (COE) for a 404 permit for construction of those pipelines and what not. And, we're leaving those impacts from construction of those pipelines up to the Corps and their review of their permit program. There've been issues dealing with nutrients, this segment of the Pamunkey River is not designated as nutrient enriched. We look at chlorophyll-A levels, the amount of algal activity in the river as well as

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nutrient levels in the river. It is not designated at this point as nutrient rich. If it were included in the nutrient rich designation in our water quality standards the affect would be to apply a 2 mg/l total phosphorus limit on the discharge. That's the only regulatory requirement in place at this time. We have included that limit in this permit just as an extra measure of protection. Additionally, the applicant has indicated that the design of the facility will include biological nutrient removal. So, we expect there to be some nutrient removal at the facility. We had the history of water supply and the impact of the discharge on potential water supplies. The county identified the Pamunkey River, at one point, as a potential source of drinking water. I don't know if they've abandoned that forever but they've since gotten a contract with the City of Richmond to buy potable water. Downstream on the Pamunkey quite a few miles the Pamunkey was identified at one point in the study of the reservoir on Cohoic Mill Pond, Cohoic Mill stream.... that the Pamunkey was identified as a secondary intake for that reservoir. Primary intake being on the Mataponi, I believe, during that process that alternative was not selected. We've had no jurisdiction come to us to ask that the Pamunkey be designated in our standards as a public water supply. If and when that were to occur we would apply our public water supply standards to the discharge. For the most part, the aquatic life standards that the limits in the permit are based upon are more protective of the stream than the public water supply designations. Humans can drink a lot of things that a fish can't live in. So that's...people find that hard to believe sometime that you can't discharge drinking water, but, if you put a goldfish in your tap water in the City of Richmond, chlorine is going to kill it. We also had comments on affect of temperature on the receiving stream. We have not found that to be a problem with the municipal wastewater discharges. It's a very moderate temperature waste stream. Probably a cooler in the river in the summer time and a little warmer in the river in the wintertime. But, overall, not really having a impact on the resource. In the event that a major industrial client would come in and provide a major source of cooling water to this wastewater plant that would cause a temperature concern, the pretreatment requirement and the local pretreatment ordinance would require that that temperature impact be addressed by the industry. And, as we've discussed there were numerous comments considered outside the purview of the VPDES permit concerning whether there were other options with neighboring jurisdictions the county could have pursued. The county's operation of their landfill and problems that we've found there recently; whether growth is good for the county; the historic resources on the property we haven't really touched on that but there's a site of a major colonial village, colonial era village that came within a vote or two of becoming the state capital. That's outside the purview of the impact of the discharge. Those issues do have to be addressed through the federal permitting process for the 404 permit. So, they will have to address those issues. That's a Virginia and a National Historic Landmark. They will have to address the impact on that property when they go to the Corps for a permit for construction of the outfall. Mr. Van Auken you served as Hearing Officer, are there any additional concerns or comments that you have to add?

Board Member (Mr. Van Auken):

If the Feds tell them that they can't run their discharge pipe to the outfall one, their preferred outfall, because of historic considerations or whatever, can they change the location of the outfall without coming back to this board?

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Brockenbrough:

No Sir.

Mr. VanAuken:

They cannot...

Brockenbrough:

No, they cannot... They'd be coming back to us for a permit modification to move the outfall.

Mr. VanAuken:

Thank you.

Board Member (Hunter Craig):

Any questions?

Gerard Seeley:

I might also add that the proposed recommendations we're going to have for changes to the permit have been considered by the Hanover County Board of Supervisors last night at their meeting and they support all of the changes that we're recommending to you today.

Board Member (Hunter Craig):

Do you have to submit all of this to the State Department of Health? If so, have they ruled on this?

Brockenbrough:

They review both the application and the draft permit and have concurred on both of those. Additionally, the health department has the major responsibility for the technical review of plans and specifications for the treatment facility. They do the real; nuts and bolts review of that.

Board Member (Hunter Craig):

And they've stated there's no concern whatsoever for health, safety?

Brockenbrough:

I don't think they've made a statement of that sort...they've indicated that they have no objections to the permit as drafted.

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Board Member (Hunter Craig):

Any questions? If not....

Brockenbrough:

Okay. I can proceed with the staff recommendation: that is that the board direct the staff to issue VPDES Permit No. VA0089915 with the following modifications:

- a. Decrease the total suspended solids (TSS) limitation to a monthly average of 10 mg/l, and a weekly maximum of 15 mg/l.
- b. Increase the minimum dissolved oxygen limitation from 5 mg/l to 6.5 mg/l.
- c. Include the following special condition dealing with an instream macroinvertebrate study:

The permittee shall perform an annual Quantitative Benthic Macroinvertebrate Study on Pamunkey River to assess impacts of the Totopotomoy Wastewater Treatment Plant discharge. The study shall be conducted between August 15th and October 15th beginning in the year 2002. The study design including sampling locations, survey methods, data analysis, etc., shall be submitted to and approved by DEQ Water Division staff prior to initiation of testing.

I would like to point out that we have some cards.

Gerard Seeley:

No one has indicated a desire to speak...only if questions arise. But, I don't know if there's other folks in the audience whom came in after the thing started.

Board Member (Hunter Craig):

Our policy, which is attached to the agenda for public speaking, allows for the applicant to make a 15 minute presentation if he or she so likes. Is it your desire as the applicant to make a brief?

Frank Harksen:

I'm Frank Harksen, Director of Public Utilities for Hanover County. I think Mr. Brockenbrough did a fine job summarizing the permit. I would mention that during the Board of Supervisors Meeting last night we did discuss with them the changes proposed by DEQ Staff. They were very supportive. In fact, they not only agreed with them, they had a formal motion, approved unanimously, to support the changes that are proposed by DEQ. I am available to answer any questions that you may have. I believe Mr. Brockenbrough did answer most of them that came up during your presentations.

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Board Member (Hunter Craig):

Any Questions?

Board Member (JoAnn Kwong):

Is there anyone here from the family?

Board Member (Hunter Craig):

Mr. Marshall, would you like to speak?

Mr. Marshall:

Yes. Thank you. My name is John Marshall, I'm with the law firm of McSweeney, Birtch and Crump here in Richmond, VA and we represent Mr. Henry Broaddus and Mrs. Frances Broaddus Crutchfield who are the owners of Newcastle Farm out in Hanover County. Focusing on I guess if I could for just a brief moment on a couple of things which were raised today about your role here today and focusing on the water quality issue there are a number of issues which have been alluded to today which we feel warrant this permit either being denied or held over. But specific to water quality issues...there are some internal DEQ memoranda and documents which were attached to our comment which clearly showed a couple of things. One, that the Pamunkey River experiences serious and persistent dissolved oxygen sags. That's well documented. I think Mr. Brockenbrough has conceded as much today, but, the some of the documentation attached to our comments makes clear that that has occurred. The DEQ, itself, has found in a memo dated June 2, 1997, that based on the DO data which we have attached to our comments that quote, "the assimilative capacity of the river with respect to DO is considered to be fully allocated." Now, in the face of that we have the new releases from the King William Reservoir on Monquin Creek which is going to then flow downstream to where the DO sag exists at mile 48.80. In addition to the permit that is being considered today which is going to be a minimum I guess of 5 MGD. Notwithstanding that, the reason that the DO issue is not a problem has been it's caused by natural conditions. Marshlands and things like that. Well, there's been no study to show that. There's no data that supports that at this time. The argument is, at least from staff at this point is well let's just go ahead anyway. We're going to do all these studies, we're going to have all this information available down the road. Well down the road if the impact has already occurred it's too late. And I would just point out.....

Board Member (Hunter Craig):

Excuse me, Mr. Marshall, can I interrupt you just for a second. I need a clarification from Mr. Treacy. The case decision public forum rules state that the owner applicant has 15 minutes and everybody has 2 minutes?

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Mr. Treacy:

That's correct.

Board Member (Hunter Craig):

Can you make a determination for meis Mr. Marshall an owner in this case?

Mr. Treacy:

Well, I think that the owner is actually the applicant, applicant/owner is the way's it's stated in the policy which suggests to me that he's not, that he's an opponent as opposed to an applicant/owner.

Board Member (Hunter Craig):

Okay, I think I failed to let you know that you have 2 minutes....could you conclude in the next minute?

Mr. Marshall:

Absolutely, absolutely. Furthermore the researcher who collected the data in 1995 and 1996 suspected that the DO sag was due, in part, to non-point sources of pollution. And, that suspicion is supported by levels of fecal coliform recorded in the data. Despite these findings by staff at DEQ, that the DO..... was that there was no more assimilative capacity in the Pamunkey River and the fact that they needed to study what was causing this, nothing was ever done. I would just ask you, please, to go back and look at the comments that we've filed and the supporting documentation behind that and at least defer this decision until some further analysis can be done. The evidence that was attached to our comments is compelling. Everyone is admitting there's a problem and rather than addressing it, analyzing and studying it, we're saying "well, let's go ahead and we'll just study it after the fact. That's not going to protect the water quality in the Pamunkey River. So, I would just ask, please, that you go back review those comments in detail that we filed with the supporting documentation. Thank You.

Board Member (Hunter Craig):

Thank you, very much. Thank you. Cindy are there any other cards for anybody that would like to speak? If not, Gerard Seeley, is it true that this VPDES permit, this comes up, this has to be renewed every 5 years?

Gerard Seeley:

That's correct.

STATE WATER CONTROL BOARD
BOARD MEETING – MARCH 11, 1999
Discussion – Totopotomoy WWTP, Hanover County

Board Member (Hunter Craig):

So, we do get a periodic look at this.

Gerard Seeley:

That's correct.

Board Member (Hunter Craig):

Which would provide us the analysis that Mr. Marshall ...

Gerard Seeley:

This plant will be constructed by 2002?

Brockenbrough:

Three (2003).

Seeley:

So, it will be up for renewal within a year to a year and a half of its starting operations.

Board Member (VanAuken):

What would be the negative effects if we deferred action on this until the next meeting of this board?

Gerard Seeley:

It would just make the decision occur later.

Board Member (VanAuken):

This backs up now the County of Hanover...I assume they have some kind of plans, or things have to happen, and if we don't act, then, does this then back them up three months in everything they do?

Gerard Seeley:

Well, that would be better answered by the County.

STATE WATER CONTROL BOARD
BOARD MEETING – MARCH 11, 1999
Discussion – Totopotomoy WWTP, Hanover County

Board Member :

Before that factor....for instance let me just ask....In three months, what are we going to know then that we don't know now?

Board Member(Van Auken):

We might still use materials that a Mr. Marshall just alluded to (comments not audible)....I don't think we've got all the reports ...we have some of the materials he has alluded to, not all of it...(not audible).

Board Member (Lance High):

Let's see, Gerard Seeley why don't we proceed, if we may.....Well, let's see if there are any other questions.

Gerard Seeley:

There's a question remaining about the impact of a delay.

Frank Harksen:

We're ready now to begin acquiring many of the easements, making some significant expenditures. To delay this for the next quarter, three months, that would put us in the position of either delaying the project which we have a pretty tight window to meet the 2003 time period, anyway, or we can begin making some fairly significant expenditures somewhat at limbo without pretty important.. we can a.... one of the reasons we did go for the request for the public hearing in order to keep the process moving forward.....garbled (inaudible).

Board Member (Hunter Craig):

Thank you.

Gerard Seeley:

I believe the staff recommendation is before you.

Board Member (Hunter Craig):

Any other questions? If not...move to adopt the staff's recommendation.

Board Members(?):

Second, second.

STATE WATER CONTROL BOARD
BOARD MEETING – MARCH 11, 1999
Discussion – Totopotomoy WWTP, Hanover County

Board Member (Hunter Craig):

Been moved and second. Any discussion

All those in favor

Board Members:

Aye (4 or 5?).....

Opposed.....nay (JoAnn Kwong)

Board Member (JoAnn Kwong):

I'm sorry. I know we're really charged with water quality standards, but I do have a problem with concentrating this on one family...and I just don't feel that I've heard that in good conscience I can do it without or have a better feeling that even though we're saying we can go ahead and reevaluate we've built this thing, it's on their land, they're stuck with it; maybe if they had a tradition of abusing the land, I would feel somewhat different, but, I'm uncomfortable with it.

Board Member (Hunter Craig):

I'll admit Ms. Kwong I have the exact same concerns you have about a private property owner accepting all of the burden for the public. I've spent a greater part of the presentation looking through the state code trying to figure out a way that that is part of our power. And I must say I wish it were part of our power.

Board Member (JoAnn Kwong):

And I understand that, and that's why I asked to clarify things. I think I probably am in a little limbo here because you know if I had to have a yes/no answer, do I think it violates anything I'd probably have to agree with you all but, in principle, I think what's going ahead here is wrong.

Board Member (Hunter Craig):

I would say that, in many ways and principle, I agree with you.

Board Member (JoAnn Kwong):

Thank you.

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Board Member (Karl Wenger):

Well, I have exactly the same concerns, same feeling. The part that puzzles me, again, this is not the board's concern, I know that. But, how does it happen that the outfall that is chosen here is over the objections of the family that owns the property...the alternative outfall that was considered and then abandoned, or not taken because the landowner objected...there's something there that I don't understand....why in one case it's being imposed on the landowner and the other case the landowner objected and the objection was accepted.

Frank Harksen:

Both locations is the same landowner. It's not that we were succumbing to one landowner to the detriment of another.

Board Member (Karl Wenger):

Okay.

Mr. Treacy :

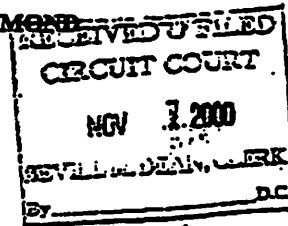
Mr. Chairman, if I may add, I think that many of those issues that are being discussed now are in the courts and as I understand it, the landowner and the county disagree vehemently about some of the questions you're talking about, but I believe that the board has acted within its authority.

Board Member (Hunter Craig):

Clearly, many of the powers we're talking about have not been delegated to this board. So, I thinkthe motion is passed and we appreciate the presentation and think you did a good job. We really appreciate that. Thank you very much.

VIRGINIA:

IN THE CIRCUIT COURT FOR THE CITY OF RICHMOND
John Marshall Courts Building



FRANCES BROADDUS CRUTCHFIELD, et al.,

Petitioners,

v.

Chancery No. 760 CH 99K 01193-00

STATE WATER CONTROL BOARD, et al.,

Respondents.

**REPLY OF PETITIONERS FRANCES BROADDUS CRUTCHFIELD
AND HENRY RUFFIN BROADDUS TO JOINT BRIEF OF
STATE WATER CONTROL BOARD AND HANOVER COUNTY**

Introduction

In a Memorandum in Support of Petition for Appeal ("Memo") filed with this Court on October 10, 2000, the Petitioners pointed out that the respondent State Water Control Board (the "Board") is prohibited by its own regulations from issuing a permit to respondent Hanover County (the "County") for any discharge that would "cause or contribute to the violation of water quality standards." Memo at 15, citing 9 VAC § 25-31-50(C)(9). They also cited evidence showing that the Pamunkey River downstream from the proposed discharge routinely violates water quality standards for dissolved oxygen. Memo at 4-6. The Board and the County now admit this. Joint Brief of Respondents State Water Control Board and County of Hanover, Virginia in Opposition to Petitioners' Petition for Appeal ("Respondents' Brief") at 7. The Petitioners also explained that the permit issued by the Board in this case provides for the discharge of additional oxygen-consuming pollutants to this area. Memo at 8. The Board and

the County admit this too (Respondents' Brief at 8), as they must.¹

The foregoing facts — which have been accepted and admitted by all the parties — are sufficient to make a *prima facie* case that a permit may not issue for the proposed discharge. See 9 VAC § 25-31-50(C)(9) and 40 C.F.R. § 122.4(i) (providing that a new source proposing to discharge into a water segment that does not meet applicable water quality standards may only be permitted if pollutant load allocations have been established for the segment and the applicant bears the burden of demonstrating that the water segment will comply with water quality standards notwithstanding the proposed discharge). See also 9 VAC § 25-31-220(D) and 40 C.F.R. § 122.44(d) (each permit issued by the Board must include conditions sufficiently stringent to "achieve water quality standards established under the law. . ."). Accordingly, and as the Petitioners explained in their Memo, this permit could not legally issue without a finding by the Board — supported by substantial evidence — that water quality standards will be achieved in the Pamunkey River notwithstanding the proposed discharge of these additional

¹ The permit authorizes the County to discharge "CBOD5" at a concentration of up to 10 milligrams per liter ("mg/l"), and "TKN" at up to 3 mg/l. Respondents' Appendix, Tab 1 at 1468-69. Both are oxygen-consuming pollutants, as the Board and the County admit. Respondents' Brief at 8, n. 7, 9. Furthermore, the permit authorizes the County to discharge "total suspended solids" ("TSS") at concentrations up to 10 mg/l. Respondents' Appendix, Tab 1 at 1468-69. Suspended solids may also consume oxygen, although the rate at which they do so varies with the nature of the solids present. Respondents' Appendix, Tab 5a at 1347 (back). The permit does not restrict the volume of wastewater flow that may be discharged by the County. However, the permit states that the design capacity of the plant is an *average* of 10 million gallons per day ("mgd") of wastewater. Respondents' Appendix, Tab 1 at 1469. The plant will be capable of discharging at a *peak* rate of up to 25 mgd (a multiple of 2.5 times average). Respondents' Appendix, Tab 5c at 939. Even if one were to ignore the oxygen-consuming properties of TSS, at the plant's 10 mgd *average* design capacity it will be permitted to discharge 1,086 pounds of the oxygen-consuming pollutants CBOD5 and TKN to the Pamunkey River each day. At its *peak* capacity, it will be permitted to discharge 2,714 pounds of these oxygen-consuming pollutants per day.

oxygen-consuming pollutants. Memo at 15-16.

In response, the Board disclaims any duty to make such a finding. Respondents' Brief at 25. The Board and the County say the Board is free to authorize any and all such discharges, and that it need not ever determine that water quality standards will be achieved. *Id.* Accordingly, the Board does not cite any "substantial evidence" capable of supporting such a finding, had one been made. In any event, the Pamunkey River will clearly continue to violate water quality standards for dissolved oxygen even if *no* additional discharges of oxygen-consuming pollutants were allowed.

Instead of making and supporting the only finding that *could* legally justify issuance of a permit to discharge additional oxygen-consuming pollutants into a water that violates water quality standards, the Board and the County resort to two wholly *irrelevant* arguments. First, they claim that the existing violations of water quality standards in the Pamunkey River are caused entirely by "natural conditions." Respondents' Brief at 8. Second, they claim that the proposed discharge incorporates stringent effluent limitations that will not make matters noticeably worse than they already are. Respondents' Brief at 12.

In this Reply, Petitioners will make two basic points. First, the Board's and the County's arguments are legally insufficient to carry their burden when proposing to permit the discharge of additional oxygen-consuming pollutants into waters that already violate water quality standards for dissolved oxygen. On its face, such a discharge "contributes to" the existing violations of water quality standards and cannot be allowed unless the respondents establish that water quality standards will be achieved notwithstanding the proposed discharge. It would not be sufficient merely to show that present substandard conditions will not be made noticeably worse.

Second, the Board's and the County's legally irrelevant and insufficient arguments are in any event untrue. They are directly contradicted by the Department of Environmental Quality ("DEQ") itself, and by the Virginia Institute of Marine Science ("VIMS"). Furthermore, when the Court examines the materials cited by the Board and the County in support of their claims, it will find they are completely unsupported by *any evidence whatever*, substantial or otherwise. The Respondents have relied entirely on unsupported opinion — not evidence — which is legally insufficient.

Before turning to these points however, Petitioners will briefly explain why they have standing to pursue this case, as this Court has already determined.

ARGUMENT

I. PETITIONERS HAVE STANDING TO PURSUE THIS CASE.

On May 24, 2000, this Court overruled the Board's demurrer that claimed the Petitioners lack standing. The Court held that "petitioners assert that the outfall location will damage historic places on their land. . . . Such allegations state a clear injury to property interests sufficient to confer standing . . . under the Article III standard." Letter Op., May 24, 2000, given effect by the Court's Order of June 14, 2000. Later, the Court granted the Board's request to take the Petitioners' depositions to further explore standing issues. Order, Sept. 13, 2000. Those depositions were taken on September 28, 2000, and they uniformly show the Petitioners have suffered broader injury than that already held sufficient for standing.

In addition to the interests specifically noted in this Court's letter opinion, the depositions

revealed that the Petitioners use their property and the adjacent Pamunkey River for swimming, canoeing, camping, and fishing. Crutchfield Depo. at 110/7 - 118/18; Broaddus Depo. at 14/11 - 15/4. The Petitioners further testified they will stop using the Pamunkey River for swimming, fishing, canoeing, and other recreational pursuits if the proposed discharge is allowed. Crutchfield Depo. at 110/7 - 118/18; Broaddus Depo. at 15/5 - 16/25. In response to warnings from the Virginia Department of Health against bodily contact with sewage effluent, DEQ's permit writer commented that, "the presence of the discharge will realistically eliminate swimming in the river as people make a reasonable choice to minimize risks to their health." Respondents' Appendix, Tab 5A at 1349.

There can be no serious doubt such facts are sufficient for standing. *Friends of the Earth, Inc. v. Laidlaw Environmental Services, Inc.*, 528 U.S. 167, ___, 120 S.Ct. 693, 705 (Jan. 12, 2000) ("plaintiffs adequately allege injury in fact when they aver that they use the affected area and are persons 'for whom the aesthetic and recreational values of the area will be lessened' by the challenged activity") (citing *Sierra Club v. Morton*, 405 U.S. 727, 735 (1972)); *Friends of the Earth, Inc. v. Gaston Copper Recycling, Corp.*, 204 F.3d 149, 154 (4th Cir. 2000) (damage to an individual's aesthetic and recreational interests is sufficient to confer Article III standing).

In addition to sustaining an injury, Article III requires that a petitioner's injury be traceable to the decision being appealed and that it is likely to be redressed were the court to issue a favorable decision. Va. Code § 62.1-44.29. In its letter ruling of May 24, 2000, this Court said, "Clearly, the injuries which petitioners allege are traceable to the Board's action . . . Just as evident is that the injury is redressable by an order of the court vacating the Board's decision and enjoining the discharge." Letter Op., May 24, 2000 at 2.

If the recreationally-active owners of waterfront property where a proposed discharge is to be made lack standing to contest it, then it is difficult to imagine what citizen in the Commonwealth would have standing.

II. THE BOARD FAILED TO MAKE OR SUPPORT A FINDING ESSENTIAL TO ISSUANCE OF THIS PERMIT.

The Board has purported to explain the "Statutory and Regulatory Basis" for its permit program to this Court. Respondents' Brief at 6-7. However, that discussion omits any mention of the rule at the heart of this case. The Board's rules are designed to assure that water quality standards *are achieved*. They do not permit the Board to authorize additional discharges that would tend to make existing, substandard water quality *worse*. Specifically, the Board's rules provide:

No permit may be issued . . . [t]o a new source or a new discharger, if the discharge from its construction or operation will cause or contribute to the violation of water quality standards. The owner or operator of a new source or new discharger proposing to discharge into a water segment which does not meet applicable water quality standards or is not expected to meet those standards even after the application of the effluent limitations required by the law and §§ 301(b)(1)(A) and 301(b)(1)(B) of the CWA, and for which the department has performed a pollutants load allocation for the pollutant to be discharged, must demonstrate, before the close of the public comment period, that:

- a. There are sufficient remaining pollutant load allocations to allow for the discharge; and
- b. The existing dischargers into that segment are subject to compliance schedules designed to bring the segment into compliance with applicable water quality standards.

There is nothing unclear about this rule. It plainly means that (1) the Board may not issue a permit for any discharge that would "contribute to the violation of water quality standards," (2) a proposed discharge into a water segment that violates an applicable water quality standard violates that prohibition and cannot be allowed, unless (3) the DEQ has performed a pollutant load allocation for the segment and the owner or operator can demonstrate on that basis that the water quality standard will be achieved notwithstanding his proposed discharge.

The United States Environmental Protection Agency ("EPA") has a virtually identical regulation (40 C.F.R. § 122.4(i)) and exercises oversight authority over the Clean Water Act's National Pollutant Discharge Elimination System program — including the program implemented here in Virginia by the Board. EPA has confirmed that this is the correct reading of this regulation. When EPA promulgated an amendment to its regulation earlier this year, it explained the provision as follows:

Section 122.4(i) prohibits the issuance of a permit to a new source or new discharger if the discharge would cause or contribute to a violation of water quality standards. A new source or new discharger may, however, obtain a permit for discharge into a water segment which does not meet applicable water quality standards by submitting information demonstrating that there is sufficient loading capacity remaining in waste load allocations (WLAs) for the stream segment to accommodate the new discharge and that existing dischargers to that segment are subject to compliance schedules designed to bring the segment into compliance with the applicable water quality standards.

65 Fed. Reg. 30886, 30888 (May 15, 2000). To summarize, a discharge of additional oxygen-consuming pollutants to a water segment that violates water quality standards for dissolved oxygen would, on its face, "contribute to a violation of water quality standards" and ordinarily cannot be allowed. The only exception to this rule is if "the department has performed a

pollutants load allocation for the pollutant to be discharged," and the applicant has demonstrated that his discharge is within the pollutant load allocation and that water quality standards will be achieved.

In the present case, neither the Board nor the DEQ has performed a pollutant load allocation for oxygen-demanding pollutants in the Pamunkey River downstream from the proposed discharge. Accordingly, no exception to the general rule banning new discharges is available. Nor, of course, has the County demonstrated that its load of pollutants may be accommodated within such an allocation and that water quality standards will be achieved in the Pamunkey notwithstanding its proposed discharge. Nor has the Board made any finding to that effect, and nor is there any evidence — substantial or otherwise — to support such a finding. In fact, the DEQ staff affirmatively has determined here that "the assimilative capacity of the river with respect to [dissolved oxygen] is considered to be fully allocated." Respondents' Appendix, Tab 2 at 1422. In other words, there are no available pollutant allocations for the County to use and the water will continue to violate applicable standards.

Because the Board did not make or support a finding essential to issuance of this permit, it must be set aside. *Browning-Ferris Industries of South Atlantic, Inc. v. Residents Involved in Saving the Environment, Inc.*, 254 Va. 278 (1997).

III. BESIDES BEING LEGALLY IRRELEVANT, THE BOARD'S AND THE COUNTY'S CLAIMS ARE UNTRUE AND ARE UNSUPPORTED BY ANY EVIDENCE WHATEVER.

Instead of performing the only analyses that could legally authorize its action, the Board and the County argue here that (1) "DEQ staff believe that the extensive marshes are the cause of the low DO conditions in the river" (Respondents' Brief at 8), and (2) "the concentrations of oxygen demanding pollutants in the discharge are low enough that they will not consume oxygen in the receiving water," "regardless of the size of the discharge" (Respondents' Brief at 9). These two (irrelevant) assertions are the entire sum and substance of the Board's and the County's defense on the merits. But in addition to being irrelevant, both assertions are contradicted by official records, and the record contains no evidence whatever to support either.

A. The DEQ Officially Has Admitted that the Water Quality Standards Violations in the Pamunkey River Cannot Be Ascribed to Natural Conditions.

As EPA recently has had to instruct the Board, the cause of violations of water quality standards — even if "natural conditions" — does not allow the Board to ignore its rules, nor those of EPA. In 1998, notwithstanding persistent violations of water quality standards for dissolved oxygen in the Pamunkey River, the Board refused to list the Pamunkey as "impaired" under Section 303(d) of the Clean Water Act. That is the list of waters for which pollutant load allocations eventually must be prepared pursuant to Clean Water Act Section 303(d)(1)(A), 33 U.S.C. § 1313(d)(1)(A). The Board refused to list the Pamunkey based on its then-held theory that the violations of water quality standards there were due to "natural causes." Virginia 1998 303(D) Total Maximum Daily Load Priority List and Report (Oct. 1998), Petitioners' Appendix,

Tab 1 at V-1, V-2, V-7. But on May 3, 1999, EPA formally overrode the Board's refusal and added the Pamunkey River to Virginia's list. EPA explained its action as follows:

The Commonwealth's water quality standard for dissolved oxygen . . . is in two parts: 1) a minimum of 4 mg/l and 2) a daily average of 5 mg/l. . . .

. . . One consideration was whether the quality of waters that are subject only to natural conditions should be used for the evaluation, on the theory put forward by some commenters that the state water quality standards regulations might allow for an automatic variance to set water quality standards where natural conditions result in conditions not meeting criteria. Under this theory, using dissolved oxygen as an example, if a water's dissolved oxygen concentration is less than the state criteria set by the state for dissolved oxygen for that water entirely because of natural conditions, then the state standard for dissolved oxygen for that water would become the dissolved oxygen level present at the natural condition. EPA disagrees with this theory. EPA has determined that there is no automatic variance and thus "natural conditions" is not the standard applicable here. . . .

. . . [V]ariations to water quality standards are not automatic; the state must identify the appropriate criteria for a water and modify the standards through the Commonwealth's routine standards modification process. Therefore, if it can be shown that the water quality impairment . . . results solely from natural conditions, that condition would have to be reflected in a standards modification process, not an automatic variance from the existing standard. Until the standard is modified any listing decision, or [pollutant load allocation] development, must be based on the state's existing water quality criteria for that water.

EPA, Rationale for Final Listing Decision, Waters Identified by EPA for Inclusion on Virginia's 1998 Section 303(d) List of Waters (May 3, 1999) at 9-10, availability noticed at 64 Fed. Reg. 26959 (May 18, 1999), *available at* <http://www.epa.gov/reg3wapd/tmdl/>.

To summarize, if existing water quality standards really could not be achieved in the Pamunkey River due to natural conditions, then the Board must proceed by amending its water

quality standards for the segment. So long as that is not done and violations of the existing water quality standards persist, the Board may not simply ignore these facts and continue to authorize discharges of additional oxygen-consuming pollutants to those waters. To repeat, water quality standards must be achieved — they are not optional. The only legal means for the Board to issue this permit — given the existing water quality standards applicable to the Pamunkey — would be to perform a pollutant load allocation and to require applicants such as Hanover County to demonstrate that their proposed discharge is consistent with that allocation and that water quality standards will be achieved despite the proposed discharge.

The Board also has failed to inform this Court that, in the wake of EPA's rebuke, it *did* consider amending (lowering) the water quality standard for dissolved oxygen in the Pamunkey River. But it specifically determined not to do so because *it was not satisfied that water quality standards violations there are in fact due to "natural causes."*

Vegetative decomposition from either The Island just upstream . . . or downstream . . . has only been theorized, not proven, to be the cause of low DO in the reach. There are only three small exit points for water from The Island to enter the Pamunkey . . . and having seen these confluences, I believe the volume of water leaving The Island would likely be diluted by the much larger Pamunkey River. Also, the water entering the Pamunkey from The Island does not reside long in The Island, but comes mostly from the Pamunkey River on the previous flood tide, not from non-tidal swamp flow out of The Island. We cannot prove with current data that low DOs come from decomposition of vegetation at The Island.

. . . [S]taff have theorized since 1995 on causes of the low DO. . . . Three times low DOs . . . followed major floods on the Pamunkey upstream. . . . One theory is that organically enriched . . . agricultural runoff mainly from the South Anna River settles out at Pampatike, where the first deep tidal holes occur in the Pamunkey River. Another theory is that in major floods hypoxic water

released through radial gates from the hypolimnion of Lake Anna may flow down the Pamunkey and exert BOD at Pampatike. If true, these would be [man-made] effects and not naturally occurring.

Memo from Mark S. Alling, DEQ, to Elleanore M. Daub, DEQ, "Tidal Pamunkey R inclusion in new lower DO standard waters?" (June 20, 2000), Petitioners' Appendix, Tab 2. Thus, although the Board has proceeded to establish a new water quality standard ("standard y") for waters low in dissolved oxygen due to natural causes, it expressly decided to exclude the Pamunkey River from that classification because violations of water quality standards for dissolved oxygen there cannot be ascribed to "natural causes." 17:3 V.A.R. 358 (Oct. 23, 2000).

B. The DEQ's Own Documents Indicate Dissolved Oxygen Levels in the Pamunkey River Will Be Adversely Affected.

At its 10 mgd *average* daily design capacity, this proposed discharge will deposit 1,086 pounds of the oxygen-consuming pollutants CBOD5 and TKN into the Pamunkey River each day. At its *peak* capacity, it will discharge 2,714 pounds of these pollutants per day.² Instead of demonstrating that the Pamunkey has adequate assimilative capacity to absorb this additional load of oxygen-demanding pollutants and still achieve water quality standards (which it clearly does not), the Board has resorted to another theory. It claims water quality will not be made *noticeably worse* by the proposed discharge. According to the Board, these admittedly oxygen-consuming pollutants somehow will not consume oxygen when they are placed into the

² The total allowed concentration of the oxygen-consuming pollutants CBOD5 and TKN is 13 mg/l, which equals .0004589 ounces per 0.264175 gallons. Multiplying this allowed concentration times the 10 mgd average flow and 25 mgd peak flow, respectively, and converting from ounces to pounds yields 1,086 and 2,714 pounds per day.

Pamunkey River:

These so-called '10-10-3' limitations establish a level of treatment that in the best professional judgment of the Board's staff, will not contribute to lower DO levels in the receiving stream, regardless of the size of the discharge. In other words, at this level of treatment, the concentrations of oxygen demanding pollutants in the discharge are low enough that they will not consume oxygen in the receiving water.

Respondents' Brief at 8.

As noted above, the Board's theory is legally insufficient to justify its action. But it also has the handicap of being untrue.

The DEQ's own water quality modeler has expressly contradicted the Board's theory that these pollutants will not lower oxygen levels regardless of flow volume. In writing to a colleague at the VIMS who had expressed concern regarding the impacts of this discharge, Mr. Dale Phillips of DEQ said, "it is unlikely that the permitted limits will result in elevating the cBOD5 concentration in the river by more than about 2 mg/l beyond that naturally existing" and that there should not be "any *significant* lowering of the existing quality." Letter from Dale Phillips, DEQ, to Dr. Albert Y. Kuo, VIMS (Oct. 13, 2000), Petitioners' Appendix, Tab (emphasis added). Of course, the existing, substandard dissolved oxygen conditions in the Pamunkey cannot be called "natural," and the law requires *achievement* of water quality standards, not merely the absence of any "*significant lowering*" of existing water quality. In any event, Mr. Phillips went on, saying "I agree that unlimited effluent flow, at the limits in the current permit, would be a problem." *Id.* He thus directly contradicts the Board's claim that these limits are "self-sustaining" and "will not contribute to lower DO levels in the receiving stream, regardless of the size of the discharge." Respondents' Brief at 8-9.

VIMS reviewed this permit and also concluded that the permit limits are not "self-sustaining" and will degrade water quality. Letter from Dr. Eugene M. Burreson, VIMS, to Mr. Tony Watkinson, Virginia Marine Resources Commission (Oct. 11, 2000), Petitioners' Appendix, Tab 4. According to VIMS, "these same effluent limits at higher flows [i.e., above 5 mgd], when combined with other point and nonpoint discharges in the watershed could result in significant DO sags that adversely impact aquatic habitats and living resources." *Id.*

The design flow of this sewage treatment plant currently is an average of 10 mgd, and a peak of 25 mgd. The County plans to expand this capacity in the future, first to 15 mgd average and 37.5 mgd peak, and eventually to 30 mgd average and 75 mgd peak. Hazen & Sawyer, Preliminary Engineering Evaluation: Totopotomoy Wastewater Treatment Plant (Aug. 1998) at i, 3-2, Petitioners' Appendix, Tab 5. Indeed, the plant probably is economically infeasible if it cannot be so expanded. At the location of the proposed discharge, natural stream flows can be expected to fall to a seven-day average of 42 mgd every ten years or so (the "7Q10 flow"). Respondents' Appendix, Tab 2 at 1409. More severe droughts will produce even lower stream flows. And, the Board recently proposed to *cut* this existing flow in the Pamunkey River by 13 mgd (20 cubic feet per second) by reducing the minimum release from the dam at Lake Anna. DEQ, Authorization — Public Notice — North Anna Power Station, Petitioners' Appendix, Tab 6. Obviously, if this permit is sustained the Pamunkey River will be composed primarily of sewage effluent for substantial periods of time and the stakes — the health of the Pamunkey River and all its resources — are too high to gamble.

Despite this, the Board has cited *no evidence whatever* in support of its legally insufficient claims. If the Court carefully checks each of the citations contained in the

Respondents' Brief, it will find they refer only to *unsupported opinions and conclusions*, not to *evidence*. Such unsupported opinion is insufficient as a matter of law to overcome the genuine evidence presented in this case that: (1) the permit will allow the discharge of thousands of pounds per day of oxygen-consuming pollutants, (2) the Pamunkey River already violates water quality standards for dissolved oxygen and has no assimilative capacity remaining for such pollutants, (3) these violations of water quality standards cannot be ascribed to natural conditions, and (4) the DEQ's effluent limitations are not "self-sustaining." *National Crushed Stone Ass'n v. EPA*, 601 F.2d 111, 116 (4th Cir. 1979) ("Courts are no longer satisfied with bare administrative *Ipse Dixits*, and the Agency must make reasoned decisions with full articulation of the reasoning and take into account all relevant factors.") (citing *Appalachian Power Co. v. EPA*, 477 F.2d 495 (4th Cir. 1973)).

Conclusion

The Board did not act within the scope of its authority when it issued this permit. It issued a permit for a discharge that on its face will contribute to an existing violation of water quality standards, and without demonstrating through development of pollutant load allocations that the River — which admittedly has no remaining assimilative capacity — can accommodate the proposed discharge and still achieve water quality standards. Issuance of this permit directly violated the Board's rules, and this illegal action must be set aside.

Dated: November 7, 2000

Respectfully submitted,

Frances Broadus Crutchfield and
Henry Ruffin Broadus

McSWEENEY, BURTCH & CRUMP, P.C.

By: 
William B. Ellis

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CERTIFICATE OF SERVICE

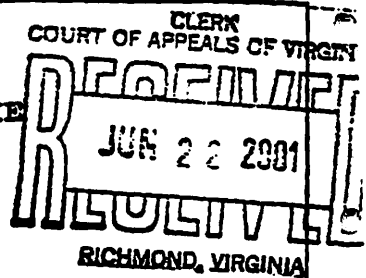
I hereby certify that a true copies of the foregoing Reply of Petitioners Frances Broaddus Crutchfield And Henry Ruffin Broaddus to Joint Brief of State Water Control Board and Hanover County, and of the accompanying Petitioners' Appendix, were delivered by hand this seventh day of November, 2000, to:

Sterling E. Rives, III, Esquire
Barbara M. Rose, Esquire
County of Hanover
Hanover Court House
Hanover, Virginia 23069

John R. Butcher, Esquire
Senior Assistant Attorney General
900 East Main Street
Richmond, Virginia 23219


William B. Ellis

VIRGINIA: IN THE CIRCUIT COURT OF THE
CITY OF RICHMOND
JOHN MARSHALL COURTS BUILDING



FRANCES BROADDUS CRUTCHFIELD,
et al.,
Plaintiffs,

v.

STATE WATER CONTROL BOARD,
et al.
Defendants.

Case No.
760CH99K01193-00

JUN 19 2001
By: *HP* 10/20

HEARING ON MERITS
Before: HONORABLE MELVIN R. HUGHES, JR.

November 9, 2000
Richmond, Virginia

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Appearances:

MCSWEENEY, BURTCH & CRUMP, P.C.
BY: WILLIAM B. ELLIS, ESQ.,
JOHN L. MARSHALL
attorney, counsel for the Plaintiffs

ASSISTANT COUNTY ATTORNEY FOR HANOVER
BY: YVONNE S. WELLFORD, ESQ.,
BARBARA M. ROSE
attorney, counsel for Hanover County

OFFICE OF THE ATTORNEY GENERAL
BY: JOHN R. BUTCHER, ESQ.,
attorney, counsel for the State Water
Control Board

* * * * *

(The hearing in this matter began at 2:12 p.m.)

* * * * *

(The court reporter was sworn.)

THE COURT: Good afternoon. Yes, sir.

MR. MARSHALL: Your Honor, we're here for a
hearing on the merits of a DBDES permit. And we're ready
to proceed when you are.

THE COURT: I'm ready. Mr. Butcher, are you

1 ready?

2 MR. BUTCHER: We were ready, Your Honor. I
3 believe the County is ready. Before the appellants start
4 on that, I have a couple of motions on a preliminary
5 matter, if I may, Your Honor.

6 THE COURT: All right.

7 MR. MARSHALL: Have you filed the pleadings
8 for these?

9 MR. BUTCHER: No. Your Honor, the appendix
10 that the appellants filed with their brief the day before
11 yesterday contains a tab 2, a memorandum or a letter dated
12 June 20th of this year. At tab 3 there's a memorandum from
13 the Water Control Board to them dated October 13th of this
14 year. At tab 4 there's a memorandum from, I believe, a
15 consultant to V.M.R.C. dated October the 11th of this year.
16 And at tab 6 there's a Vepco document dated September 29th
17 of this year.

18 I'd remind the Court that this permit was
19 issued in April of last year. So what we have is four
20 documents that postdate the decision that's before the
21 Court today.

22 At tab 5 of this same appendix, that the
23 appellants filed with their reply brief, we have a
24 preliminary engineering report from the county's project
25 plainly predated the Board's decision, which it was not

1 before the Board. It was not part of the information that
2 the Board made its decision on.

3 And at the reply brief on page 12 we have a
4 citation, too, and an argument about a proposed rule in the
5 Virginia Register on October 23rd of this year. Again,
6 more than a year after the decision that's under appeal
7 here. None of this information, Your Honor, was before the
8 State Water Control Board when it made the decision to
9 issue this permit.

10 I would remind the Court that under Section
11 17 of the Administrative Process Act, this is a review on
12 the record of the Water Control Board's Decision. Indeed,
13 this is an appeal, the Surpinent Case (phonetic) in the
14 Court of Appeals and the Pence Case (phonetic) both quite
15 specifically point out that Your Honor is sitting here as
16 an Appellant Court today. And the decision is the appeal
17 that the State Water Control Board made in April a year
18 ago.

19 These materials, while they might be
20 interesting and while they might relate to whether what the
21 Board did in the past was wise, were not before the Board.
22 And asking the Court now to judge the Board's decision
23 based on information that was not before the Board is
24 simply dirty pool. So I move, Your Honor, to strike tabs 2
25 through 6, the references to those tabs in the brief, 2

1 through 6 of the appendix to their reply brief. The reply
2 brief insofar as it argues those documents, and also at
3 page 12 where it refers to the proposed rule, that was not
4 even proposed until after the decision that's in question.

5 Second, Your Honor, we have throughout their
6 original brief and this reply brief a series of claims that
7 the Water Control Board was required to make some kind of a
8 finding with respect to the issuance of the this permit, as
9 a matter of fact, findings, plural. However, if you'll
10 examine the amended petition for appeal there's no mention
11 there of required findings not being made, they didn't
12 plead it.

13 Rule 28:4 requires the petition to specify
14 the errors assigned. And so the petitioners are now
15 undertaking to argue issues that are not raised in their
16 petition. They want to try a case that they didn't plead.
17 I would remind Your Honor that protecting the lane for that
18 also is dirty pool. And I submit that it's improper for
19 them to try to raise these issues that they didn't plead.
20 And I move Your Honor to strike the references to those
21 issues from their brief and to exclude them from this
22 appeal.

23 THE COURT: All right.

24 MR. MARSHALL: Good afternoon, Your Honor, my
25 name is John Marshall, I'm here on behalf of the

1 petitioners today. With me at counsel table is William
2 Ellis, he'll be arguing the merits of the appeal today, but
3 I'm going to be responding to these particular motions.

4 THE COURT: All right.

5 MR. MARSHALL: I'll take the second first,
6 Your Honor. Obviously, we disagree and ask that you deny
7 the respondents motion that issues briefed were not raised,
8 they in fact, were in the first amended petition for
9 appeal. The errors assigned section, Your Honor, track
10 very closely what we have argued both in our opening brief
11 and our reply brief. I point you specifically to errors 10
12 and 11, errors assigned number 10 and 11, which are page 3
13 in the first amended appeal, Your Honor.

14 The first error assigned is that the Board
15 violated the State Water Control Law and its own
16 implementing regulations by issuing a permit for proposed
17 discharge that in combination with other sources of
18 pollution contribute to and exacerbate significant existing
19 violations of Virginia's Applicable Water Quality Standards
20 for dissolved oxygen. The second error assigned in
21 paragraph 11, Your Honor, speaks further to that as do 12
22 through 16.

23 Error assigned 10 encapsulates exactly what
24 we argue both in the opening brief and in our reply brief.
25 That, in fact, was violated the State Water Control Law and

1 its implementing regulations by allowing a discharge, Your
2 Honor, that will contribute to an exacerbate existing water
3 quality violations. That's as clearly pled as it can be.
4 The petitioners are on clear notice. If you go back to
5 both our opening brief and our reply brief you'll see that
6 is very much what we argued. I don't think that the motion
7 is well placed that these issues were somehow not pled or
8 not raised, that puts the Board on full notice.

9 THE COURT: Did I understand Mr. Butcher, to
10 you, complained that you complain, the petitioners do, that
11 the Board didn't make findings?

12 MR. MARSHALL: Correct.

13 THE COURT: So you think that that assignment
14 covers that?

15 MR. MARSHALL: Absolutely, Your Honor. The
16 law requires them to make findings. Their own regulations
17 require them to make particular findings. That is clearly
18 covered by this. They violated the law and their
19 regulations. We will show you, Your Honor, their
20 regulations that require them to make these findings. They
21 have violated these regulations by not making these
22 findings, and that was clearly laid out in both of our
23 briefs. And this error of assignment puts it on notice.

24 I would also point out, Your Honor, that
25 assigning error is to put everyone on notice as to what's

1 going to be argued so that parties aren't sandbagged or
2 errors are not reserved. They were not -- errors of
3 assignment are not established to litigating your case down
4 to dotting every "I" and crossing every "T." That's
5 certainly not the intent of it and is not the practice in
6 administrative law, it is to preserve the error, I admit
7 that. And we have done that, Your Honor, and will show you
8 and argue how the Board violated its own statute in
9 implementing regulations, it's clearly culpable. We're not
10 required, Your Honor, to our opening brief in the errors
11 assigned, that's not appropriate and that's not proper
12 practice and not what the assignment of the error section
13 is for, Your Honor.

14 THE COURT: Would you mind reading 10 again
15 to me?

16 MR. MARSHALL: Sure. The State Water Control
17 Board violated the State Water Control Law. Virginia Code
18 Section 62.1-44.2 ad sec replaced by in 1998 and the State
19 Water Control Board's own implementing regulations by
20 issuing the permit for proposed discharge that in
21 combination with other existing sources of pollution will
22 contribute to and exacerbate significant existing
23 violations of Virginia's Applicable Water Quality Standards
24 for dissolved oxygen downstream for the proposed discharge.

25 And, Your Honor, what we have argued in the

1 opening and the reply brief is they violated these
2 regulations as relates to dissolved oxygen. We have cited
3 the regulations that they violated and argue that violation
4 based on dissolved oxygen, this discharge in combination
5 with other discharges relating to water quality violations.
6 I think it's very clear and it is absolutely preserved in
7 10.

8 And there are other errors, Your Honor, as
9 well, 11 through 16 that deal with other specifics. An
10 anadromous fish, recreational uses, failing to consider
11 other locations, Your Honor, those cover other issues that
12 have been argued to some extent as well. But 10, Your
13 Honor, and 11 clearly cover that.

14 And I'll read 11 for you again, too. It
15 follows after 10. It says: The State Water Control Board
16 violated the State Water Control Law in implementing
17 regulations in failing to consider adequately, evidence of
18 proposed discharge in combination of other sources of
19 pollution will contribute to and exacerbate significant
20 existing violations of the water quality standard.

21 Again, focusing on the regulation of the
22 existing standards, the regulations that we're going to
23 argue about to today, they're in both of our briefs, the
24 opening brief and the reply brief.

25 THE COURT: All right. There's another point

1 I think he raised, tabs on the appendix --

2 MR. MARSHALL: Yes, sir, Your Honor, the tabs
3 the respondents have moved to strike. As I recall it's 2
4 through 6; is that right, John?

5 THE COURT: 2 through 6.

6 MR. MARSHALL: Your Honor, I'll address, I
7 guess, each of those in turn. The first, is an e-mail
8 drafted by a gentleman named Mark Allen with -- at the
9 Virginia Department of Environmental of Quality, several
10 people at the DEQ, that focuses on the permit or issues
11 related to the permit at issue in this case.

12 And I ask, Your Honor, as I go through each
13 of these, one of obviously the important considerations
14 that you've got to take into account is the relevance of
15 these documents. And I would ask that you just hold off
16 ruling on those until I've addressed them and Mr. Ellis has
17 had a chance to present in the argument how those are
18 relevant to what's going on here. I think that will have a
19 bearing on how you rule.

20 THE COURT: The thrust of Mr. Butcher's
21 comments were that these documents postdate the decision of
22 the Board and weren't before the Board, this is an appeal,
23 so forth and so on.

24 MR. MARSHALL: Correct. They do, Your Honor,
25 postdate the decision by the Board. Pursuant to Virginia

1 Code though, Your Honor, as we have argued before you, this
2 record according to Code can be supplemented by any
3 allowable necessary proofs induced in court. Each of these
4 documents, and I'll explain to you how, are necessary for
5 this Court to fully consider what is at issue here. Some
6 of them go to specifically -- they go to issues that were
7 argued by the respondents in one way in their briefs and
8 clearly indicate another reality in them. So they go, Your
9 Honor, to a large extent, to rebut what has been argued by
10 the respondents in their brief. And as I said, Mr. Ellis
11 can argue that further.

12 But as an initial matter for the e-mail, at
13 tab number 2, Your Honor, it is necessary and can be
14 admitted into proof. It's necessary, Your Honor, because
15 it explains why the Pamunkey River is not on a special list
16 that has been proposed and put together by DEQ. And as I
17 said, Mr. Ellis will get into more detail about that.

18 But the respondents have argued a particular
19 proposition in their brief that is incorrect. This
20 document rebuts that. It directly rebuts a statement made
21 in the brief that low dissolved oxygen in the Pamunkey
22 River is a result of natural conditions. So it can come
23 in, number one, as necessary for this Court to fully
24 consider and understand exactly what respondents are
25 arguing and to see, in fact, that this document rebuts

1 that. It's also an admission by the Department of
2 Environmental Quality, Your Honor, that directly
3 contradicts something that they've argued in their brief.
4 I'll be happy to go in that in a little bit more detail,
5 but again we prefer that Mr. Ellis address that in the
6 argument so that you can see how it fits into what has
7 happened.

8 These documents, Your Honor, were produced --
9 or this document, the e-mail, was produced by the
10 Department of Environmental Quality, pursuant to a Freedom
11 of Information Act request, Your Honor. We think it comes
12 in under the nonjudicial record of agency exception. You
13 will see from the e-mail it is dated, has -- the individual
14 to whom it was addressed, who wrote it, who else received
15 it and the subject. There's no problem with its
16 authenticity of being what it is. And I don't think
17 counsel will argue that they're not, in fact, what they
18 are. And they're e-mails addressing these particular
19 issues.

20 But I think it does meet the statutory
21 requirement, Your Honor, that is a proof -- is necessary
22 for you to fully understand the issues. It does not inject
23 new evidence into the record, it merely explains what is in
24 the agency file that was produced to this Court. And I
25 think it's critical for the judge of this court to be fully

1 aware of and have a full understanding of what's happening
2 here. There's some difficult issues to have this document
3 before you.

4 The same argument, Your Honor, applies to
5 what is at tab number 3. That involves a letter from an
6 individual at the DEQ to an individual at the Virginia
7 Institute of Marine Science. That letter too discusses,
8 Your Honor, helps to explain and demonstrate that what are
9 called 10-10-3 limitations, which were argued in the
10 respondents briefs and ours, it is one of the major issues
11 in this case, are not self-sustained. That will be
12 explained further in our argument, but that is a critical
13 issue in this case.

14 This letter is from the Department of
15 Environment Quality, it is dated October 13th, 2000. It is
16 after the decision was made. But again, we feel it falls
17 under the rugger of necessary proofs that can be induced in
18 this court, so that the Court can have a full and complete
19 understanding of what's been argued and briefed. Again,
20 it's not new evidence, it merely, one, explains what is
21 already in the agency file. And number two, rebuts
22 arguments made in the respondent's brief that are factually
23 incorrect. So it goes to credibility to some extent as
24 well, Your Honor. Again it falls under the 8.01-390
25 exception for a nonjudicial record as evidence. There's no

1 authentication problem here, Your Honor, it's clearly from
2 DEQ. There's a fax tag line at the top of the page marked
3 as received by a gentleman named Allen Brochenbough
4 (phonetic) who is with DEQ who's cc: on the letter. So
5 again, I don't think that there's any issue as to it not
6 being what it says. The real question is: Should this
7 Court consider it? And this Court should consider this
8 document. Again, Mr. Ellis will explain in further detail
9 in argument how it's relevant. But I will represent to the
10 Court that it goes directly to issues that were argued in
11 the brief and rebuts statements that have been made in the
12 brief that do warrant consideration from this Court that
13 fully understand and consider all of the relevant issues.

14 Tab number 4, Your Honor, is a letter to a
15 gentleman named Tony Watkinson, The Virginia Marine
16 Resources Commission. Again, the topic of this letter is
17 this particular permit, and it focuses on the dissolved
18 oxygen sag that, as we have eluded to earlier, Your Honor,
19 is one of the focal points of this case and whether or not
20 the decision by this Board complies with law and
21 regulations.

22 This too, Your Honor, was noted by
23 Mr. Butcher. It's dated on October 11th, again we feel it
24 falls under the necessary exception because it helps to
25 explain again this 10-10-3 limitation and the fact that it

1 is not self-sustaining as is claimed to be by the Board in
2 its brief. This document directly rebuts an argument in
3 the respondent's brief, focuses on this particular permit,
4 so it's clearly relevant to rebutting that argument, Your
5 Honor. We feel it falls again under the exception for the
6 nonjudicial record of an agency. It is what it is. All
7 parties have seen this document and are aware of what this
8 document is about. Again, I don't think -- there's not an
9 authentication problem with this document. It comes down
10 to whether it's necessary for this Court to understand and
11 fully explain the issues, and I think that it is. And
12 Mr. Ellis will explain further in his argument how that is.
13 But this is clearly relevant and important for this Court
14 to see, because it rebuts a fundamental argument and
15 premise of the respondent's brief that is incorrect.

16 Tab 5, Your Honor, is a preliminary
17 engineering evaluation that was obtained from Hanover
18 County pursuant to a voyeur request. This document was
19 prepared before the permit was issued. Again, Your Honor,
20 the respondent's brief addresses the capacity of this
21 plant, how much water it's going to be discharging, at page
22 four, footnote three. That representation, Your Honor, is
23 not complete. This document explains what that capacity
24 is. And it's necessary for the Court to fully understand
25 that because this document, as well, relates to the

1 dissolved oxygen issue and what will be explained to the
2 Court as self-sustaining limits, this 10-10-3. And I won't
3 get into all the details about that, but that's going to be
4 one of the themes you're going to hear over and over again
5 today. It explains -- Your Honor, it helps to explain the
6 permit that's at issue here and the extent of the
7 discharge. And again, it was produced pursuant to a voyeur
8 request to the County. This is not something that we have
9 created. But we do feel that it is necessary for the Court
10 to consider it and it is otherwise admissible.

11 As to document -- the document at tab 6, Your
12 Honor, the Court can take judicial notice of this
13 particular document. It is public information that has
14 been produced by a state agency. It's official publication
15 because it must go out for review and comment. If you will
16 turn to that document you will see part of it is a public
17 notice, Your Honor, that was published in the Richmond
18 Times Dispatch. That notice and a page that outlines
19 conditions for river-flow release at the Lake Anna
20 impowment. It's a public document that this Court can take
21 judicial notice of. There doesn't even need to be any
22 other type of statutory exception. This is something they
23 must publish and make available. They did that in the
24 public notice that is four pages back, Your Honor.

25 This, too, in addition to being a document

1 that can be admitted under judicial notice, Your Honor, it
2 is necessary because it goes directly to the question of
3 dissolved oxygen that is one of the major points of
4 contention in the appeal of this permit. But this one,
5 Your Honor, simply you can take judicial notice of. And I
6 think it's appropriate that you do. It is an official
7 publication, Your Honor. 8.01-388 provides that this Court
8 can take judicial notice of all official publications of
9 this Commonwealth. And this notice and the information
10 provided in that notice must be published pursuant to law,
11 therefore you can take judicial notice of number 6.

12 Your Honor, all -- for each of these
13 documents, as I have indicated, and I'll just reiterate
14 quickly, are necessary for this Court to have a full and
15 complete understanding, not only of the permit at issue in
16 this case, but to specifically rebut claims made in the
17 respondent's brief. Therefore, under Virginia Code
18 9-6.1417 we think they are admissible because they are
19 necessary and they were allowable for the reasons that I
20 have outlined.

21 THE COURT: What is that statute you just
22 mentioned?

23 MR. MARSHALL: Which one was that, Your
24 Honor?

25 THE COURT: 8.01-something.

1 MR. MARSHALL: The judicial notice is
2 8.01-3 --

3 THE COURT: I have that. But there's another
4 statute you mentioned after that.

5 MR. MARSHALL: Yes, Your Honor, it is
6 8.01-390. And again, each of those documents, as I said,
7 are necessary. And the reasons they are admissible, Your
8 Honor, I have outlined as to each specific document. I
9 think that --

10 THE COURT: Well, I don't think --
11 Mr. Butcher probably won't complain about the authorizing
12 statutes that would obligate authenticity and admissibility
13 issues. He's more complaining about the fact that they're
14 in the materials and that they all weren't a part of the
15 agency record and -- and let me say quickly, I understand
16 your other statement that you think that this will be tied
17 in by Mr. Ellis' comments. But that seems to be the thrust
18 of his complaint. I don't think he'll quarrel with the
19 statutes and what they do by allowing records such as this
20 to be admitted. For example 8.1388 but he's complaining
21 about the record questions.

22 MR. MARSHALL: Right. And as I've argued, I
23 think it comes down to a question of: Is it necessary for
24 this Court to have this information? And I would argue
25 that each of these documents is necessary to the Court,

1 one, having a full understanding of the record. Again,
2 this is not new evidence, this explains what is already in
3 the agency file. And again, Your Honor, specifically
4 rebuts arguments and claims that are made in the
5 respondent's brief.

6 THE COURT: All right.

7 MR. MARSHALL: Was there anything else in
8 here that I have not addressed on tabs 2 through 6, the
9 issues not pled?

10 THE COURT: There was a proposed rule that
11 was mentioned that's a part of the --

12 MR. MARSHALL: Again, Your Honor, I think
13 that's something that the Court can take judicial notice
14 of. It's in the Virginia Register, it's a publication,
15 it's put out by law. I think it falls under the 8.01-388
16 it is a public record, Your Honor. You can go and easily
17 access that reference.

18 THE COURT: That's a proposal, that's not a
19 rule that's in effect, is it?

20 MR. MARSHALL: That's my understanding, Your
21 Honor. But again, it's been published. It's available and
22 is out for public comment and review. And clearly, Your
23 Honor, something that this Court can take judicial notice
24 of.

25 MR. BUTCHER: Your Honor, I would remind this

1 Court that under Section 17 of the Administrative Process
2 Act this is an appeal of an administrative decision of an
3 agency, based on the information that was before the
4 agency. Language at 17 about additional necessary proofs,
5 Your Honor should be familiar with. We have used that in
6 this very case.

7 THE COURT: What's that again? I'm sorry, I
8 was writing.

9 MR. BUTCHER: Section 9-6.14:17.

10 THE COURT: All right.

11 MR. BUTCHER: We have, with Your Honor's
12 permission, taken additional proofs in this very case on
13 the question of standing. Because it's a question that was
14 not before the Board and is not reflected in the Board's
15 files. Your Honor is perhaps aware that we came very close
16 to taking evidence in an earlier case on attorney's fees.

17 Again, because that's not an issue that was
18 decided by the Board and the information for the Court to
19 decide that is not in the agency's files. The reason for
20 that language in the statute is explained in the revisor's
21 note, Your Honor. That is the revisor's note to Section 17
22 of the APA says that: Allowable and necessary proofs can
23 be taken in situations otherwise unavoidable as for
24 example, where bad faith is charged in substance and
25 procedure. The Godfrey Case (phonetic) in the Supreme

1 Court recognizes that if bad faith by the agency is an
2 issue then, of course, the agency's decision is not -- and
3 the fact basis for the agency's decision won't provide a
4 basis for deciding that, you'll have to go outside the
5 record.

6 We don't have that play in this
7 case, Your Honor. There's no reason at all to go outside
8 the record unless you want to make a case that you didn't
9 make to the Water Control Board, and that's where we are,
10 Judge. They want to put in new information about low
11 dissolved oxygen by saying it provides new information or
12 new explanation. Well, Judge, either it provides facts or
13 it provides opinions, or we don't need it because the
14 lawyer can take care of it. And if it provides facts or
15 opinions, it's evidence and it's outside the record.
16 They're trying to play dirty pool with you, Judge. They're
17 trying to bring in new evidence because they're unhappy
18 with what was before the Board. They're saying to you,
19 don't review the Board's decision based on what was the
20 before the Board, review the Board's decision based on what
21 we brought you after the Board was finished making its
22 decision, because we thought of some other things they
23 should have thought of.

24 Most of these documents are actually
25 documents they brought to the Marine Resource Commission
trying to get the Marine Resource Commission to review the

1 Water Control Board's permit. The Marine Resource
2 Commission can't do that either.

3 Finally, they talk about the engineering
4 report as being necessary to understanding the capacity of
5 the plant. Judge, we didn't -- the Water Board didn't
6 issue this permit for any conceivable capacity or any
7 conceivable plan that the County might have. It issued it
8 for 5-, and then for 10 million gallons a day on specific
9 terms. And those are the terms that have to be the basis
10 of this appeal not what the engineers thought might be
11 doable in the future.

12 Turning from that to the question of
13 findings. Your Honor has already recognized that the
14 correctness of the agency decision and the question of
15 whether or not the agency made findings are two different
16 things. We all learned that in the Maria's Case
17 (phonetic). I just point out to the Court in page 15 of
18 their opening brief the appellants talk about an obligation
19 for the Water Control Board to make a determination. And
20 then they say the record contains no substantial evidence
21 to support such a finding were it made.

22 They recognize on the face of their own brief
23 the substantial evidence question, which is the question
24 before this Court, is different from the question whether
25 the Board made a particular finding. We'll argue, if Your

1 Honor lets them bring this issue on, of course, there's no
2 such requirement. But I suggest that we never have to get
3 that far because they never pled it. And they're obliged
4 to identify the issues and then demonstrate that the Board
5 made the issues that they have alleged. They have not
6 alleged those errors until they get to their brief. And
7 now they want to prove errors that they didn't allege that
8 the Board made. I suggest again, Judge, that that's dirty
9 pool and you ought to strike that from their pleading.

10 Thank you, Your Honor.

11 THE COURT: Thank you, counsel. I'm going to
12 keep these points in mind as I listen to the argument. And
13 I may call on Mr. Butcher to -- I took some pretty good
14 notes here about, I think I did, about the points he's just
15 raised. But I think given Mr. Marshall's comments it would
16 probably be better to have the argument come forward now
17 with these points in mind. And to the extent to the degree
18 that the Court would or should consider these matters, is
19 in question. And after hearing the argument, if Mr. Ellis
20 can convince me that these are things that while they
21 postdated the decision and weren't part of the record --
22 perhaps he can show me now how they bear on the question
23 and the appeal and the record as it existed at the time the
24 decision was made.

25 So I'll take that under advisement, counsel,

1 and consider those points when we get to the end of the
2 decision process in the case.

3 Are you ready now to go forward,
4 Mr. Marshall?

5 MR. MARSHALL: We are, Your Honor. We have
6 another issue standing, has not been conceded to by the
7 respondents. We came before this Court maybe two months
8 ago, a month and a half ago, I don't recall. Standing is
9 an issue that this Court has already ruled on this case.
10 The Board filed a demur back in June claiming that we had
11 not adequately pled standing. The Court specifically
12 found, in fact, that standing did exist and overruled the
13 demurrer.

14 Subsequent to that, the Board moved for leave
15 to take depositions to further inquire as to standing.
16 During those depositions, Your Honor, testimony was taken
17 as to both the finding in your letter opinion regarding the
18 impact and harm to historic and archeological resources at
19 New Castle Farm, which is property owned by my clients.

20 Other issues were explored as well, Your
21 Honor. I know that we had eluded to the fact that
22 swimming, canoeing, fishing and other activities took place
23 at New Castle Farm, my client's property, at and just below
24 the point of discharge, and that my clients would no longer
25 engage in those activities as a result of the issuance of

1 this permit.

2 Under Federal Law, Standing Law, which
3 applies here, the State Statute has specifically
4 incorporated Article 3, United States Constitution Standing
5 Requirements, Your Honor. That is -- I don't understand
6 how that can be in dispute at this point. The Fourth
7 Circuit Case that you referred to in your opinion
8 overruling the demur on Friends of the Earth, cited some of
9 the exact language that we've relied on throughout to
10 establish standing, Your Honor.

11 But in any event through testimony of
12 Mr. Broadus and Ms. Crutchfield, we feel the need to go
13 ahead and establish standing with this Court since the
14 respondents did not concede to the fact, and move ahead.

15 THE COURT: How did they not concede; in
16 their papers? They renewed -- given the fact that the
17 Court's ruled on this and ruled in your favor, why do you
18 think you need to address it now again?

19 MR. MARSHALL: Your Honor, it's something --
20 I agree with that, you have ruled in our favor. And I
21 think that solves the question. However, they moved to
22 take depositions and argued it in their brief. They spent
23 several days arguing that we do not have standing. And I
24 obviously need -- we responded to that your brief, but I
25 also want --

1 THE COURT: Well, I have some depositions of
2 Ms. Crutchfield and Mr. Broaddus. Is this why those
3 depositions were taken?

4 MR. MARSHALL: Yes, sir. And that's where
5 testimony was elicited about the activities that took place
6 in the river, the fishing and swimming and whatnot, and
7 that that's no longer to going to occur. And our position,
8 Your Honor, under the case law that is absolutely
9 sufficient --

10 THE COURT: Well, what do you want to do
11 right now? What do you suggest --

12 MR. MARSHALL: What I was going to do, Your
13 Honor, with the Court's permission is put Mr. Broaddus and
14 Ms. Crutchfield on the stand and ask them some questions
15 about their activities and --

16 THE COURT: Well, I read some of the -- I
17 didn't read complete of Ms. Crutchfield, but I read most of
18 Mr. Broaddus', and he speaks of these things.

19 MR. MARSHALL: Yes, Your Honor.

20 THE COURT: So why do we need to go back to
21 that again if we have something in the record that purports
22 what they feel in depositions on that issue?

23 MR. MARSHALL: Well, Your Honor, I want to
24 make sure that the issue is fully addressed before you. If
25 you're prepared to rule on that --

1 THE COURT: I think I am. If need be -- if I
2 need to rule on it again -- but I think to save time,
3 rather than have them retestify about these questions, and
4 given the depositions and these issues were explored there,
5 you can refer me, perhaps, to part or parts of the
6 deposition you think that support of your position or I can
7 read them or whatever.

8 MR. MARSHALL: Your Honor, I would like to
9 put them on, but I would refer to the recommendation --

10 THE COURT: Well, I've got this deposition
11 here. And they've testified already on these points. If
12 indeed, as you suggest, there's a need to do that --

13 MR. MARSHALL: Okay. How would you like to
14 proceed then, Your Honor, on arguing the standing issue?
15 Should we argue that at the end, then?

16 THE COURT: Argue that at the end. Let's get
17 to the merits on the point you're raising on the appeal.

18 MR. ELLIS: Good afternoon, Judge Hughes.

19 THE COURT: Good afternoon.

20 MR. ELLIS: My name is Bill Ellis. I'm with
21 the firm McSweeney, Burtch & Crump here in Richmond.

22 I think at its heart you have in front of you
23 today a very simple case. It does, however, require some
24 familiarity with the Clean Water Act -- the Federal Clean
25 Water Act and also our Virginia State Water Control Law.

1 And with your permission I'd like to discuss the background
2 of those provisions just a little bit before starting into
3 the heart of this case.

4 The purpose of these laws, Your Honor, is
5 very clear, it is to clean up the water of the Commonwealth
6 of Virginia and also the nation. But that presents an
7 interesting question: How clean is clean? How clean do
8 the waters have to become? Well, we're fortunate that we
9 have a ready answer to that question. The waters have to
10 become as clean as water quality standards that are
11 promulgated by this State.

12 What the state does is it looks at all the
13 waters across the Commonwealth and it asks the question:
14 What should these waters be used for? And in the case of
15 the Pamunkey River it answered that question by saying: It
16 should be used for fish habitat and for recreation.

17 THE COURT: Who answered that question?

18 MR. ELLIS: The State Water Control Board by
19 promulgating what are called State Water Quality Standards.
20 And in this case, particular relevance to this case is that
21 they established a standard applicable to the Pamunkey
22 River that said that over 24-hour period dissolved oxygen
23 levels must average five milligrams per liter and they can
24 never, not even for an instance, to be allowed to dip below
25 four milligrams per liter. Those standards are promulgated

1 by the regulation by the State Water Control Board. That's
2 how clean the water is supposed to be. And the reason it's
3 supposed to be that clean is because if it doesn't stay
4 that clean, adverse effects occur to fish. The State Water
5 Control Board has already decided that.

6 Now particularly vulnerable are early life
7 stages of fish which don't have the ability to move through
8 the water column and swim around and get away from water
9 conditions that are unhealthful to them. If you and I walk
10 into a room that is filled with cigarette smoke and don't
11 like it, we can walk out. But fish eggs and fish larvae
12 can't do that. They are taken with the current wherever
13 they go. And if they spend substantial amounts of time in
14 water that has less than five milligrams per liter over a
15 24-hour period or less than four milligrams per liter at
16 any time, those fish eggs and larvae are in danger of
17 becoming deformed or even dying.

18 Now the Board, to make sure the water quality
19 standards are maintained, the Board has legal
20 responsibility for issuing permits. The law says that you
21 can't discharge anything into the water, any pollutant
22 unless you get a permit from the Board. And among the
23 things that the Board has to decide is whether the
24 discharge that is going to be issued is compatible with
25 achieving State Water Quality Standards.

1 Now when you have a water that is already in
2 compliance with water quality standards, this is a pretty
3 easy question. The Board then says, well, put on the
4 technological controls to reduce the pollution to the
5 extent you can, and go ahead. And that's what normally
6 happens. But this case involves something different. This
7 case involves a stream segment in the Pamunkey River that
8 does not meet water quality standards for dissolved oxygen.
9 The evidence that we've submitted, and the effect, the
10 Board has admitted that there are substantial and
11 persistent violations of water quality --

12 MR. BUTCHER: Objection, Your Honor, that's a
13 misrepresentation of the memorandum that they're trying to
14 bring before you. I'd be glad to argue it, but that's a
15 staff memorandum by an individual. It's not stated by the
16 Board, and it's not an admission.

17 MR. ELLIS: Well, Your Honor, in any event --

18 THE COURT: Is any of that, Mr. Butcher,
19 before me?

20 MR. BUTCHER: Your Honor, only if you accept
21 this post hoc document that they're trying to get in.

22 MR. ELLIS: Your Honor, this is not an issue
23 that is subject to debate. The Environmental Protection
24 Agency has told the Board -- and, in fact, overruled the
25 Board's judgement on this question. They've told the Board

1 that the water quality of the Pamunkey River violates water
2 quality standards. And the U.S. Environmental Protection
3 Agency has insisted that this stretch of river be put on
4 what's called the 303-D List, which I'll explain in a
5 moment. But it's simply not a matter of debate that water
6 quality in the Pamunkey is substandard.

7 MR. BUTCHER: I'd be remiss if I didn't point
8 out that that's also after the fact, Your Honor. That's
9 why I tried to raise this evidential issue. What they're
10 trying to do --

11 THE COURT: So these documents you just
12 pointed to suggest that, that the water quality of the
13 river right now is below standards somehow? These
14 documents that have come forward after the --

15 MR. BUTCHER: The documents they're
16 producing, they're going to argue that lead to that
17 conclusion, Judge. We have our own view about that. But
18 the reason I raised admissibility is because what they're
19 trying to do is bring up information that came up after the
20 Board finished its decision and bring it to this appeal of
21 the Board's decision.

22 MR. ELLIS: Your Honor, this is a Red
23 Herring. If Your Honor will look at tab 7 of the documents
24 that we've produced, you will find the Board's own printout
25 demonstrating what the Board itself calls persistent

1 violations of water quality standards in the Pamunkey
2 River. This is the Board's own data, and it predates the
3 decision in this case. It's from -- the data began in the
4 early '90s. The worst data is collected in 1995. And all
5 of it was before the Board at the time it made its
6 decision.

7 THE COURT: I don't think I have that
8 material.

9 MR. ELLIS: But the -- I think that the point
10 is, the point that I'm making --

11 THE COURT: So you're saying that the
12 determination was made before this decision?

13 MR. ELLIS: The Board had full knowledge and,
14 in fact, our comments attached to the relevant data -- when
15 the Board was proposing to issue this permit, my clients
16 submitted comments on the proposal which attached the water
17 quality standard data that I'm referring to. And those
18 comments say: Data collected by the Virginia Department of
19 Environmental Quality shows that the Pamunkey River
20 persistently experiences severe and persistent violations
21 of water quality standards for dissolved oxygen at river
22 mile 48.8. And it goes on and cites that those violations
23 occurred over a period of 106 days in 1995 with 40 daily
24 enviro violations indicating dissolved concentrations were
25 below the standard for 38 percent of the time over that

1 period. None of this is disputed. It's all in the data.
2 It's all in the Board's own data that predated their
3 decision in this case.

4 Now that presented the Board with a problem,
5 because in terms of explaining the structure of the Clean
6 Water Act to the State Water Control Law, what it's trying
7 to accomplish, it's trying to see that areas that have
8 substandard water quality are forced by law, eventually, to
9 comply with water quality standards. So when the Board is
10 faced with an application to discharge a pollutant into a
11 stream that already violates the water quality standard for
12 that pollutant, that presents a substantial problem. And
13 that's the problem that this case presents.

14 Now what the law says in this situation, the
15 Clean Water Act and the State Water Control Law want to, on
16 one hand, provide flexibility. They don't want to just
17 blanket, say, you can never under any circumstances
18 authorize the discharge of additional pollutants into a
19 segment that violates water quality standards for that
20 pollutant. But what it does say is, if that's what you
21 want to do then you must adhere to some fairly significant
22 procedural and substantive requirements. And that's what
23 the heart of this case involves. What are those
24 requirements? And the answer for us, fortunately, is
25 simple.

1 If you turn to the Board's regulations, you
2 will find a regulation that directly addresses this
3 question. And that regulation reads as follow: The owner
4 or operator of a new source proposing to discharge into a
5 water segment which does not meet applicable water quality
6 standards, and for which the department has performed a
7 pollutant-load allocation for the pollutant to be
8 discharged, must demonstrate before the close of the public
9 comment period that, A) There were sufficient remaining
10 pollutant-load allocations to allow for the discharge.
11 And, B) The existing dischargers into that segment are
12 subject to compliance schedules -- and it goes on to say
13 designed to bring the water quality standard -- or the
14 water quality of the river up to standards.

15 Now -- all right, what does that mean? What
16 it means is, that on its face, if you're getting ready to
17 discharge a pollutant into a stream that already violates
18 the water quality standard for that pollutant you can only
19 do it if the Board takes a look at all the pollutant inputs
20 into the water body and concludes that if water -- when you
21 consider all of the sources of the pollutants, there are
22 what they call pollutant-load allocations still available.
23 In other words, you can continue discharging more of these
24 pollutants without violating water quality standards. Now
25 the problem here is -- the problem that the Board faces

1 here is that the Board had already determined, or at least
2 its staff had told it, that the Pamunkey River has no
3 available allocation, if you will, it has no remaining
4 assimilate capacity for pollutants that consume oxygen, it
5 simply has none.

6 And the Board has never undertaken a
7 pollutant load allocation analysis. If you -- there are
8 five facts, I think, that are dispositive of this case in
9 light of this regulation. And each of these five facts is
10 admitted.

11 The first fact is that the Pamunkey River
12 does violate already water quality standards for dissolved
13 oxygen.

14 The second fact is that this proposed
15 discharge will add more oxygen-consuming pollutants to this
16 already substandard water body.

17 The third fact is that the Board has never
18 performed a pollutant-load allocation.

19 The fourth fact is that, therefore, there are
20 no available pollutant-load allocations that are available
21 to Hanover County.

22 And the fifth fact is that the existing
23 dischargers to this stream segment are not subject to
24 compliance schedules to reduce their pollutant loads in
25 order to make room for any new dischargers of

1 oxygen-consuming pollutants.

2 Now you take those five facts and you read
3 down through the Board's own regulation and you see when it
4 says you can issue a permit and you find that none of
5 the -- that the essential elements are not there. The
6 general prohibition applies, which says it may not issue a
7 permit which would contribute to violations of the water
8 quality standards.

9 Now if you doubt my interpretation of this --
10 I think the regulation is very clear on its face. But if
11 you should doubt that it means what I think it means, an
12 appropriate place to look is the United States
13 Environmental Protection Agency. Because the United States
14 Environmental Protection Agency has an essentially
15 identical regulation. And it's set out in the Code of
16 Federal Regulations at 40CFR, Section 122.4 "I".

17 Now, of course, the U.S. Environmental
18 Protection Agency exercises oversight authority over all
19 the State Water Quality Program, including the one we have
20 here in Virginia. It has that authority pursuant to the
21 Federal Clean Water Act. So what they say regarding this
22 is of some import. And here is the way the United States
23 Environmental Protection Agency recently summarized
24 obligations under this regulation. It said: The
25 regulation prohibits the issuance of a permit to a new

1 source or new discharger if the discharge would cause or
2 contribute to a violation of the water quality standards.
3 A new source may, however, obtain a permit for discharge
4 into a water segment which does not meet applicable water
5 quality standards by submitting information demonstrating
6 that there is sufficient load capacity remaining in waste
7 load allocations for the stream segment to accommodate new
8 discharge and that existing dischargers to that segment are
9 not -- I'm sorry, are subject to compliance schedules
10 designed to bring the segment into compliance with
11 applicable water quality standards.

12 Now one of the things -- well, EPA has also
13 given another statement as to what this means. And I
14 apologize and I regret that we did not have it in time to
15 bind it into our addenda. However, I have with me copies
16 of a guidance document issued by EPA Region 4. This is not
17 the regional office that controls things in Virginia, it is
18 the regional office in Atlanta, rather than the regional
19 office in Philadelphia which has authority over what
20 happens in Virginia. Nevertheless, I think it's reflective
21 of the interpretation placed on this provision by the
22 United States Environmental Protection Agency.

23 MS. ROSE: Your Honor, we object to this
24 document. He said himself that it doesn't even apply in
25 this district, has no relevance.

1 MR. ELLIS: The document -- it's true the
2 document has no force of law in this district, but it does
3 reflect what the EPA thinks. And as guidance, it's
4 something of that, that the Court can take judicial notice
5 of. I'd be pleased to provide Your Honor with a copy of it
6 and a copy to opposing counsel.

7 THE COURT: Let me have it. And I'll
8 consider this on the same basis as the other matters.

9 MR. BUTCHER: Your Honor, I'll renew my
10 objection that this apparently was not before the Water
11 Control Board and therefore it is a further attempt to ask
12 you to review their decision on the basis of information
13 that was not before them.

14 MR. ELLIS: Your Honor, this is -- it's true,
15 this was not before the State Water Control Board, but
16 neither was case law that we cite to you. This is a kin to
17 citing case law. We're citing the interpretation of a
18 regulation by the agency that's charged with its
19 administration and enforcement. It's a legal matter, it's
20 not a factual matter that has to be before the agency.

21 If Your Honor looks at paragraph D, which
22 I've highlighted, you'll see it reads as follows: New
23 sources/new dischargers are not allowed to discharge to
24 303-D listed waters unless offsets from nonpoint sources,
25 et cetera, are documented in the permit fact sheet. Any

1 issued permit should contain a mechanism for the reopening
2 and documenting the offsets --

3 THE COURT: I think it says, reporting.
4 Should contain a mechanism for reporting.

5 MR. ELLIS: I'm sorry, reporting.

6 -- and documenting the offsets periodically
7 during the term of a permit.

8 It states very plainly that unless you offset
9 the pollution that's already in the water body you cannot
10 issue a permit for a new discharger.

11 Now let me raise an objection that the Board
12 has already raised, because it's a legitimate question.
13 They ask in their brief, if this is EPA's view of the world
14 why then didn't EPA object when this permit was proposed
15 and ultimately issued? And as I say, it's a legitimate
16 question. But I think it has a ready answer.

17 The fact is that the Pamunkey River, although
18 EPA had proposed to overrule the Board and require the
19 Pamunkey River to be designated as a water out of
20 compliance with water quality standards and be listed on
21 the 303-D list, the Board at the time it acted on the
22 permit EPA's action wasn't complete. The Board had been
23 arguing to EPA that they weren't required to put the
24 Pamunkey River on the list of rivers that failed to meet
25 water quality standards. And they did so claiming that the

1 Pamunkey didn't meet water quality standards because of
2 natural conditions.

3 And EPA turned back to the Board and said to
4 them -- they overruled the Board, required that the
5 Pamunkey go on the list. And they said officially to the
6 Board, It doesn't matter why the stream segment is not
7 meeting water quality standards. If you think that this
8 stream segment isn't meeting water quality standards due to
9 natural conditions in the water body, then what you need to
10 do is revise and lower your water quality standard. But it
11 cannot excuse you from complying with the regulations and
12 the program which is designed to achieve those water
13 quality standards.

14 In short, the Board tries to make an end to
15 run, if you will, around the whole water quality standards
16 system by avoiding having the Pamunkey River listed on the
17 303-D list in the first place. And they're doing the same
18 thing with this permit. They were again attempting the
19 same end run.

20 Now what about the Board's arguments? They
21 say first of all -- they really have two arguments. Their
22 first argument, which they make vociferously in their
23 brief, they claim that the conditions in the Pamunkey River
24 are the result of natural pollutants. And I want to talk
25 for a moment to the question of dirty pool, because

1 Mr. Butcher raised that question several times. It is
2 dirty pool, Your Honor, to make representations in a brief
3 that you know are unsupported, that is dirty pool. And
4 that is what the Board has done here.

5 As a legal matter the Board is aware that
6 this water quality standard is not being achieved, it is
7 aware that that cannot be ascribed to natural conditions in
8 the waterway, because the very person responsible at DEQ
9 for writing the memo that is in the record wrote the e-mail
10 that Mr. Marshall referred to and that the Board has
11 proposed to exclude from your consideration here. The
12 Board would make representations that it knows are not
13 sustainable.

14 So in the first instance, I think -- I've got
15 two real points here. One is, when the Board comes and
16 says to you, these water quality conditions are the result
17 of the natural conditions, therefore we don't have to try
18 to achieve water quality standards, that's an insufficient
19 argument. EPA has already told them it's an insufficient
20 argument. And, in fact, they overwrote the Board's prior
21 action based on that very point. But not only is their
22 contention really wrong, it's also factually wrong. And
23 that's what the e-mail at tab 2, I believe it is, points
24 out.

25 Now what about their second argument, because

1 they have only one other argument. And that argument is
2 that the D.O. levels, that's dissolved oxygen, the
3 dissolved levels in the water of the Pamunkey River won't
4 be made substantially worse by this proposed discharge.
5 Now I have two responses to this argument, too. And
6 they're the same two responses. First of all, it doesn't
7 matter because it's legally insufficient. It's not enough
8 if this discharge won't make things substantially worse,
9 the Board has a legal obligation to see that water quality
10 standards are being achieved and will be achieved.

11 And the regulation that I read to you, and
12 the EPA interpretations of it make it plain that their
13 obligation isn't simply to say, it's not going to get much
14 worse. Their obligation is to force a structure and force
15 permit terms that make sure that water quality standards
16 will be achieved. This is not an optional program. They
17 act as though water quality standards don't have to be
18 achieved. And that's why I say they're relying on this
19 whole idea of natural conditions to do an end run around
20 the whole water quality standards program. So my first
21 response to their argument is to say it's legally
22 insufficient. They can't be satisfied with not making
23 things significantly worse than they already are.

24 Now secondly, this argument, too, is
25 factually wrong. And the Board has done the same thing

1 with you that they did with respect to the prior argument.
2 They have told you in their brief that it doesn't matter
3 how much of this pollutant is discharged, that the stream
4 won't have -- that these pollutants aren't going to consume
5 dissolved oxygen, and they can discharge as much as they
6 want, have as high flow rate as they want. They say
7 this -- this is what they mean when they say "the limits
8 are self-sustaining."

9 But what they don't want you to know is that
10 the very water quality modeler who did the work in the
11 record back in 1998, 1999, that's not what he thought. The
12 record -- the item in our addendum that we have filed with
13 you contains a letter by Mr. Dale Phillips who is the
14 Board's water quality modeler. And in his letter, which I
15 think is very relevant for understanding what he meant when
16 he wrote the memorandum and when others in reliance on it
17 wrote their memoranda for this permit process back in 1998,
18 1999, this letter shows what he was thinking about and what
19 he meant.

20 And if Your Honor examines that letter you'll
21 see that he says two very interesting things. First he
22 says, that this permit -- or that this discharge will
23 elevate oxygen demand CBOD5, that's the technical name for
24 oxygen consuming pollutants. He says: This discharge will
25 elevate CBOD5 concentrations in the river by up to 2

1 milligrams per liter beyond naturally occurring. Now
2 remember, we now know that what's out there is not
3 naturally occurring in the first place --

4 MR. BUTCHER: Your Honor, I object. That's a
5 misrepresentation. The memorandum does not say that.

6 MR. ELLIS: Well, let's read it. It is
7 unlikely, he says, that the permitted limits will result in
8 elevating the CBOD5 concentration in the river by more than
9 about 2 milligrams per liter beyond that natural occurring.
10 In other words, he's saying that the discharge could result
11 in an increase in CBOD5 in the water body of up to 2
12 milligrams per liter above that naturally occurring.

13 Now you and I know, from the other document
14 that the Board seeks to keep from you, that the levels in
15 the water body are not even naturally occurring or they may
16 not be naturally occurring. And he's saying that that is
17 going to increase it by 2 milligrams per liter beyond that.
18 That is hardly consistent with the theory and purpose of
19 the Clean Water Act or the State Water Control Law.

20 He goes on to say in this same letter: I
21 agree that unlimited affluent flow at the limits in the
22 current permit would be a problem. In other words, the
23 contention made in the Board's brief, that it doesn't
24 matter how much of this new discharge because the limits
25 are self-sustaining, it doesn't matter. The water quality

1 modeler doesn't believe that. This letter is essential to
2 understanding what he thought. Now if any confirmation of
3 this were needed it would be -- it is obtained by looking
4 at tab 4 in our addendum.

5 And let me set the context for you. The
6 letter that I was just discussing prepared by the water
7 quality modeler at the Board, Mr. Dale Phillips, it was
8 written on October -- approximately October 11, I
9 believe -- October 13th. October 13th. It reflects that
10 he had had a conversation back on October 6th, with a fella
11 at the Virginia Institute of Marine Resources.

12 Now -- and the letter addresses matters of
13 concern that arose during that conversation. We know one
14 half of that conversation because we have Mr. Phillip's
15 letter. But to complete the picture we need to understand
16 what was on the other side of that conversation. And this
17 is what the letter at tab 4 reveals for us. It was written
18 on October 11th, and addressed to the Virginia Marine
19 Resources Commission. And when Your Honor reads that
20 letter you will find that it contains the following
21 statement, it says that: The discharge in issue quote,
22 could result in significant dissolved oxygen sags that
23 adversely impact aquatic habitats and living resources.
24 Now he was speaking specifically to if the flow were -- if
25 the flow of wastewater were to exceed 5 million gallons per

1 day.

2 Now one of the things that I think was not
3 accurately stated earlier by Mr. Butcher concerns the
4 amount of flow from this facility. He mentioned that the
5 permit talks of the design capacity of 10 million gallons a
6 day. And he's right, it does mention a capacity of 10
7 million gallons a day. But if you look, Your Honor, under
8 the limitations column you will see that there are no
9 limits on flow from this facility, none. That is simply
10 the design capacity. And that reflects the average
11 discharge. So if you're going to have a 10 million gallon
12 a day average, you could be discharging up to 25 million
13 gallons a day at your peak flow rates.

14 So what that brings us to, this letter says
15 that the very -- at the lowest that are allowed in this
16 very permit that's before you, this is what could occur,
17 significant dissolved oxygen sags that adversely impact
18 aquatic habitats and living resources.

19 Now I want to conclude by again saying that
20 from a legal perspective and a factual perspective this
21 case is remarkably simple. We have the five dispositive
22 facts that I mentioned early on. The Pamunkey River is
23 already in violation of water quality standards for
24 dissolved oxygen. This discharge is going to add
25 additional oxygen-consuming pollutants. The Board hasn't

1 performed a load allocation with respect to those
2 pollutants. There are no available pollutant allocations.
3 And indeed the assimilating capacity of the river, they
4 admit, is already exhausted. And finally, the existing
5 dischargers to the river aren't subject to any sort of
6 compliance schedule.

7 So the regulation is clear, the facts are
8 clear. Why is it, how is it that the agency is avoiding
9 the plain conclusion? And I would like to suggest to you
10 that this raises a question of credibility. The Board has
11 described its program to you, but it failed to tell you
12 that it's prohibited from issuing a permit for a discharge
13 of a pollutant into a water quality segment that it already
14 exceeds water quality standards for that pollutant, because
15 that would contribute to an existing violation of water
16 quality standards.

17 They told you that EPA didn't object to their
18 permit, but they failed to say that the Pamunkey River at
19 that time had not been designated as an impaired water.
20 EPA didn't have the factual basis to object to the permit,
21 because the finding hadn't been made.

22 Now have they told you that the reason the
23 dissolved oxygen levels are low here is natural conditions,
24 and they flunked on that hard in their brief, knowing all
25 the while that the DEQ researcher didn't believe it.

1 They also didn't tell you that EPA itself objected to that
2 as a basis for doing an end run around pollutant-load
3 allocations and water quality standards regulations.

4 They also told you that the permit
5 limitations in this case will not make matters
6 significantly worse when they knew the DEQ's own modeler
7 said that it would make matters worse, maybe not
8 significantly, but we don't know what he means by
9 significantly, is he talking statistically or biologically.
10 Biological significance is quite a bit difference. And we
11 also know that he then said that this discharge as proposed
12 could cause significant D.O. sags and problems for the
13 living resources.

14 Now I'm not here to suggest to you that the
15 Board or the Department of the Environmental Quality is
16 evil or that it's inhabited by evil people, I don't believe
17 that. I think that they have not done their usual and
18 thorough, by-the-book job in this case that they usually
19 do. But I think that that does beg the question, Why have
20 they not done so here? Well, I would suggest to you that
21 one possibility is that it may be the only way to sustain
22 an illegal but politically, very expedient permit. And
23 this Court cannot allow that to stand. This Court, if it
24 maintains the rule of law in matters of the environmental
25 quality, that simply cannot be permitted. Thank you, Your

1 Honor.

2 THE COURT: Thank you. Counsel, let me take
3 a brief recess for about 10 minutes or so, we've been going
4 for about an hour and a half.

5 (Recess)

6 THE COURT: All right. Mr. Butcher.

7 MR. BUTCHER: Your Honor, if it's all right
8 Ms. Rose will go first.

9 THE COURT: Ms. Rose.

10 MS. ROSE: I will open with a brief summary
11 of the law and the County's arguments, and then Ms.
12 Wellford also for the County Attorney's Office will present
13 arguments in full. And then Mr. Butcher will speak on
14 behalf of the State.

15 First, Your Honor, we want to note that this
16 is a straightforward case, there are no end runs that
17 Mr. Ellis intended. Hanover has a need for and carefully
18 study the wastewater treatment project. In order to have
19 it there's a need for a permit to discharge the treated
20 affluent into the states here at the Pamunkey River.

21 The permit was applied for in April of 1997.
22 Careful conversation and analysis was given to it by DEQ
23 Staff. Careful conversation was given to it by the State
24 Water Control Board, based on the staff's work, reports,
25 oral presentations. The State Water Control Board then

1 issued the permit in April of 1999 with the strict limits,
2 the so-called 10-10-3 self-sustaining limits. Now what
3 does this mean? These limits are based on longstanding,
4 since 1987, best professional judgment of the experienced
5 staff of DEQ that the discharge with these 10-10-3 limits
6 will not contribute to nor cause water quality standard
7 violations to the receiving stream. It complied with the
8 law. The agency file is full of the support for this. And
9 the burden here is for the petitioners to demonstrate
10 otherwise.

11 Now the fact that six miles downstream we
12 have, in the record, these naturally occurring violations
13 of D.O. that's not determinative, because this discharge
14 that's been permitted does not, with the self-sustaining
15 limits, cause or contribute to water quality standard
16 violations.

17 The petitioners offered no evidence to
18 contradict the appropriateness of these self-sustaining
19 limits. They offer you mere conjecture, misinterpretation
20 of documents and the regulations. And this mere conjecture
21 is why it's so important that these after-the-fact
22 documents not come in. There was no opportunity for the
23 State Water Control Board to consider them. There was no
24 opportunity for people to comment on them, they happened
25 after the fact. Just as we have revolving law, we have

1 revolving things in regulations. But when this permit was
2 issued those documents weren't there.

3 And I note also that the impaired status of
4 the Pamunkey River by the EPA was after this permit. The
5 permit was issued April 28th, that impaired river status
6 came May 10th of 1999. And the EPA approved, concurred in
7 the issuance of this permit.

8 I'd like to also note upfront that
9 petitioners have standing only as to injury related to
10 alleged impact of the discharge on historic resources on
11 their property. They make no argument about this, they
12 present no evidence in their briefs. Thus, they've
13 conceded this point. And moreover, the record before the
14 Court shows that those historic resources are not
15 applicable to this permit. The impact on historic
16 resources is not related to water quality, that's what this
17 permit's about.

18 The petitioner's argument focuses instead of
19 on historic resources on dissolved oxygen, anadromous fish
20 and recreational uses. Without waiving lack of standing
21 with respect to these issues we turn now to an overview of
22 the applicable law. Now the law, it requires prevention of
23 increase in pollution. And it requires protection of the
24 beneficial uses of the water and the anadromous fish. But
25 the law does not prohibit new discharges. And the law does

1 not prohibit new discharges into impaired waters. The law
2 prohibits the State Water Control Board from issuing a
3 permit where the discharge will cause or contribute to
4 water quality violation. The record is clear, the permit
5 protects the water quality, it won't -- this discharge will
6 not contribute or cause violations. There may be existing
7 naturally occurring ones, that's not the issue.

8 Under the APA law places the burden upon the
9 petitioner to demonstrate the error of law. They have not
10 met that burden. They make assertions, they're not
11 evidence to contradict. They don't have another model,
12 they don't have an engineering report.

13 Now applying the law to this case can result
14 in no conclusion except that this permit issued meets the
15 State Water Control Board Laws; why? The Board approved a
16 permit with stringent limits, these 10-10-3 limits. And in
17 addition they put a 6.5 dissolved oxygen limit. That is
18 way above the standard. Initially it was 5, they added.
19 So this means that you've got an oxygen standard, you've
20 got oxygen above what the receiving stream is, so that
21 offsets other oxygen pollutants. And I think we've already
22 made it clear the self-sustaining limits mean at this level
23 of treatment the concentration of oxygen-demanding
24 pollutants in the discharge are low enough that they will
25 not contribute to nor cause water quality violations. And

1 again, the D.O. levels in the permit of 6.5 further offset
2 these oxygen-demanding pollutants.

3 There is substantial evidence in the record
4 to support that these self-sustained limits won't
5 contribute nor cause water quality standard violations.
6 This is based on the experience and specialized competence
7 of the DEQ Staff since 1987. And I just refer you to a few
8 examples of the supporting evidence.

9 In tab 4 attached to the joint brief of the
10 state of accounting there are four critical documents
11 showing longstanding applications of the self-sustaining
12 limits.

13 Tab 3 has an analysis of the 1995 D.O. study
14 in this very river.

15 Tab 5A is the critical memorandum from
16 Mr. Jerry Sealy (phonetic) of staff to the State Water
17 Control Board. And it has a summary of issues. It goes
18 point-by-point about the comments raised by the petitioners
19 here. It addresses the D.O. It addresses the fish. It
20 addresses recreational uses.

21 And finally, it was also reviewed, I think
22 we've mentioned this already, and concurred in by other
23 permitting agencies. They don't issue this permit but by
24 other agencies, and that includes the Environmental
25 Protection Agency.

1 And in contrast now, let's turn to the
2 petitioners and what they have presented. No evidence to
3 contradict the self-sustaining limits. Absent these
4 petitioners' imagined requirement for explicit finding by
5 the State Water Control Board that are not required by law
6 but are implicit in the issuance of this permit, and in
7 addition, an issue not pled, petitioners argument boils
8 down to unsupported and flawed assumption. That assumption
9 is that any new discharge will necessarily contribute to
10 existing water quality standard violations. This flawed
11 assumption is clearly refuted by the experienced and
12 special competence of the State Water Control Board's
13 Staff, their 1995 D.O. studies, but most importantly the
14 analysis of the self-sustaining 10-10-3 limits.

15 Petitioners again offer no evidence, no
16 letter from their own experts' engineer. They only raise
17 issues, try to confuse something that's straightforward.
18 They ask for more studies and they mischaracterize
19 documents and law. This unsupported assumption also leads
20 them to an incorrect view that 9VAC25-3150C9, he talked
21 about that in length, imposes duties on the State and the
22 County. That section applies when the discharge will cause
23 or contribute to the violation of water quality standards.
24 We have self-sustaining limits, it does not apply. So what
25 they're saying imposes duties just does not apply.

1 The anadromous fish claim is based on the
2 same erroneous assumption that the new discharge will cause
3 or contribute to lower D.O. Levels in the Pamunkey River,
4 and that's just not the case with the self-sustaining
5 limits. And indeed I note that the file at 1400 -- Bate
6 Stamp 1400 shows that notwithstanding the natural
7 occurring D.O. sag six miles downstream from this discharge
8 site, the Shad population is increasing. And that is an
9 article from a news paper about the band on Shad fishing.
10 So I suggest that the band on Shad fishing may be helping
11 D.O. sag, is not keeping the Shad population from
12 increasing.

13 And the petitioners fair no better with their
14 argument on whether there's substantial evidence in the
15 file to support a conclusion that the permit will protect
16 recreational uses of the Pamunkey River. The Board had
17 adopted a fecal collar form to protect such uses including
18 swimming. The agency file shows that fecal collar form
19 limit meets the standard of swimmable waters. And comments
20 of the petitioners that they'll choose not to swim there
21 and that they've been told by somebody, but they don't have
22 the document, that perhaps it would be better not to swim
23 there, this choice of not swimming is their personal
24 choice.

25 I submit the permit meets the standards and

1 it complies with the law. The only way for the Court to
2 find for the petitioners would be for the Court to draw on
3 collusions without evidence that self-sustained limits
4 cause or contribute to the water quality standard
5 violations, that is the Court, contrary to law, would be
6 substituting its own judgment for that of the State Water
7 Control Board. I think in summary it's clear the
8 petitioner's appeal must be dismissed. They have not met
9 their burden. And the Board's decisions are based on
10 substantial evidence and should be affirmed. I turn to Ms.
11 Wellford.

12 THE COURT: Thank you.

13 MS. WELLFORD: Thank you, Your Honor. As Ms.
14 Rose pointed out, I think it's important in this case to
15 bear in mind that it is the petitioners who bears the
16 burden of proof in this case. It is a burden they appear
17 to be uncomfortable with as they have deciduously attempted
18 to assert that somehow the State and the County of Hanover
19 have a burden in this case, which they most certainly do
20 not, under the Administrative Process Act.

21 It is also important to note, too, that this
22 Court as the reviewing agency must take due account of
23 presumption of official regularity, the experience and
24 specialized competence of the agency and the purposes of
25 the basic law under which the agency has acted.

1 In order for the plaintiffs -- the
2 petitioners here to meet their burden of proof they must
3 point to evidence in this agency record that refutes the
4 Board's conclusion that Hanover's discharge will not
5 violate water quality standards for D.O., dissolved oxygen.
6 And it is our position that this is a burden that the
7 petitioners have utterly failed to meet.

8 Indeed, I found it interesting listening to
9 Mr. Ellis' argument earlier this afternoon that not once
10 did he point to any evidence that is in the agency record
11 to support his argument. Indeed, what he has relied upon
12 is this post hoc evidence that the County and State object
13 to simply because of the fact, not that there is anything
14 that is indefensible in that information, but more
15 importantly because it was never presented before the Board
16 for them to consider and assess as to whether it bears any
17 relevance to the issuance of this permit. What the Board
18 did consider is in the record and that's what we feel that
19 this Court must look to.

20 What the record shows is that this permit
21 that was issued imposes a very set of strict -- a very
22 stringent set of limits on Hanover's discharge. The
23 so-called 10-10-3 limitations, which are self-sustaining,
24 are considered self-sustaining for this reason: They
25 require that oxygen be added to the affluent. The affluent

1 is the mass that will be discharged from the County's plant
2 ultimately. And these 10-10-3 limits require that oxygen
3 be added to that affluent. And the way that the oxygen
4 will be added is through a re-aeration structure which will
5 be located down at the discharge site.

6 And this discharge -- this re-aeration
7 structure is really quite simple. It is an enclosed series
8 of steps. And affluent will, sort of, cascade over these
9 steps and the affluent will be re-oxygenated as a result.
10 And the significance of this is, to the extent that the
11 affluent contains pollutants that have oxygen demand in
12 them, the inclusion -- or the addition of this added oxygen
13 will offset that oxygen demand so that the net result will
14 be that there will be no oxygen demand from this affluent
15 going into the river.

16 And, indeed, because of the fact that the
17 agency's permit requires that the dissolved oxygen be at a
18 6.5 milligrams per liter level rather than 5.0 milligrams
19 per liter, which is the base level in the river -- that is
20 the amount of the oxygen found in the river, dissolved
21 oxygen. What will come out of the County's discharge will
22 be at a higher level than what's in the river already, so
23 we will actually add oxygen, through our affluent, to the
24 river, under the Board's strict limitations that are
25 imposed in this permit.

1 And so when we say that the limitations that
2 are imposed by the permit are self-sustaining, it means
3 that the net result is that any oxygen demands in this
4 affluent are offset by the addition of the oxygen through
5 the re-aeration process, and there are no demands placed on
6 the river as a result of Hanover's discharged.

7 The Board has used 10-10-3 limitations
8 successfully since roughly 1987 when it first issued what's
9 referred to as the Swamp Guidance, which appears in the
10 record. It's a memorandum dated in 1987. And the record
11 also contains reference to three other discharges into the
12 same body of water, the same general area of the Pamunkey
13 River where the board had imposed the same limitations the,
14 10-10-. These are the King William Sewage Treatment Plant,
15 which was permitted in 1997. The Cumberland Wastewater
16 Treatment in 1992. And the Parham Landing Wastewater
17 Treatment Plant in 1994. And I think it's interesting that
18 despite the fact that the partitioners participated in the
19 agency's consideration of this permit, they never once
20 brought forward any evidence to suggest that the 10-10-3
21 limitations that were imposed on these three facilities
22 into the Pamunkey River were inappropriate, that the
23 monitoring showed somehow that the 10-10-3 limits did not
24 adequately protect water quality. They certainly had ample
25 time to do that, they did not. There's absolutely no

1 evidence in the record to suggest that the 10-10-3
2 limitations are inappropriate.

3 The fact that the EPA has subsequently listed
4 this title area of the Pamunkey River as an impaired water
5 is a Red Herring with respect to the issues in this case.
6 The reason being most importantly that that listing
7 occurred two months after the Board issued the permit in
8 this case -- or approved it. One month after it was
9 issued. But more importantly, I think, is the fact that we
10 have three letters in this agency record from the EPA, one
11 in July of '98, another in November of '98 and the third
12 one, the same month of the approval of the permit, March of
13 1999, confirming that the EPA had no objection to the State
14 Water Control Board's issuance of this permit. And,
15 indeed, had the EPA objected to this permit it could not
16 have been issued. So whether or not this water has
17 subsequently been determined by the EPA to be impaired, is
18 of no consequence in this case.

19 Let's talk about the State Water Control
20 Board's dissolved oxygen criteria. The State Water Control
21 Board has issued in its regs, numerical criteria for
22 dissolved oxygen in the Pamunkey. And the petitioners
23 suggest -- they represent to this Court, because I heard it
24 again today from Mr. Ellis and also in their brief, that
25 these criteria can never, not even for an instant be

1 violated, and that's just not true. In fact, the very
2 regulation that these criteria appear in recognize that in
3 drought conditions they may be violated. Indeed, the Board
4 recognizes that they probably will be violated. Moreover,
5 there is a regulation issued by the Board that recognizes
6 because of naturally occurring conditions water quality may
7 vary from the criteria set forth in the regs. So the
8 petitioners' contentions are simply off base.

9 And so when we look at the Department of
10 Environmental Quality Staff Analysis of the D.O. condition
11 in the Pamunkey related to the Hanover permit application,
12 the staff noted, yes, there are D.O. violations that have
13 occurred in the title Pamunkey, they're documented, no
14 question about that. We know that, too. But they found,
15 and this is in the agency record, that they are the result
16 of naturally occurring conditions. But recognizing that
17 these conditions do occur the staff recommended and the
18 Board approved a permit that employed this best
19 professional judgment 10-10-3 limitation approach. And
20 that was a very conservative approach, the one that they
21 felt would be most protective of water quality conditions
22 and reflects the concern that this Board had for preserving
23 alter quality, as they are required to do under the State's
24 Water Control Law.

25 The State Water Control Board Regulation that

1 has been eluded to by Mr. Ellis in his argument today as
2 well as in his brief, that is: 99, Virginia Administrative
3 Code 25-31-50 simply does not apply to Hanover's permit.

4 The petitioners are contending that this regulation at
5 Subsection C-9, first required Hanover to establish that
6 water quality standards will be achieved notwithstanding
7 the proposed discharge. And secondly, required the State
8 Water Control Board to make a finding of that fact, that
9 water quality standards would be achieved notwithstanding
10 the proposed discharge and, all that had to happen before a
11 permit could be issued. We disagree. The regulation
12 simply doesn't apply to this situation.

13 What the regulation says is: No permit may
14 be issued to a new discharger -- and we recognize we're a
15 new discharger -- if the discharge from its operation will
16 cause or contribute to the violation of water quality
17 standards. And for the reasons I've explained just a
18 moment ago, the self-sustaining limitations, there is no
19 contribution to a violation of water quality standards as a
20 result of anything that Hanover will be doing with its
21 discharge, because of the stringent limit placed on it by
22 the permit issued by the Board. So this regulation simply
23 doesn't apply.

24 Now the petitioners made an issue of the
25 effect of Hanover's discharge on anadromous fish, those are

1 the fish that primarily reside in salt water, but migrate
2 upstream to fresh water to spawn. And these would include
3 Shad, Herring, so forth. What the agency record shows is
4 that the 10-10-3 limitations that it imposes through this
5 permit are specifically designed to protect all aquatic
6 life, including anadromous fish life. According to the DEQ
7 Staff, as reflected in this record, the 10-10-3 limitations
8 typically show no toxic impact on aquatic life at the
9 in-stream waste concentrations expected from the project,
10 and I refer to tab 5A at Baits Number 1348.

11 In addition to the 10-10-3 limitation
12 providing protection to anadromous fish, the State Water
13 Control Board's own water quality standards contain halogen
14 bank. The significance of this is that the use of chlorine
15 as a disinfectant for wastewater is prohibited under the
16 State regs. This is significant because it is designed to
17 protect an endangered species such as Muscles. Hanover
18 County has always proposed, with respect to this project,
19 the use of ultra violet disinfectants as opposed to
20 chlorine and that is what will be included in this project
21 ultimately when it gets started. The permit, itself,
22 specifically prohibits the use of chlorine, so that added
23 protection is there.

24 In addition, Hanover's permit requires
25 Hanover to conduct an annual study at the impact of the

1 discharge on macro-invertebrate, primarily the aquatic life
2 that lives, in this case, at the bottom of the river, the
3 shell fish and so forth. These studies are going to be
4 testing for toxicity to stationary aquatic life, primarily.
5 It's designed, again, to ensure there's going to be no
6 toxic impact associated with the discharge.

7 And I think it's also important to point out
8 here that the State Water Control Board's efforts to
9 protect aquatic life, that's reflected in the record
10 itself, is specifically reflected, I think, in the letters
11 issued by the Virginia Department of Game and Inland
12 Fishery and U.S. Fish and Wildlife Service, approving the
13 issuance of this permit. They blessed this project in its
14 entirety. And that, too, is in the record, they appear at
15 tab 6G and 6N.

16 Now if we go to the next argument that the
17 petitioners have raised, which is the effect of Hanover's
18 discharge on recreational uses. The usage record, again,
19 is strong in supporting the protections that the agency has
20 designed into its permit here. The affluent limits that
21 are imposed by the permit meet the regulatory definition of
22 swimmable waters. And I refer the Court to 5A Bait Number
23 1349.

24 What the petitioners have claimed in their
25 brief, and I believe in argument today, is that the

1 Virginia Department of Health had stated that primary
2 contact with water should be avoided downstream of the
3 discharge and treated sewant. That is nowhere in the
4 record, aside from Mr. Ellis' letter to the State Water
5 Control Board. He says that, but he does not offer any
6 document from the State Department of Health that says
7 that. What is in the record is this, there are letters
8 from the Department of Health confirming its lack of
9 objection to the issuance of this permit. And I think that
10 is what is significant.

11 Now the final issue that they have raised in
12 this case and I -- because the Court has not yet ruled on
13 the procedural objection that the County and the State have
14 made to this, I'm going to address it on the merits. The
15 petitioners contend that the State Water Control Board did
16 not make specific findings in this case. Now what the
17 petitioners alleged is that the Board was required to make
18 findings first, that the proposed discharge won't cause or
19 contribute to violations of water quality standards. And
20 second, that the proposed discharge is compatible with
21 existing uses of the water body. Now neither the
22 regulations -- the implementing regulations or the State
23 Water Control Law requires the SWCB to do anything of this
24 nature.

25 The petitioners in their reply brief cite to

1 a case Browning Ferris Industries versus Residents. And I
2 believe this is a case that the Court is familiar with. In
3 that case, which dealt with the Virginia Waste Management
4 Act, the Supreme Court of Virginia found that the DEQ had
5 failed to make specific findings and overturned the
6 decision in that case as a result. And it specifically
7 looked to a provision of the Code in the Virginia
8 Wastewater Management Act 10.1-1408.1D. And if you read
9 that code section it is very clear that the agency was
10 required to make a finding. But such a requirement does
11 not exist in State Water Control Law at all. So it is our
12 position that the petitioners' argument is entirely without
13 merit.

14 In conclusion then, it is the position of
15 both the State Water Control Board and the County that the
16 Board issued a permit that imposes stringent limitations
17 and monitoring requirements that protect water quality and
18 the beneficial uses of the Pamunkey River. The agency
19 record fully supports that. And the petitioners are unable
20 to, as they are obligated to in order to prevail in this
21 case, they are unable to point to any evidence in this
22 record that refutes the substantial evidence in which the
23 State Water Control Board relied to make that decision. So
24 it is our position that they have failed to meet their
25 burden. And for that reason we ask this Court to affirm

1 the issuance of the permit and dismiss this appeal. Thank
2 you.

3 THE COURT: Thank you.

4 MR. BUTCHER: Your Honor, they gave me the
5 standing issue. Your Honor has already recognized that the
6 Court has decided that the petitioners pled the standing
7 issue, that's water down the creek now. We're here today
8 to talk about whether they have standing, whether they have
9 proved it. As Your Honor is aware, they're obliged at
10 every step of the process to have standing and to be able
11 to demonstrate they do indeed have it. I'm here to submit
12 they do not, on the facts, that's the reason that we took
13 the depositions and put them before Your Honor. And you'll
14 notice that both sides have now cited to those depositions
15 as the evidential basis for the discussion that follows.

16 Mr. Broaddus owns the farm that includes the
17 New Castle archaeological site. Ms. Crutchfield has a
18 dower interest in that property. That property's a farm,
19 it has a considerable historical interest and the documents
20 actually in their addendum there talks about fiance of
21 interest, there used to be a port there. Mr. Broaddus owns
22 another portion of the Marlbourne side, and that's the
23 Edmund Ruffin Plantation which is on the National Historic
24 Register, I believe. And Ms. Crutchfield has a dower
25 interest in that property.

1 Per Your Honor's decision, the sole issue
2 that these petitioners have pled with respect to standing
3 is historic sites. That is the sole place in their petition
4 where they have asserted standing is by asserting harm to
5 historic sites that are of interest to them.

6 Well, if you look at that deposition, Your
7 Honor, and our discussion of it in our briefs, you'll see
8 that historic structures on the Marlbourne site are two
9 miles away, they're across Route 360 and they're on
10 property that these folks don't own, that's the structures
11 on the Marlbourne site. As part of this process they hired
12 a consultant, I believe the County paid for them, but
13 whoever did, the consultant went out and did an assessment
14 for them that said the project will not have an effect on
15 the locations' setting or use that contribute to
16 Marlbourne's significance.

17 The Newtown archaeological site, which is
18 down by where the discharge is going to be, down along the
19 river, is a farm. And if you look at their tab 9 you'll
20 see that its use -- its importance today, it's valuable for
21 archaeological investigation because of the Colonial use of
22 the site, what's left that is, after it's been farmed.

23 Your Honor, we addressed in the depositions
24 the question of fishing and swimming and other recreational
25 uses of the property, although these plaintiffs have not

1 pled that issue, just for completeness. I'll submit to the
2 Court that because they didn't plead it, it's not before
3 you. To the extent that Your Honor is going to consider
4 fishing and swimming and the like, the point I'd like you
5 to fasten on is that neither of the petitioners could
6 identify how the permit limits that the Water Control Board
7 put in place harpened the resource. We asked them, okay,
8 what's wrong with the CBOD limit of the 10; how is it
9 harming fishing, swimming, so on? And they were unable to
10 identify any specific harm. As a matter of fact, they
11 admitted that their use -- the use as far as they were
12 concerned would be impaired even if this project were
13 discharging drinking water.

14 Now, Your Honor, the Water Control Board
15 can't make the County discharge drinking water as outfault,
16 all it can do is make them protect the uses. And if they
17 protect the uses, I'll submit, then we don't have a
18 standing problem here, because these folks have already
19 told you that no matter how clean it is, it can't be clean
20 enough to suit them.

21 Specifically, Your Honor has already analyzed
22 Section 29 of the Water Control Law in your letter opinion
23 earlier on whether they had pled standings. And it raises
24 three specific issues. First, is whether the petitioners
25 are actually harmed by the Water Control Board's decision.

1 I submit on this record, Your Honor, that they don't even
2 claim that they're harmed by the Water Control Board's
3 decision. They claimed that they're harmed by the idea of
4 a sewer pipe going across their farm, or a portion of it,
5 and go into the river adjacent to their property. They do
6 not claim any objective harm to personal or property or
7 esthetic interest other than that they dislike this so much
8 they don't want it there even if it's discharging drinking
9 water. They admit, if you will, to an irrational prejudice
10 against pipes -- sewage, I mean. Treated sewage, that is.

11 As to the historic resources that they have
12 pled, it's abundantly clear that the project isn't going to
13 harm them. Even as to the uses they haven't pled, they
14 didn't think important enough to plead I suppose, the
15 petitioners have admitted that any harm comes from the
16 existence of the County's project, not from the Board's
17 limits on that project. They're saying there's no limit
18 the Board could put on that would make it acceptable to
19 them. And that's the second element, is the harm that
20 they're complaining traceable to the Water Control Board.

21 Your Honor, the permit does not authorize the
22 County to harm these folks. Quite the contrary, on its
23 face the permit says it does not authorize any injury to
24 private property or invasion of personal rights. And the
25 petitioners' complaint is not the permit should be more

1 stringent in order to protect the beneficial uses. Their
2 complaint is that the permit should be denied because they
3 don't like having the project there. I submit that their
4 complaint is against the County Zoning Process that allowed
5 this to be in this location, not against the limits that
6 the Water Control Board selected once it's going to be
7 there in order to protect what's going on in the stream.

8 And the third arm of the standing inquiry,
9 Your Honor, is whether the petitioners' complaint could be
10 redressed by a favorable decision here. Now as Your Honor
11 pointed out in your letter opinion, you can vacate this
12 permit and remand it, but the only basis for that is a lack
13 of substantial evidence to support the Board's conclusion
14 that it's not going to hurt the stream. They've told you
15 that even if it's not going to hurt the stream, even if
16 it's discharging drinking water, they're not satisfied.
17 Their complaint cannot be remedied, Your Honor, in this
18 proceeding, it can only be remedied in a County Zoning
19 Proceeding. Even if there were a defect in that permit,
20 curing that defect would not cure that problem.

21 On this basis, Your Honor, I suggest that
22 these folks don't have standing and, therefore, don't have
23 the ability to bring this appeal. And I suggest that the
24 appeal needs to be dismissed. Thank you, Your Honor.

25 THE COURT: Thank you, Mr. Butcher.

1 Anything else, Mr. Ellis or Mr. Marshall?

2 MR. ELLIS: Yes, Your Honor. With Your
3 Honor's permission I'll briefly address a couple of points
4 on the merits and then ask Mr. Marshall to address a couple
5 of points with respect to standing.

6 The drafters of the regulation is at the
7 heart of this case, plainly did not contemplate what I will
8 call the creative or inventive argument that you have just
9 heard. The drafters, I think, very plainly attempted to
10 craft a situation where you would have on the one hand
11 discharges of pollutants to waters that comply with water
12 quality standards and on the other side you would have
13 discharges of pollutants to waters that do not meet water
14 quality standards for that pollutant. And they assume, as
15 it's apparent from the structure of the regulation, that
16 the latter category would contribute to violations of water
17 quality standards.

18 Now -- and they went on to explain, then what
19 one needs to do if you wish to issue a permit in that
20 situation. I think that that's apparent in EPA's
21 explanation of the provision that I quoted originally.
22 This was published by the Environmental Protection Agency
23 at 65 SEC REG, 30,886 page 30,888. And again it says:
24 Section 122.4I prohibits the issuance of a permit to a new
25 source or a new discharger if the discharge would cause or

1 contribute to a violation of water quality standards. And
2 here's the key sentence. It says: A new source or a new
3 discharger may, however, obtain a permit -- indicating that
4 the prior sentence plainly contemplated that it couldn't,
5 and it goes on and says -- but you may for a discharge into
6 a water segment which does not meet applicable water
7 quality standards by submitting information ..
8 demonstrating -- and it goes on to say essentially that
9 water quality standards will be achieved as a result of a
10 pollutant-load allocation analysis.

11 Now I think on the merits that's the issue
12 that's before you. I think it's very clearly published.
13 Is it available at this point for the Board to create a
14 whole new way to get around this requirement to say that
15 you can discharge pollutants to water quality segments that
16 violate water quality standards for that very pollutant,
17 but we've determined in our wisdom that that will not
18 contribute to water quality standards; therefore, we don't
19 have to do all the procedures and safeguards that are
20 specified in the regulation. That's their argument, I
21 think it's very clearly posed. And I think the answer to
22 it is very clear, and I won't go further into it.

23 With respect to the record, we've heard
24 reference to the record. This is not a case that has an
25 administrative record, it is not a formal adjudicatory

1 case. We do not have a formally designated record in this
2 case. And with respect to this kind of case Virginia Code
3 Section 9-6.14:17, very clearly says: Where there is no
4 such agency record -- and that's our case -- where there is
5 no such agency record so required, and made, any necessary
6 facts in controversy shall be determined by the Court upon
7 the basis of the agency file minutes, records of its
8 proceedings under two code sections as augmented if need be
9 by the agency pursuant to the order of the Court or
10 supplemented by any allowable and necessary proofs adduced
11 in Court. So Your Honor it is not bound in this case to an
12 administrative record.

13 The final point that I wish to make is
14 respect to this question -- I will elude to it briefly and
15 then turn the remainder of the standing issue over to Mr.
16 Marshall. I apologize for intruding on his ground, but I
17 could not let the assertion stand that the only thing
18 preventing my clients from swimming, fishing canoeing or
19 otherwise enjoying their waterfront property is the idea in
20 their own heads that those activities might not be a good
21 idea. In fact, Your Honor, this is in the record -- except
22 that there isn't a record -- it is in the documents
23 specified to the Court by the agency. And the DEQ Staff,
24 in pondering our comment that the affluent discharge would
25 reduce recreational use of the river, here's what the staff

1 said: Although affluent limits are set to establish a
2 level of disinfection which would meet the regulatory
3 definition of swimmable waters -- by the way, I don't
4 believe there is any such definition, but in any event, it
5 goes on to say -- the presence of the discharge will
6 realistically eliminate swimming in the river in the
7 vicinity of the outfall as people make a reasonable choice
8 to minimize risks to their health. That's from the Board's
9 staff. It appears at page 1349 of their appendix. Unless
10 Your Honor has any questions I'll ask Mr. Marshall to
11 address --

12 THE COURT: No, sir, thank you.

13 MR. MARSHALL: Your Honor, as I noted
14 earlier, I do think the standing issue has been addressed,
15 you've ruled on it, we have standing, we maintain standing,
16 we maintain this action. However, I do feel we need to
17 respond to the challenges that have been made in the brief
18 and in the comments today by Mr. Butcher. But I do want to
19 be clear, that I think that decision has already been made
20 and the law in the case here to our clients having
21 standing.

22 Your Honor, Mr. Butcher has alluded to no
23 case law that applies here, because the case law makes
24 clear that our folks have standing. One element of that is
25 the damage to the historic and archeological resources on

1 that property. The property that they own, New Castle
2 Farm, contains the historic town of New Castle and a
3 portion of Marlbourne. Now from their property that -- it
4 constitutes the Town of New Castle, they're going to be
5 able to see the discharge structure that is going to be at
6 the edge of the Pamunkey River from where they stand.
7 Their use and enjoyment of those historic resources is
8 lessened. Their esthetic interest in that is damaged, and
9 that in and of itself, by itself under the Fourth Circuit's
10 cases is enough to establish standard.

11 On top of that, Your Honor, depositions, as
12 you know, were taken to further explore the recreational
13 uses of the river by my clients. It was very clear through
14 pictures, which are attached to those depositions, Your
15 Honor, that for years, ever since Mr. Broaddus was a little
16 boy he has swam in the river, fished in the river, canoed,
17 camped with Boy Scouts. Your Honor, his mother has done
18 the same thing. It's been a family refuge for family
19 picnics, swimming and water skiing. And all of that is
20 documented in the record. That activity is going to stop
21 as a result of the issuance of this permit, if waste is
22 allowed to flow through that pipe and into the Pamunkey
23 River. Those, the succession of swimming, the succession
24 of fishing, the succession of other water contact sports
25 such as water skiing or canoeing are going to stop because

1 of the issuance of that permit. That is enough to
2 establish standing.

3 Mr. Butcher alluded to the fact that we
4 haven't told him what make-up would be adequate to
5 alleviate this harm. We don't have to do that under the
6 law, Your Honor. The Friends of the Earth Case, which we
7 cited when the demurrer was originally filed, which lays
8 out the Fourth Circuit's requirements for standing,
9 reversed the District Court because the District Court
10 specifically said, they didn't tell us how the chemical
11 content of the waterway affects them. They don't tell us
12 specifically about any change in the echo system.

13 And the Fourth Circuit said very clearly,
14 turn to the Lade Law Case. The Supreme Court does not
15 require such proof. They said: The Court found that
16 several citizens signed affidavits attesting to the reduced
17 use of a waterway out of a reasonable fear and concern of
18 pollution adequately documented injury and fact. If
19 there's any question, Your Honor, the Board's own record
20 that said: People won't swim here and that's a reasonable
21 choice. If you need anything else to establish standing
22 that alone is enough. But they said: Each of the citizens
23 alleged that he or she would make greater recreational use
24 of some part of the affected waterway were it not for their
25 concern about the harmful effects of the defendant's

1 discharges.

2 The Court required no evidence of actual harm
3 to the waterway, noting, and I'm quoting: Again, we have
4 held that the environmental plaintiffs adequately alleged
5 injury and fact when they avoid the use of the affected
6 area and the purpose for whom the esthetic and recreational
7 values of the area will be lessened by the challenged
8 activity. Now you have already ruled as to historic and
9 archaeological resources that are use and enjoyment, and
10 esthetic enjoyment have been lessened
11 and damaged by the issuance of this permit.

12 They also found out that we're not going to
13 fish in the water, we're not going to swim in it, we can't
14 kayak, we're going to limit what the Boy Scouts can do on
15 the edge of the river because of what is being discharged
16 into it. And that alone, Your Honor, accomplishes
17 standing. I will refer you one final time to the language
18 in Friends of the Earth, where it clearly points out, Your
19 Honor, that damage to an individual's esthetic or
20 recreational interest may be vindicated, it is absolutely
21 sufficient to establish standing. And this Fourth Circuit
22 Case cites Friends of the Earth v Lade Law, the recent
23 Supreme Court Case, but a string of other Supreme Court
24 Cases all with that holding, that an effect, just an effect
25 on recreational, esthetic and economic interest is

1 cognizable injury for purposes of standing.

2 Clearly, Your Honor, the traceability and
3 redressability issues you also ruled on, the fact of that
4 the damage being suffered as a result of the issuance of
5 the permit and a vacationer injunction to this permit is
6 going to fix the harm that has been claimed.

7 Redressability and traceability you've already ruled on
8 correctly in your letter opinion. And I think, you know,
9 again, that doesn't need to be ruled on again, but it has
10 been argued that that, in fact, has not been met, the final
11 two prongs of the three-part test. And I think they have,
12 Your Honor.

13 THE COURT: What do you make of Mr. Butcher's
14 comment argument that this is a zoning -- in the eyes of
15 the plaintiff to take their -- the petitioners take their
16 argument about how they see that there would be no limit
17 that would ever prevent any harm to them, the very
18 existence of the facility there is harmful, that there
19 could be no limits placed on the discharge that would
20 satisfy them? And rather than complaining, as they do,
21 about the siting of this facility in this context and this
22 appeal as the State Board -- Control Board's decision is
23 rather, to him, a zoning problem?

24 MR. MARSHALL: Not at all, Your Honor. I
25 would initially point out that whether they're opposed to

1 this under any and all circumstance is irrelevant to
2 standing, it has nothing do to with standing. What the
3 Board is trying to do here is more --

4 THE COURT: Well, I think he was thinking --
5 he said in the argument there that if the Court accepts the
6 petitioners' position, the only thing the Court can do is
7 remand this case to the agency for reconsideration. And
8 there we go again. What could this Court do to -- if that
9 is indeed the petitioners' position, what could this Court
10 do with respect to granting any relief?

11 MR. MARSHALL: Well, Your Honor, I think it's
12 pretty straightforward. Standing is our folks' ability to
13 maintain an action. Now if you remand it, if you find in
14 our favor that the respondents did not make the required
15 findings, did not do what they needed to do pursuant to
16 statute and law, you send it back so that the agency does
17 what it is required to do by law.

18 Now if they do that and we come back again,
19 it's like any other appeal to a permit, Your Honor. This
20 cannot go on, it is going to be a permit that is or is not
21 issued in accordance with law and regulation. Or if it
22 comes down to it in a subsequent case whether there's
23 substantial evidence in the record, we're not going to be
24 stuck in this forever do little (phonetic). There's going
25 to be a point where, you know, that ends. But it's just

1 standing.

2 THE COURT: I'd like to see a point where it
3 ends.

4 MR. MARSHALL: We would as well, Your Honor.

5 THE COURT: I know you would.

6 MR. MARSHALL: But that, I think, is -- and I
7 don't mean any malice -- a misleading argument. It gets
8 you looking over to the right when you really should be
9 looking over to the left. We're asking the Court to
10 require the Board to do what it's supposed to have done
11 pursuant to statute and regulation.

12 Now our folks are opposed to this project,
13 that's clear from the depositions. They don't want this
14 project in their backyard. But, Your Honor, if based on
15 the facts, not only the damage to historic and
16 archaeological resources and their enjoyment of those,
17 which again is enough to establish standing. The
18 succession of swimming and fishing and those other things
19 for my clients who own property immediately down the
20 stream, literally right next door to this discharge, then
21 nobody in the Commonwealth of Virginia could ever challenge
22 the issuance of a State Water Control Board permit except
23 an owner/operator perhaps who was denied a permit. And
24 that's not what the State Water Control Law is about, and
25 that's not the purposes of the standing or requirements in

1 that act. If our folks don't have standing here then no
2 one could ever challenge a permit. We're there. We've had
3 the damage that you've already found sufficient to
4 establish standing.

5 In addition to all the other things that came
6 up in that deposition I -- you know, you mentioned that you
7 had perused Mr. Broaddus' deposition transcript. And I'll
8 immediately refer you to some cites in both to focus on the
9 fishing and the swimming issues just to save the Court some
10 time.

11 THE COURT: All right.

12 MR. MARSHALL: And Ms. Crutchfield's
13 deposition page 91, lines 8 through 22. And at page 108,
14 lines 9 through 17. And page 109, 4 through 21. Mr.
15 Broaddus' deposition at page 7 at line 6 through 12. And
16 page 19, lines 13 through 19. Those speak --

17 THE COURT: What was that last page?

18 MR. MARSHALL: 13 through 19. It's page 19,
19 lines 13 through 19.

20 THE COURT: Thank you.

21 MR. MARSHALL: Those go to the impact -- the
22 negative impact and injury to the historic and
23 archaeological resources. The fact that as they're
24 standing on historical property they have to smell this,
25 they have to look at the discharge structure. And, Your

1 Honor, if you apply those facts to the law -- and I
2 encourage you to go back and look at this case again, I
3 think we provided it to you at the demurrer hearing -- that
4 that's enough.

5 In addition to that, though, Your Honor, I
6 refer you to the fishing, swimming and camping discussion
7 in both depositions. In Ms. Crutchfield's deposition, page
8 110, line 7 through page 118, line 18. And in
9 Mr. Broaddus' deposition page 14, line 11 through page 16,
10 line 25. And, you know, light was made of the fact that
11 from somewhere my clients came up with the idea that they
12 couldn't swim in it. Well, it's in the Board's own
13 document that folks would make a reasonable decision not to
14 swim in it.

15 THE COURT: That's the thing Mr. Ellis
16 referred to?

17 MR. MARSHALL: Yes, sir, exactly. I believe
18 it's page 1349 in the record.

19 THE COURT: Right.

20 MR. MARSHALL: That is the deal closer, Your
21 Honor, based on the case law in the Fourth Circuit Court.
22 Even -- whether they feel my client's concerns and injuries
23 are reasonable enough don't matter. That doesn't matter.
24 The case law does not require them to agree that we're
25 injured, all it requires is that we unearth and show what

1 we have shown both in our pleadings and in this
2 deposition -- and in the deposition transcripts, Your
3 Honor. And if there was any doubt about reasonableness,
4 it's been answered by the Board that, in fact, swimming
5 will cease there and that will be a reasonable thing to do.
6 But again, their idea of reasonableness is not a driving
7 factor in the standing decision.

8 But if the Court would like I would send it a
9 copy of the Friends of the Earth Case. I don't know
10 whether you have that one. That is the governing law in
11 the Fourth Circuit now. And since the State Water Control
12 Law has specifically incorporated that, I think it would be
13 very helpful for the Court. It's at 204 F3rd, 149. And
14 throughout it discusses the fact.

15 And, Your Honor, one final point on standing.
16 The Fourth Circuit again citing a long series of cases
17 makes clear that this standard is -- for standing of kind
18 and not of degree. There doesn't have to be a particular
19 amount of standing that has to occur. And they quote from
20 a Fifth Circuit case specifically, but this standard is one
21 of kind and not degree. Indeed, the claim injury need not
22 be large, an identifiable trifle will suffice. We have
23 pled that, we have averred that. That is clear that much
24 more than that exists. But under the law our standing
25 maintains suit, Your Honor, we have gone far beyond

1 identifiable trifle. If the Court doesn't have any
2 questions, that concludes --

3 THE COURT: I don't have any questions, Mr.
4 Marshall, thank you. Ladies and gentlemen, there's a lot
5 to consider. And I will be doing that in the next few
6 coming days. And I will let you know --

7 MS. ROSE: Your Honor, you haven't yet ruled
8 on the motion to strike. And if you --

9 THE COURT: The motion that Mr. Butcher made?

10 MS. ROSE: Correct.

11 THE COURT: I'm going to keep that under
12 advisement. I need to specifically look at these
13 documents, each one. As I mentioned --

14 MS. ROSE: If I could just revisit each one
15 of them, we didn't have an opportunity. The tab 2 is
16 the -- Mr. Allen's memo, it's not an official policy of
17 DEQ, it's merely an e-mail. As we've said, it's not
18 available --

19 THE COURT: I think Mr. Butcher took me
20 through these tabs.

21 MR. MARSHALL: He did, Your Honor.

22 THE COURT: I thought we talked about --

23 MS. ROSE: They did, but we did not, Your
24 Honor.

25 THE COURT: You didn't go through them

1 specifically?

2 MS. ROSE: Correct. Mr. Marshall, I believe,
3 did. And it's the Allen memo, you might look at it like
4 changing the state law, you're in year one and it's "X" but
5 in year two it might be "Y." But the fact that the permit
6 was issued in year -- the first year doesn't mean the
7 permit's no good, because the law changes after the fact.

8 The tab 3, the letter from Mr. Phillips, he
9 read only parts of that. That letter concludes that we
10 believe that the limits provide adequate protection for the
11 situation permitted. And also in the last paragraph the
12 letter also addresses the fact that although there are no
13 expressed limits in the permit, there are, in fact,
14 requirements that if you are going to increase your
15 capacities beyond the permitted levels you will have to
16 come back and get a permit. So there were limits there,
17 although nonexpressed, there are limits to the discharge.

18 Tab 4, which is the letter of Mr. Burrison, I
19 guess he's from VIMS. His conclusion was, in this
20 particular situation the 10-10-3 and 6.5 D.O. limits are
21 believed sufficient to maintain healthy water quality for
22 anadromous fish. The point being, when you read these
23 documents as a whole, they do not say what the petitioners
24 have claimed.

25 And along those same lines, and I don't

1 really want to add more, but if you have not decided, the
2 County has documents which address these, that were
3 submitted, and I would suggest, to the Virginia Marine
4 Resources Commission, which is when all this came up, that
5 the County would put these into this record. We don't
6 really -- you know, our preference is you exclude all these
7 documents, but we would submit that -- and I have copies
8 for counsel -- I guess I provisionally submit these --

9 THE COURT: What are those documents again?

10 MS. ROSE: These were the County's response
11 to the matters that they're trying to put in, the tab 2,
12 tab 3, tab 4 --

13 THE COURT: Where were those responses?

14 MS. ROSE: Our response was written to the
15 Virginia Marine Resource Commission, which was when these
16 documents were first surfaced from the petitioners,
17 actually.

18 THE COURT: Do you have any objection to
19 this, Mr. Marshall?

20 MR. ELLIS: Your Honor, assuming that you're
21 willing to take and consider the documents we submitted, we
22 surely feel turnabout is fair play. We'll be glad to --

23 THE COURT: Well, I'll take those and -- but
24 the question is whether or not they should be considered at
25 all is still on the table?

1 MS. ROSE: Yes, Your Honor, definitely.

2 THE COURT: All right. Is that all you have,
3 Ms. Rose?

4 MS. ROSE: If I might briefly address that
5 one regulation, the paragraph E9.

6 THE COURT: The proposed rule?

7 MS. ROSE: No. This one is actually a
8 regulation. It is the one -- 25-3150C9. And we already
9 addressed the first sentence and that is clearly that this
10 only applies if you have a discharge that will cause or
11 contribute to the violation of water quality standards,
12 that's not the case here, we said self-sustaining.

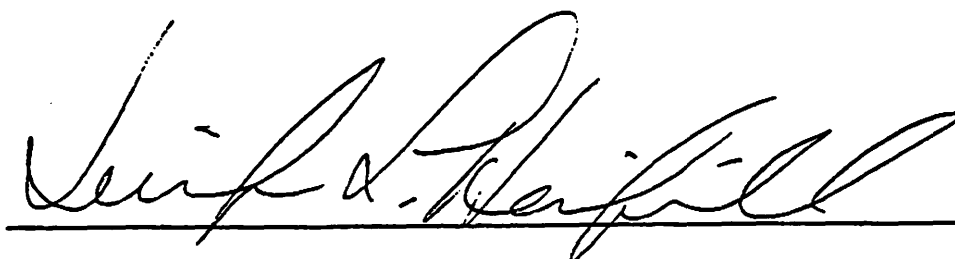
13 But the second one is the one that Mr. Ellis
14 is trying to, in my opinion, misconstrue. He in his brief
15 at page 7 adds a word that says, you know, unless DEQ has
16 performed a pollutant-load allocation and the owner
17 demonstrates on that basis that the water quality standard
18 will be achieved. But that's not what the second sentence
19 says. The second sentence says: The owner of a new
20 discharge into a water segment which doesn't meet the
21 standards. And it says going on down: And for which the
22 department has performed pollutant-load allocations for
23 pollutant to be discharged. It doesn't say "unless," it
24 says "and." There is no such pollutant-load allocation for
25 this segment of the river. The reason being, we're using

1 self-sustaining limits. So the department has not done it,
2 they don't need to do it. Thank you, Your Honor.

3 THE COURT: Well, thank you, ladies and
4 gentlemen, it's been interesting.

5
6
7
8 REPORTER'S CERTIFICATE

9 I, Jennifer L. Hairfield, Notary Public in
10 and for the Commonwealth of Virginia at large, and whose
11 commission expires March 31, 2003, do hereby certify that
12 the pages contained herein accurately reflect the notes
13 taken by me, to the best of my ability, in the above-styled
14 action.

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21 Jennifer L. Hairfield
22 Shorthand Reporter
23
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25

VIRGINIA:

IN THE CIRCUIT COURT OF THE CITY OF RICHMOND
John Marshall Courts Building

FRANCES BROADDUS CRUTCHFIELD, *et al.*,)

Petitioners,)

v.)

No. 760CH99K01193-00

STATE WATER CONTROL BOARD, *et al.*,)

Respondents.)

MEMORANDUM IN SUPPORT OF MOTION TO STRIKE
AND POST TRIAL BRIEF OF RESPONDENTS
STATE WATER CONTROL BOARD AND
COUNTY OF HANOVER, VIRGINIA

The State Water Control Board (the "Board" or "SWCB") and the County of Hanover, Virginia ("Hanover"), by counsel, say the following in response to the new materials and argument on 9 VAC 25-31-50(C)(9) the Petitioners offered in their reply brief and at trial.

1. The Permit Complies With
9 VAC 25-31-50(C)(9)

At trial and in their reply brief Petitioners advance the flawed argument that the Board's regulation - 9 VAC 25-31-50(C)(9) - operates to prohibit the Board's issuance of the permit in question. In fact, by its clear terms the regulation allows the permit to be issued to Hanover.

9 VAC 25-31-50(C)(9) provides in pertinent part:

No [VPDES] permit may be issued . . .

9. To a new source or a new discharge, if the discharge from its construction or operation will cause or contribute to the violation of water quality standards. The owner or operator of a new source or new discharger proposing to discharge into a water segment which does not meet applicable water quality standards or is not expected to meet those standards even after the application of the effluent limitations required by the law and §§ 301(b)(1)(A) and 301(b)(1)(B) of the CWA, and for which the [SWCB] has performed a pollutants load allocation for the pollutant to be discharged, must demonstrate, before the close of the public comment period, that:

a. There are sufficient remaining pollutant load allocations to allow for the discharge; and

b. The existing dischargers into that segment are subject to compliance schedules designed to bring the segment into compliance with applicable water quality standards.

The first sentence of subsection (C)(9) of this regulation prohibits issuance of a VPDES permit only if the new discharge will cause or contribute to a violation of water quality standards. The record before this Court shows that Hanover's discharge will not cause or contribute to such a violation. The DEQ staff advised the State Water Control Board that the "10-10-3" self-sustaining limits of this permit require Hanover's discharge to be stringently treated so that pollutants present in the effluent will have no net effect upon the river. DEQ staff noted in its "Summary of Issues and Staff Response" prepared for the Board in connection with Hanover's permit application that:

These so-called "10-10-3" limitations establish a level of treatment which in the best professional judgment of the Board's staff will not further contribute to lower dissolved oxygen levels in the receiving stream, regardless of the size of

the discharge. This same standard was used to establish effluent limitations for 3 other discharges to this section of the Pamunkey River over the past years (King William STP on Monquin Creek, Cumberland WWTP and Parham Landing WWTP on the Pamunkey River).

Respondents' Appendix, Tab 5A at 001347 (emphasis added).

Because the permit's self-sustaining effluent limitations require treatment that will not exacerbate any existing dissolved oxygen deficits in the Pamunkey River, Hanover's discharge will not "cause or contribute to the violation of water quality standards." Accordingly, issuance of Hanover's permit is not prohibited under this regulation and Hanover's permit is in compliance therewith.

Petitioners argue further that the remainder of the subsection (C)(9) bars the permit because it places duties or obligations on respondents which they have not performed. Yet the express language of the regulation shows that it does not apply to this permit.

The second portion of subsection (C)(9) focuses on new dischargers: (1) that will discharge into water that does not meet water quality standards or are not expected to meet water quality standards even after effluent limitations are applied; and (2) for which the Board "has performed a pollutants load allocation for the pollutant to be discharged." The regulation does not say the Board "must" or "shall" perform a pollutant load allocation. This sentence is written in the conjunctive. The sentence sets out two prerequisites to trigger the requirements placed on a new discharger by subparagraphs (a) and (b) of subsection (C)(9) above. Therefore, both items (1) and (2) above must exist for this provision to apply to a new discharge.

In this case, no pollutant load allocation has been performed – the second prerequisite. Indeed, petitioners acknowledge this fact in their reply brief. Pet. Reply Br. at 8. With no pollutant load allocation having been performed¹, the regulation, on its face, does not apply to Hanover's permit.

2. Documents Generated After the Board's Approval of the Permit Are Improper for This Appeal Proceeding under the Applicable Statute and Case Law and Should Be Excluded

Petitioners submitted with their reply brief four exhibits that were created after the permit was issued on April 28, 1999:

- Tab 2: Alling to Daub, 6/20/00
- Tab 3: Phillips to Kuo, 10/13/00
- Tab 4: Burreson to VMRC, 10/11/00
- Tab 6: Faggert to Pandey, 9/29/00

They also cited a similarly after-created document, a proposed regulation, in their reply brief: 17:3 VA.R. 358 (Oct. 23, 2000), Pet. Reply Br. at 12.

At the same time, the Petitioners tendered an exhibit that had not been presented to the Board:

- Tab 5: Hazen & Sawyer Preliminary Engineering Evaluation.

¹ No pollutant load allocation was performed because the level of treatment required by the "10-10-3" self-sustaining limits "will not further contribute to lower dissolved oxygen levels in the receiving stream." In other words, under the permit's stringent limits Hanover's discharge will not result in a pollutant load. Accordingly, no pollutant load allocation needed to be performed.

Finally, at trial, Petitioners tendered a U.S. EPA Clean Water Act guidance document not presented to the Board and not even from the EPA region with authority over this geographic area.

The Petitioners justify these documents as "allowable and necessary proofs adduced in court" under the authority of Va. Code § 9-6.14:17. In fact, these documents are an improper attempt to appeal the case based on information that was not before the Board when it decided the matter.

Va. Code § 9-6.14:17 provides in relevant part:

The burden shall be upon the party complaining of agency action to designate and demonstrate an error of law subject to review by the court. Such issues of law include: . . . (iv) the substantiality of the evidential support for findings of fact . . . Where there is no such agency record so required and made, any necessary facts in controversy shall be determined by the court upon the basis of the agency file, minutes, and records of its proceedings under § 9-6.14:7.1 or § 9-6.14:11 as augmented, if need be, by the agency pursuant to order of the court or supplemented by any allowable and necessary proofs adduced in court except that the function of the court shall be to determine only whether the result reached by the agency could reasonably be said, on all such proofs, to be within the scope of the legal authority of the agency.

The Revisor's note to § 9-6.14:17 emphasizes that the "allowable and necessary proofs" language does not authorize a retrial of the issue being appealed:

Although a court may sometimes order an agency to augment its informal record or in rare instances supplement the same by evidence adduced in court, it would defeat justice to allow agencies to make fact decisions in the first instance without the necessary factual basis . . . This is not to say, however, that courts may not permit "any allowable and necessary proofs" in situations otherwise unavoidable as, for example, where bad faith is charged in substance or procedure

The case law specifically allows the reviewing court to go outside the record to examine a claim of bias in the decision maker. *State Bd. of Health v. Godfrey*, 223 Va. 423 (1982). This court further has authorized depositions to examine the standing of Petitioners, another issue that could not have been tried by the agency.

However, the courts are clear that the authority to take additional evidence is not authority to retry the issue on appeal:

A case subject to the standard of review outlined in Code § 9-6.14:17 [and] . . . the factual issues on appeal [therein] are controlled solely by the agency record. The reviewing court is not free to take additional evidence, even at the request of one of the parties. Therefore, under the VAPA, the circuit court's role in an appeal from an agency decision is equivalent to an appellate court's role in an appeal from a trial court. In this sense, the General Assembly has provided that a circuit court acts as an appellate tribunal.

J. P. v. Carter, 24 Va. App. 707, 721 (1997), quoting *School Board v. Nicely*, 12 Va. App. 1051, 1061 (1991) (citations and footnote omitted) (emphasis added by the Court).

The issue here is whether the Board had substantial evidence to support its decision, not whether the Petitioners can find possibly contradictory evidence after the fact. These documents, and the Petitioners' briefs and arguments based upon them, are improper. The Court should strike them and decide this appeal on the same information the State Water Control Board used to make the decision that is being appealed.

3. Documents Generated After the Board's Approval of the Permit Are Not Relevant to Whether Substantial Evidence Exists to Support the Board's Action.

Even if the Court were to consider the Petitioners' *post hoc* attack upon the Board's decision, the new documents do not call into question the substantial evidence supporting the Board's decision.

Tab 2

Tab 2 in Petitioners' Appendix to their Reply Brief is an email from Mark Alling of DEQ to Elleanor M. Daub of DEQ. The email is dated June 20, 2000 (over 14 months after the Board issued the Permit). Mr. Alling raises questions whether the tidal Pamunkey should be included in the Board's proposed special Water Quality Standard for naturally impaired waters. In the course of the email, Mr. Alling questions the conclusion that the DO sags in the Pamunkey are caused by inflow of waters from tidal marshes.

At most, this email shows that one person on the Board's staff may have a different view from the Board's conclusion that the DO sags are caused by natural conditions. Indeed, the Board encourages its staff to question the conventional wisdom. The Board's public process for adopting water quality standards will allow a discussion and reconsideration of this issue. In the meantime, Mr. Alling's email does not in any way impair the substantiality of the evidence supporting the Board's decision to issue the Permit with limits that will protect the River whether the DO sags are natural or the result of upstream nonpoint pollution.

The Petitioners' characterization of Mr. Alling's email as a statement of the Board's views is an outrageous fabrication. The permit decision states the Board's view; Mr. Alling states only his own (probably incorrect) view.

Tab 3

Tab 3 to Petitioners' Appendix is a letter of October 13, 2000 from Dale Phillips of DEQ to Albert Kuo of the Virginia Institute of Marine Science (written over sixteen months after the permit issued). Interestingly, Petitioners do not quote the Phillips letter for the statement there that "the section of stream involved is heavily impacted by tidal marshes." Nor do they quote its conclusion that "we believe the limits provide adequate protection for the situation permitted." Instead they focus upon the statement that "[g]iven that there is approximately a 4:1 dilution available for the effluent, it is unlikely that the permitted limits will result in elevating the CBOD5 in the river by more than 2 mg/l."

Petitioners proffer this statement as evidence that the discharge will increase the CBOD5 in the river by 2 mg/l. In fact, Phillips is demonstrating that the effect of the discharge will be negligible. At a 4:1 dilution, a 10 mg/l discharge² would produce $10/(4+1) = 2$ mg/l in the river if the River were pure water. On the other hand, if the river also had a 10 mg/l CBOD5, the discharge would have no effect whatever. And if the river were >10 mg/l, the discharge would dilute the river.

² 10 mg/l is the effluent limit. As the staff presentation points out, to meet 10 mg/l consistently the County's effluent more typically will have a CBOD5 in the low single digits.

Phillips' letter shows a scientist calculating the worst case situation: A 2 mg/l increase in CBOD5 in the case where the river is pure water. He argues that even in this worst case situation, "the stream will be able to assimilate that additional concentration without any significant lowering of the existing quality."

The Petitioners distort these statements to argue that the Hanover discharge will impair the river. To the contrary, Phillips letter contains a demonstration of the rationale to conclude that the discharge will not harm the river.

Tab 4

Tab 4 to Petitioners' Appendix is a (bad copy of a) letter of October 11, 2000 from Eugene Burreson of VIMS to Tony Watkinson of the Marine Resources Commission (also written over sixteen months after the permit issued). The Petitioners do not rely upon the letter where it says "we found minimal reason for concern regarding adverse water quality impacts and impacts to anadromous fish from this specific project" and "the . . . limits are believed sufficient to maintain healthy water quality for anadromous fish." Instead, Petitioners focus upon the statement that the limits "when combined with other point and nonpoint discharges in the watershed could (*sic*) result in significant DO sags that adversely impact aquatic habitats and living resources."

The letter itself puts that statement in context in its last paragraph:

Our extended analysis has confirmed that the daily flows and effluent limits proposed for this treatment plant have a low probability of adversely affecting anadromous fish resources in the Pamunkey River. Future growth and growth patterns may change this conclusion but are beyond the scope of the present analysis."

Indeed, speculation about "future growth and growth patterns" also is beyond the VPDES Permit at issue here. The Permit is for current conditions and 10 million gallons per day. This VIMS letter confirms the Board's view that the discharge will not have an adverse impact.

Tab 5

Tab 5 to Petitioners' Appendix is an excerpt from a preliminary engineering evaluation of the County's proposed wastewater treatment plant. That document was not before the Board. Moreover, the Petitioners offer the document to prove hypothetical (and incorrect) issues about future expansions of the plant not at issue with this permit. Pet. Reply Br. at 14. Such expansions would require permit modifications approved by the Board. The Petitioners offer the document to prove information the Board did not consider, in order to attack the Board's decision. Thus, Petitioners seek to retry the Board's decision based upon evidence not presented to the Board. The Court should not tolerate this affront.

Tab 6


Tab 6 to Petitioners' Appendix is a Virginia Power document dated September 29, 2000 , authorizing a public notice for a proposed VPDES Permit for the North Anna power station. The document shows careful consideration to minimize any adverse impacts by such reductions. See last page of Tab 6. The Petitioners offer the document to prove information the Board did not consider (and could not have considered), in order

to attack the Board's decision. Thus, Petitioners seek to retry the Board's decision based upon evidence not presented to the Board. The Court should not tolerate this affront.

Conclusion

The Petitioners mischaracterize the Board's regulation and they seek to appeal the Board's decision using information that they did not present to the Board and that, in any case, does not contradict the abundant evidence supporting the Board's decision. The Court should (1) construe the regulation to mean what it says, ignoring the fiction invented by the Petitioners, and (2) strike the evidence the Petitioners improperly seek to bring forward.

STATE WATER CONTROL BOARD
By Counsel



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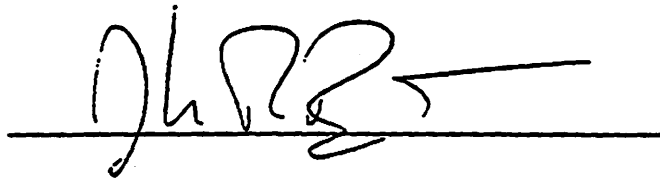
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Certificate of Service

I hereby certify that a true copy of the foregoing Memorandum in Support of Motion to Strike and Post Trial Brief of Respondents State Water Control Board and County of Hanover, Virginia in Opposition to Petitioners' Petition for Appeal was mailed to: William B. Ellis and John L. Marshall, Jr., McSweeney, Burtch & Crump, P.C., Post Office Box 1463, 11 South Twelfth Street, Richmond, Virginia 23218-1463, counsel for Petitioners this 16th day of November, 2000.

A handwritten signature, likely "JL Marshall", is written over a horizontal line.

H:\Govern\Jrb\414\Crutchfield\Pleadings\Appellees' Post Trial Brief.Doc
Printed November 17, 2000 at 12:59 PM

Circuit Court
OF THE
City of Richmond

MELVIN R. HUGHES, JR.
JUDGE

March 15, 2001

JOHN MARSHALL COURTS BUILDING
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Re: Case No. HK-1193
Frances Broaddus Crutchfield and
Henry Ruffin Broaddus
v.
State Water Control Board,
Department of Environmental Quality and
County of Hanover, Virginia

Dear Counsel:

This case is an appeal from a decision of a Virginia administrative agency.

On April 28, 1999, the State Water Control Board granted to Hanover County, Virginia a Virginia Pollution Discharge Elimination System permit. The permit allows Hanover County to discharge wastewater into the Pamunkey River from a planned outfall structure for the planned Totopotomoy Wastewater Treatment Plant.

The proposed plant will be located on a 128 acre tract of land. The proposed discharge structure will be located approximately eight miles from the plant on Newcastle Farm, owned by the petitioners. The wastewater will be transported from the plant to the discharge structure through a buried thirty-six inch diameter pipe, part of which will cross petitioners' land.

John L. Marshall, Jr., Esq.

Page 2

March 15, 2001

Both sides agree that the Pamunkey River, below the discharge site, has experienced problems with dissolved oxygen levels falling below standards set for the river. The wastewater that is discharged contains oxygen demanding pollutants which can contribute to low dissolved oxygen levels.

In January, 1999, the Board held a public hearing on the County's then pending application. Petitioners attended the meeting and presented information for Board consideration. In February, 1999, petitioners submitted additional comments in writing. The following April the board issued the permit which allows the County to discharge up to ten million gallons per day of wastewater into the Pamunkey River.

The parties have addressed all the relevant issues pertinent to court review of an administrative decision. They do not disagree on the standard of review; rather, they disagree on what exactly is being reviewed. Both sides have cited the Virginia Supreme Court:

"An agency's factual findings should only be rejected if 'considering the record as a whole, a reasonable mind would necessarily come to a different conclusion.'" *Virginia Real Estate Comm'n v. Bias*, 226 Va. 264, 268-269 (1983).

Petitioners claim that because they allege that the Board was required to make certain findings but failed to do so that the court is reviewing a question of law. Respondents state that petitioners did not plead that the Board failed to make required findings. They argue, therefore, that by bringing that argument up now, petitioners are trying to disguise and muddle what is essentially a lack of substantial evidence claim in order to assert a less stringent standard of review.

Specifically petitioners claim that the permit must be set aside because the Board did not make the proper findings regarding the dissolved oxygen levels in the river, because the board did not find that existing recreational uses of the river such as swimming, fishing, canoeing and nature observation would be protected and because the Board did not find that the use of the river by anadromous fish would be protected. The petitioners further assert that the record contains no substantial evidence that would support such findings.

John L. Marshall, Jr., Esq.
Page 3
March 15, 2001

Notwithstanding the question of whether substantial evidence is in place or whether the agency acted in accordance with law, *Johnston-Willis, Ltd. v. Kenley*, 6 Va. App. 231, 242 (1988), the issue of standing asserted by respondents on demurrer and reasserted now on the merits is determinative.

In May, 2000 the court decided against the respondents on demurrer which in part asserted that petitioners could not maintain this appeal because they had no standing. The court overruled on the basis of a letter attached to the petition for appeal which contained allegations of damage to historic sites on petitioner's property.

The petition alleges three categories of injury: injury to plant and animal life, injury to the public's recreational use of their property which borders the Pamunkey, and injury to certain historic attributes of Newcastle Farm.

Standing under Va. Code Section 62.1-44.24 in the State Water Control Law relating to that law's definition of "owner" provides as pertinent here:

Judicial review -- Any owner aggrieved by, or any person who has participated, in person or by submittal of written comments, in the public comment process related to, a final decision of the Board . . . is entitled to judicial review thereof . . . if such person meets the standard for obtaining judicial review of a case or controversy pursuant to Article III of the United States Constitution . . . A person shall be deemed to meet such standard if (i) such person has suffered an actual or imminent injury which is an invasion of a legally protected interest and which is concrete and particularized; (ii) such injury is fairly traceable to the decision of the Board and not the result of the independent action of some third party not before the court; and (iii) such injury will likely be redressed by a favorable decision by the court.

See also *Mattaponi Indian Tribe, et al. v. Commonwealth of Virginia, etc.*, Va. Sup. Ct. Rec. #000509, Dec'd March 2, 2001.

John L. Marshall, Jr., Esq.
Page 4
March 15, 2001

Petitioners own the land known as Newcastle Farm, which borders the Pamunkey River. The discharge structure is proposed to occupy part of petitioners' land and the underground pipe described above will cross part of it. Newcastle Farm contains a portion of Marlbourne and the Newcastle archeological site. Marlbourne is the former Edmund Ruffin Plantation. It has been listed on the National Historic Landmark registry since 1964 and on the Virginia Landmarks Register since 1969. Petitioner Broaddus owns, and petitioner Crutchfield has a dower interest in, a strip of the Marlbourne property. Neither has an interest in any of the structures located on the former plantation. The depositions of the petitioners of record reveal that a cultural resource study concluded the project will not have an effect on the location, setting or use that contributes to Marlbourne's significance. Crutchfield asserts that the sight and smell of the discharge facility will harm her enjoyment of the historic resources even if the discharge is of the quality of drinking water. The court finds that standing, although sufficiently alleged, has not been proved. Whatever injury petitioners claim such claims only amount to what respondents have aptly described as an "abstract distress," not sufficient to pass muster for standing under the rules described. See *Friend of the Earth v. Gaston Copper Recycling*, 204 F.3d 149 (4th Cir. 2000). The record is devoid of any actual or imminent injury in the other two categories of injury the petitioners have listed as well.

So, the court finds that the petitioners' sole averment of harm to historic sites and on which petitioners were allowed to proceed on the issue of standing has not been borne out by the record on review. Petitioners' objection to the issuance of any permit with any effluent limits cannot be harm traceable to the Board's decision because the decision came with limitations. Thus, petitioners lack standing under the relevant factors for standing and their appeal shall be dismissed.

Mr. Butcher is directed to prepare and submit for entry an appropriate order upholding the agency's decision in this case which notes petitioners' exceptions.

Very truly yours,



Melvin R. Hughes, Jr.

jsn

VIRGINIA:

IN THE CIRCUIT COURT OF THE CITY OF RICHMOND
John Marshall Courts Building

FRANCES BROADDUS CRUTCHFIELD,
et al.,

v.

STATE WATER CONTROL BOARD
et al.,

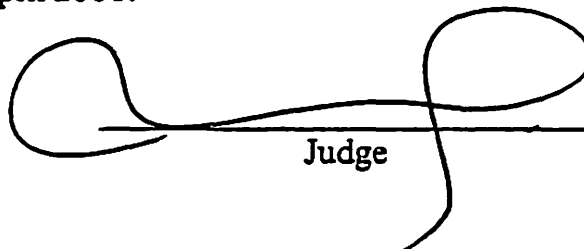
Chancery No.
760CH99K01193-1

01 H-488

FINAL ORDER


On November 9, 2000, the parties came to be heard on the merits of this appeal. Upon consideration of the pleadings, the briefs, the depositions of the Petitioners taken pursuant to this Court's Order of September 13, 2000, and the arguments of counsel, the Court finds that, for the reasons stated in the letter opinion of March 15, 2001, the Petitioners lack standing. Accordingly this appeal is DISMISSED.

ENTER this 3 day of April 2001.



Judge

We ask for this:


Mark L. Earley

Attorney General

John R Butcher (VSB No. 18761)

Senior Assistant Attorney General

900 East Main Street

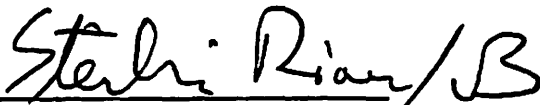
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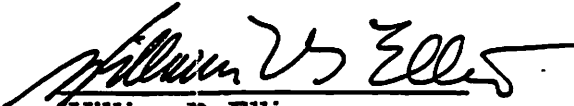
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(804) 698-2049 (facsimile)

Counsel for the County of Hanover

SEEN AND OBJECTED TO:

A handwritten signature in dark ink, appearing to read "William B. Ellis", with a horizontal line drawn underneath it.

William B. Ellis

Ellis & Thorp

1406 Confederate Avenue

Richmond, Virginia 23227

Counsel for Frances Broadus Crutchfield and

Henry Ruffin Broadus

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Printed March 19, 2001 at 3:52 PM

VIRGINIA:

IN THE CIRCUIT COURT OF THE CITY OF RICHMOND

FRANCES BROADDUS CRUTCHFIELD

and

HENRY RUFFIN BROADDUS,

Petitioners

v.

STATE WATER CONTROL BOARD

and

**DEPARTMENT OF ENVIRONMENTAL
QUALITY**

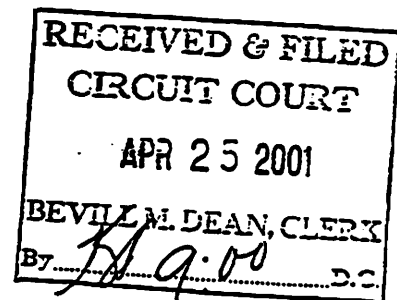
and

**THE COUNTY OF HANOVER,
VIRGINIA,**

Respondents.

Chancery No.

760CH99K01193-00



NOTICE OF APPEAL

Frances Broaddus Crutchfield and Henry Ruffin Broaddus, Petitioners, by counsel, hereby appeal to the Court of Appeals of Virginia from the Final Order of this Court entered on April 3, 2001. The transcripts of the following hearings in this matter have been filed with the Circuit Court of the City of Richmond:

April 26, 2000 Hearing

**Prepared and certified by: Shloma Pierce
Filed with Circuit Court on April 19, 2001**

September 13, 2000 Hearing

**Prepared and certified by: Tracy Stroh
Filed with Circuit Court on April 19, 2001**

November 9, 2000 Hearing

**Prepared and Certified by: Jennifer L. Hairfield
Filed with Circuit Court on April 19, 2001**

November 9, 2000 Hearing – Amended Transcript to Correct Errors
Prepared and certified by Jennifer L. Hairfield
Filed with Circuit Court on April 24, 2001

No additional transcripts will be filed. Pursuant to Rule 5A:8(b) of the Rules of the Supreme Court of Virginia, no additional notice of filing of transcripts is required.

CERTIFICATE

The undersigned certifies as follows:

- (1) The names and addresses of the appellants are:

Frances Broaddus Crutchfield
Henry Ruffin Broaddus
1196 Huguenot Trail
Midlothian, Virginia 23113

- (2) The names, addresses and telephone numbers of counsel for appellants are:

William B. Ellis
Benjamin A. Thorp IV
Ellis & Thorp, P.L.L.C.
1406 Confederate Avenue
Richmond, Virginia 23227
Benjamin A. Thorp: (804) 346-4504
William B. Ellis: (804) 355-4043

- (3) The names and addresses of the appellees are:

Department of Environmental Quality
Dennis H. Treacy
Agency Secretary
629 East Main Street
Richmond, Virginia 23219

State Water Control Board
Dennis H. Treacy
Agency Secretary
629 East Main Street
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County of Hanover, Virginia
Sterling Rives
County Attorney
6497 County Complex Road
Hanover, Virginia 23069

(4) The names, addresses and telephone numbers of counsel for appellees are:

John R. Butcher, Senior Assistant Attorney General
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Yvonne S. Wellford, Assistant County Attorney
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David E. Evans
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901 East Cary Street
Richmond, Virginia 23219
(804) 775-4317

(5) Copies of the following transcripts in this matter have been filed with the Clerk of the Circuit Court for the City of Richmond. No additional transcripts will be filed in this matter.

April 26, 2000 Hearing
Prepared and certified by: Shloma Pierce
Filed with Circuit Court on April 19, 2001

September 13, 2000 Hearing
Prepared and certified by: Tracy Stroh
Filed with Circuit Court on April 19, 2001

November 9, 2000 Hearing
Prepared and Certified by: Jennifer L. Hairfield
Filed with Circuit Court on April 19, 2001

November 9, 2000 Hearing – Amended Transcript to Correct Errors
Prepared and certified by Jennifer L. Hairfield
Filed with Circuit Court on April 24, 2001

(6) A copy of this Notice of Appeal has been mailed or delivered to all opposing counsel and to the Clerk of the Court of Appeals this 25th day of April, 2001.

Dated: April 25, 2001

Respectfully submitted,

FRANCES BROADDUS CRUTCHFIELD
AND HENRY RUFFIN BROADDUS

By:



William B. Ellis (VSB No. 19753)
Benjamin A. Thorp IV (VSB No. 45931)
Ellis & Thorp, P.L.L.C.
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Telephone: (804) 346-4504
Telefax: (804) 346-4505

CERTIFICATE OF SERVICE

I hereby certify that on this 25th day of April, 2001, a true copy of the foregoing

"Notice of Appeal" was delivered, by hand delivery, to:

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(804) 786-2444

Barbara Rose, Deputy County Attorney
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David E. Evans
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(804) 775-4317



VIRGINIA:

IN THE CIRCUIT COURT FOR THE CITY OF RICHMOND
John Marshall Courts Building

Frances Broaddus Crutchfield

And

Henry Ruffin Broaddus

)

Plaintiffs,

)

)

V.

)

Chancery No. HK-1193

)

State Water Control Board

And

Department of Environmental Quality

And County of Hanover, Virginia

)

)

Defendants.

)

APPEAL BOND

KNOW ALL MEN BY THESE PRESENTS, that We, Frances Broaddus Crutchfield and Henry Ruffin Broaddus, by Benjamin A. Thorp, IV, attorney for appellants, Principals, having delivered to the Clerk \$500.00 as security therefore, am firmly bound unto the State Water Control Board, the Department of Environmental Quality and the County of Hanover, Virginia, in the sum of FIVE HUNDRED DOLLARS (\$500.00) to the payment of which We bind ourselves, our heirs, successors, personal representatives and assigns, jointly and severally, by these presents.

The condition of this obligation is such that:

WHEREAS, an Order was rendered by the Circuit Court of the City of Richmond on the 3rd day of April, 2001, in the case aforesaid, Chancery No. HK-1193; and

WHEREAS, it is the intention of Frances Broaddus Crutchfield and Henry Ruffin Broaddus, to appeal said Order to the Court of Appeals of Virginia.

NOW, THEREFORE, if Frances Broaddus Crutchfield and Henry Ruffin Broaddus shall pay all damages, costs and fees which may be awarded against them in the Court of Appeals of Virginia and the Supreme Court, if it takes cognizance of the claim, then this obligation shall be void, otherwise to remain in full force and virtue.

IN WITNESS WHEREOF, the said Frances Broaddus Crutchfield and Henry Ruffin Broaddus, by Benjamin A. Thorp, IV, who has hereunto set his hand and seal, this 25th day of April, 2001.

 (SEAL)

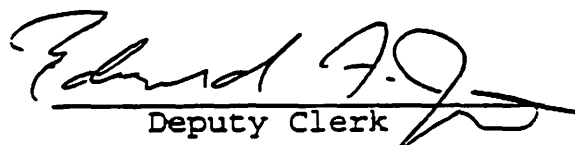
Frances Broaddus Crutchfield and Henry Ruffin
Broaddus

Principals, by Benjamin A. Thorp, IV

COMMONWEALTH OF VIRGINIA

CITY OF RICHMOND:

The foregoing instrument was acknowledged by Benjamin A. Thorp, IV, before me this 25th day of April, 2001.


Deputy Clerk

COURT OF APPEALS OF VIRGINIA

RECEIVED

Present: Chief Judge Fitzpatrick, Judge Annunziata and APR 02 2002
Senior Judge Coleman

Argued at Richmond, Virginia

OFFICE OF THE ATTORNEY GENERAL
LIBRARY

FRANCES BROADDUS CRUTCHFIELD AND
HENRY RUFFIN BROADDUS

v. Record No. 1095-01-2

MEMORANDUM OPINION* BY
JUDGE SAM W. COLEMAN III
APRIL 2, 2002

STATE WATER CONTROL BOARD,
DEPARTMENT OF ENVIRONMENTAL QUALITY AND
COUNTY OF HANOVER, VIRGINIA

FROM THE CIRCUIT COURT OF THE CITY OF RICHMOND
Melvin R. Hughes, Jr., Judge

Benjamin A. Thorp IV (William B. Ellis;
Ellis & Thorp, P.L.L.C., on briefs), for
appellants.

John R. Butcher, Senior Assistant Attorney
General; Barbara M. Rose, Deputy County
Attorney (Randolph A. Beales, Attorney
General; Sterling E. Rives III, County
Attorney; Yvonne Wellford, Senior Assistant
County Attorney, on brief), for appellees.

Frances Broaddus Crutchfield and Henry Ruffin Broaddus,
appellants, appeal a decision of the trial court finding that
Crutchfield and Broaddus lack standing to appeal a decision of the
State Water Control Board (SWCB) to issue a permit to Hanover
County (the County) for the discharge of treated sewage into the
Pamunkey River. Appellants also contend the trial court abused

* Pursuant to Code § 17.1-413, this opinion is not
designated for publication.

its discretion in refusing to allow them to file an amended petition for appeal setting forth more detailed allegations of the damage to the appellants' property. The SWCB and the County contend the trial court erred in allowing appellants to file an amended petition for appeal adding the County as a party when the County had not been named as a party in the initial appeal. We find that appellants have standing to contest the issuance of the permit and that the trial court abused its discretion in refusing to allow appellants to file an amended petition for appeal setting forth more detailed allegations of their claimed damages. We further find that the County did not object in the trial court to being named a party to the appeal and the County cannot raise the issue for the first time here. Therefore, we reverse the decisions of the trial court and remand the case for hearings and a decision on the merits.

BACKGROUND

Appellants own Newcastle Farm (the farm), an 878 acre property located in Hanover County. The farm, which has been in the Broaddus family for six generations, has several miles of river frontage along the Pamunkey River. The farm contains the remains of a colonial era town which is listed as a Virginia Historic Landmark and a portion of Marlbourne, a former plantation, which is listed on the National Historic Landmark Registry.

On April 28, 1999, the SWCB granted the County a Virginia Pollution Discharge Elimination System permit (the permit). The permit allows the County to discharge up to ten million gallons per day of wastewater into the Pamunkey River from an outfall located on appellants' farm. The project also includes a buried thirty-six inch pipe that will transport the waste to the outfall across appellants' farm.

In January 1999, the SWCB held a public hearing on the County's pending application. Appellants presented evidence at the hearing, and, on February 4, 1999, they submitted written comments to the SWCB. The comments explained appellants' opposition to the project based on their concerns that the proposed discharge would adversely affect the river's already impaired water quality and would cause damage to fish and other wildlife.

The parties agree that the Pamunkey River below the proposed discharge site has experienced problems with dissolved oxygen levels falling below the standard established for the river. Furthermore, they agree that the proposed discharge will contain oxygen demanding pollutants which can contribute to low dissolved oxygen levels.

On June 28, 1999, appellants filed a petition for appeal in the Richmond Circuit Court alleging that the permit was issued in violation of state water control law. Appellants requested that the trial court find the permit invalid and void. The petition

identified appellants as the owners of the property which is the site of the proposed outfall and discharge. The petition specifically alleged that the proposed discharge would harm the water quality of the already impaired Pamunkey River, would harm fish and other animal life, and would impair the use of the river for recreation. Appellants attached as an exhibit to the petition a February 4, 1999 letter containing their written comments to SWCB concerning the project. In the letter, appellants also alleged the proposed plan would adversely affect significant, documented historic resources on the farm.

On July 23, 1999, the SWCB filed a demurrer to the appeal, alleging that the petition failed to name a necessary party, the County. The SWCB also alleged that appellants lacked standing to appeal the issuance of the permit because they failed to allege injury or damage to their personal interests. At a hearing held on April 26, 2000 on the demurrer, appellants argued that the initial petition contained sufficient allegations to confer standing in the case, but in the event the trial court decided otherwise, they requested leave to amend the original petition to include a more detailed accounting of the injuries and damage that would be sustained by them as a result of the proposed discharge. They also requested leave to amend the petition to add the County as a party.

In a letter opinion dated May 24, 2000, the trial court rejected the positions of the SWCB, found that appellants had

standing in the case, and granted leave to appellants to amend the petition to add the County as a party. The trial court found that the February 4, 1999 letter contained sufficient allegations of injury and damage directly to appellants by alleging that the proposed project would injure the historic resources located on appellants' farm. The trial court also found that the initial petition and the February 4, 1999 letter failed to include sufficient allegations of injury or damage to appellants' aesthetic or recreational interests. The trial court entered an order on June 14, 2000 granting leave to appellants to amend their petition to name the County as a party.

On June 30, 2000, appellants filed a First Amended Petition for Appeal (amended petition), naming the County as a party and adding several paragraphs that were not included in the original petition further expounding on the injuries and damage they contend would result from the issuance of the permit. In the amended petition, appellants described themselves as "riparian" co-owners of the farm. Appellants also added paragraphs stating that they personally use the river for recreational activities, such as swimming, boating, fishing, and canoeing and that they would cease to use the river at and near the proposed discharge location site for these recreational activities if the sewage outfall was located as proposed. In addition, appellants alleged in the amended petition that the project would damage the aesthetic interests of the farm.

The SWCB and the County each filed a motion to strike all of the new allegations in the amended petition. The SWCB requested that the trial court strike the amended petition and direct appellants to file an amended petition in conformance with the court's June 14, 2000 order. In its motion to strike, the County conceded that the June 14, 2000 trial court order granted leave to appellants to amend the petition to name the County as a party. Furthermore, in its motion to strike, the County asserted that appellants amended the petition to add allegations that were not authorized by the court's order and letter opinion. The County requested only that appellants be directed to file an amended petition in conformance with the trial court's June 14, 2000 order and May 24, 2000 letter opinion, raising no objection to the trial court's ruling granting leave to appellants to name the County as a party. The SWCB also sought leave to take the depositions of appellants regarding the standing issue.

At a hearing held on September 13, 2000, the trial court granted the motions to strike the new allegations in the amended petition. Appellants renewed their motion to file an amended petition containing the additional allegations of injury. The trial court asked, "[H]aving found that the [original] petition was sufficient on its face, and . . . having overruled the [SWCB's] demurrer, why do you need these additional allegations?" Appellants asserted that the SWCB was continuing to contest the issue of standing because it requested to take their depositions.

Therefore, appellants averred that the additional allegations in the amended petition would clarify the standing issue. Indeed, counsel for the SWCB later stated that the purpose of taking the depositions was to gather information from appellants concerning the standing issue. The trial court granted the SWCB's motion for leave to take depositions of appellants and denied appellants' motion to amend the petition.

At a hearing held on November 9, 2000, the SWCB argued that appellants had not proved they had standing to contest the issuance of the permit. The SWCB argued that appellants' original petition pled standing based only on their claim that the project would injure historic resources. The SWCB then asserted that appellants' testimony in the depositions showed that a consultant had indicated that the project would not affect the historical resources located on the property. Furthermore, the SWCB asserted that appellants indicated in their depositions that they would cease their recreational uses of the river even if the project discharged water that met drinking water standards and that appellants objected to the project whether or not it met water quality standards.

On March 15, 2001, the trial court issued another letter opinion finding that "standing, although sufficiently alleged, has not been proved." The trial court dismissed the case on that ground. The trial court found that appellants' sole averment in the original petition had been damage to historic sites. However,

appellants' depositions had revealed that a cultural resource study concluded the project "will not have an effect on the location, setting or use that contributes to Marlbourne's significance." In addition, the trial court found that whatever injuries appellants claimed, such claims amounted only to "'abstract distress'" and were insufficient to confer standing. Appellants appeal the trial court's decision that they lack standing.

I. STANDING

"In analyzing a decision on Article III standing, we review the [trial] court's factual findings for clear error. We consider the legal question of whether [appellants] possess[] standing to sue as a de novo matter." Piney Run Pres. Ass'n v. County Comm'rs, 268 F.3d 255, 262 (4th Cir. 2001). The elements of standing are "not mere pleading requirements," but must be supported by sufficient evidence. Lujan v. Defenders of Wildlife, 504 U.S. 555, 561 (1992).

Code § 62.1-44.29 provides that any person who has participated, in person or by submittal of written comments, in the public comment process related to a final decision of the SWCB to issue a Virginia Pollution Discharge Elimination System permit is entitled to judicial review thereof if such person meets the standard for obtaining judicial review of a case or controversy under Article III of the United States Constitution.

A person shall be deemed to meet such standard if (i) such person has suffered an actual or imminent injury which is an invasion of a legally protected interest and which is concrete and particularized; (ii) such injury is fairly traceable to the decision of the [SWCB] and not the result of the independent action of some third party not before the court; and (iii) such injury will likely be redressed by a favorable decision by the court.

Code § 62.1-44.29.

"[W]hen the suit is one challenging the legality of government action . . . , the nature and extent of facts that must be averred . . . in order to establish standing depends considerably upon whether the plaintiff is himself an object of the action . . . at issue. If he is, there is ordinarily little question that the action . . . has caused him injury, and that a judgment preventing . . . the action will redress it."

Mattaponi Indian Tribe v. Commonwealth, 261 Va. 366, 376-77, 541 S.E.2d 920, 925 (2001) (quoting Lujan, 504 U.S. at 561-62).

We find that the original petition for appeal sufficiently alleged the elements of standing and that appellants' deposition testimony further proved they had standing in the case. The original petition stated that appellants are co-owners of the property located on the Pamunkey River. The treated sewage outfall will be located on appellants' property, and the sewage will be discharged from this outfall into the waters of the Pamunkey River.

"'Riparian land' is land which is contiguous to and touches a watercourse." Code § 62.1-104(5). "'Riparian owner' is an

owner of riparian land." Code § 62.1-104(6). The rights of a riparian owner include "'[t]he right to make a reasonable use of the water as it flows past or leaves the land.'" Thurston v. City of Portsmouth, 205 Va. 909, 912, 140 S.E.2d 678, 680 (1965) (citation omitted). Riparian rights also include "'[t]he right to be and remain a riparian proprietor and to enjoy the natural advantages thereby conferred upon the land by its adjacency to the water.'" Id. at 911-12, 140 S.E.2d at 680 (citation omitted).

The original petition and the February 4, 1999 letter alleged harm to resources to which riparian owners have a recognized legal right. The February 4, 1999 letter states that several speakers commented at the public hearing concerning their recreational uses of the river immediately downstream from the proposed discharge site. The letter further states, "Those using this area are not limited to the property owners." Clearly, this statement indicates that appellants use the river for recreational activities. Indeed, in their depositions, which were considered by the trial court in deciding this issue, appellants confirmed that they use the river for swimming, boating, and fishing and that the location of the outfall would adversely affect their recreational use of the river and the aesthetic value of the river. These allegations show more than "abstract distress" or "'general averments'" of injury to others. See Friends of the Earth v. Laidlaw Envtl Servs., Inc.,

528 U.S. 167, 183 (2000) (citation omitted) (Court found standing where plaintiffs' "reasonable concerns about the effects of . . . discharges directly affected [their] recreational [and], aesthetic interests" and were more than "'general averments'" and "'conclusory allegations'").

Furthermore, "[a] plaintiff can show an 'injury in fact' when he or she suffers 'an invasion of a legally protected interest which is concrete and particularized, as well as actual or imminent.'" Piney Run, 268 F.3d at 263 (citation omitted). "[A] plaintiff need only show that he used the affected area, and that he is an individual 'for whom the aesthetic and recreational values of the area [are] lessened' by the defendant's activity." Id. (citation omitted). Moreover, the Fifth Circuit has held that citizens' concerns about water quality sufficed as an injury in fact where two of the affiants lived near the affected water and used the water for recreational activities. The Court stated that it was sufficient to confer standing where "the affiants expressed fear that the discharge . . . will impair their enjoyment of these activities because these activities are dependent upon good water quality. Clearly, [the] affiants have a direct stake in the outcome of this lawsuit." Sierra Club v. Cedar Point Oil Co., 73 F.3d 546, 556 (5th Cir. 1996). See also Sierra Club v. Morton, 405 U.S. 727, 735 (1972) (plaintiffs adequately allege injury in fact when they aver they use affected area and are

persons "for whom the aesthetic and recreational values of the area will be lessened" by challenged activity); Friends of the Earth v. Gaston Copper Recycling Corp., 204 F.3d 149, 159 (4th Cir. 2000) (allegations that plaintiffs use affected area and aesthetic and recreational values would be decreased by challenged activity sufficient for injury in fact).

Appellants have also met the "causation" prong of standing criteria. The injuries they have alleged are "fairly traceable" to the decision of the County to discharge sewage into the Pamunkey River from an outfall located on appellants' property and the decision of the SWCB to issue the discharge permit to the County. The injuries are not the result of a third party not before the court. See Mattaponi Indian Tribe, 261 Va. at 377, 541 S.E.2d at 925-26. Indeed, the parties agree that the river below the discharge site has experienced problems with dissolved oxygen levels and that the sewage discharge will contain oxygen demanding pollutants which can contribute to low dissolved oxygen levels.

Furthermore, the injuries alleged would be redressed by a favorable decision of the court if the trial court declared that the permit was issued illegally and was therefore void. Accordingly, appellants have standing to challenge the issuance of the permit.

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II. AMENDED PETITION

The original petition alleged that the project would cause damage to historic resources on the property. Initially, the trial court found that those allegations were sufficient to confer standing. However, the trial court later reversed itself, finding that a cultural resources study indicated that historic resources on the property would not be affected by the project. Prior to the trial court's decision that appellants lacked standing, appellants requested leave to amend the petition in order to make further allegations as to the injuries they would suffer as a result of the project. However, the trial court denied the request. We find that the trial court abused its discretion in denying appellants leave to amend the petition to add allegations of injury.

Rule 1:8 provides that "[l]eave to amend [any pleading] shall be liberally granted in furtherance of the ends of justice." "[T]he decision to permit a party to amend a pleading is discretionary with the trial court. It is reviewable by this Court only for an abuse of that discretion." Thompson v. Thompson, 6 Va. App. 277, 281, 367 S.E.2d 747, 750 (1988).

The original petition and the amended petition both arose in the context of appellants' challenge to the decision of the SWCB to issue the permit to the County. Both the original and amended petitions requested the same relief--that the trial court declare that the permit was issued in violation of state

law and was therefore invalid. The amended petition did not state a completely new case and was sufficiently related to the original petition. See Rosenberg v. Rosenberg, 210 Va. 44, 47, 168 S.E.2d 251, 253 (1969) (finding trial court erred in refusing to grant leave to husband to file amended bill of complaint in divorce action). The amended petition merely contained detailed allegations concerning the injuries appellants purportedly would suffer as a result of the project. Furthermore, appellants' deposition testimony supported these allegations of injury. Accordingly, the trial court abused its discretion in refusing to allow appellants to file the amended petition for appeal.

III. THE COUNTY AS A PARTY

The SWCB and the County argue that the County is a necessary party to the action, but that, pursuant to the time limitations of Rule 2A:4, the trial court was without authority to grant appellants leave to amend the petition for appeal to add the County as a party.

"Where an individual is in the actual enjoyment of the subject matter, or has an interest in it, either in possession or expectancy, which is likely either to be defeated or diminished by the plaintiff's claim, in such case he has an immediate interest in resisting the demand, and all persons who have such immediate interests are necessary parties to the suit."

Asch v. Friends of the Cmty. of Mount Vernon Yacht Club, 251 Va. 89, 90-91, 465 S.E.2d 817, 818 (1996) (citations omitted).

The County, as the permittee, has an immediate interest in the outcome of the suit and is a necessary party to the action. See Browning-Ferris Indus. v. Residents Involved in Saving the Environment, Inc., 254 Va. 278, 282-83, 492 S.E.2d 431, 434 (1997). Furthermore, appellants' failure to name the County in the original petition is not fatal pursuant to Rule 2A:4. Rule 2A:4(a) requires an appellant to file a petition for appeal within thirty days of filing the notice of appeal. This Court has held that the time limitation in Rule 2A:4 is mandatory and the trial court is not authorized to extend the time limits. Mayo v. Dep't of Commerce, 4 Va. App. 520, 524, 358 S.E.2d 759, 762 (1987). However, here, appellants timely filed a petition for appeal, and, pursuant to Rule 1:8, the trial court had discretion to grant leave to appellants to amend the petition to name the County as a party. Thus, the failure to name the County in the original petition was not a jurisdictional defect in the pleading.

Furthermore, the record contains no objection or pleading filed by the County raising an objection to being added as a party to the suit. The County filed an answer to appellants' amended petition. Moreover, in its motion to strike the amended petition for appeal, the County requested only that appellants be directed to file an amended petition for appeal that

conformed with the trial court's June 14, 2000 order granting leave to appellants to amend the petition to name the County as a party. Accordingly, the County has waived any objection to being named as a party.

For the foregoing reasons, we reverse the trial court's ruling that appellants lack standing to appeal the issuance by the SWCB of the permit. We also reverse the trial court's decision refusing appellants leave to file the amended petition for appeal to add further allegations of injury, and we remand the case to the trial court for trial upon the merits of appellants' claims.

Reversed and remanded.

VIRGINIA:

In the Court of Appeals of Virginia on Wednesday *the* 22nd
day of May, 2002.

Frances Broaddus Crutchfield and
Henry Ruffin Broaddus,

Appellants.

against Record No. 1095-01-2
Circuit Court No. 760CH99K01193-1

State Water Control Board,
Department of Environmental Quality and
County of Hanover, Virginia,

Appellees.

Upon a Petition for Rehearing

Before Chief Judge Fitzpatrick, Judge Annunziata and
Senior Judge Coleman

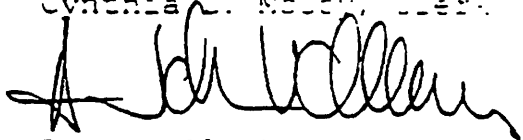
On consideration of the petition of the appellees to set
aside the judgment rendered herein on the 2nd day of April, 2002 and
grant a rehearing thereof, the said petition is denied.

A Copy,

Teste:

Cynthia L. McCow, Clerk

By:


Deputy Clerk

VIRGINIA:

In the Court of Appeals of Virginia on Wednesday the 22nd
day of May, 2002.

Frances Broaddus Crutchfield and
Henry Ruffin Broaddus,

Appellants.

against Record No. 1095-01-2
Circuit Court No. 760CH99K01193-1

State Water Control Board,
Department of Environmental Quality and
County of Hanover, Virginia,

Appellees.

Upon a Petition for Rehearing En Banc

Before the Full Court


On consideration of the petition of the appellees to set aside the judgment rendered herein on the 2nd day of April, 2002 and grant a rehearing en banc thereof, the said petition is denied on the grounds that there is no dissent in the panel decision, no member of the panel has certified that the decision is in conflict with a prior decision of the Court, nor has a majority of the Court determined that it is appropriate to grant the petition for rehearing en banc in this case. Code § 17.1-402(D).

A Copy,

Teste:

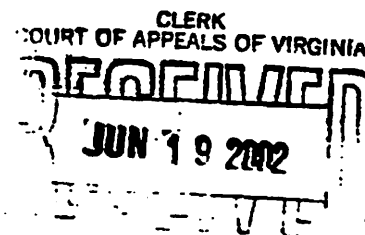
Cynthia L. McCoy, Clerk

By:


Deputy Clerk

VIRGINIA:

IN THE COURT OF APPEALS



FRANCES BROADDUS CRUTCHFIELD
AND HENRY RUFFIN BROADDUS,

Appellants,

v.

STATE WATER CONTROL BOARD,
DEPARTMENT OF ENVIRONMENTAL
QUALITY AND COUNTY OF HANOVER,

Appellees.

Record No. 1095-01-2

NOTICE OF APPEAL

Pursuant to Rule 5:14 of the Rules of the Supreme Court of Virginia, appellees, the Virginia State Water Control Board, Virginia Department of Environmental Quality and County of Hanover (collectively, the "Appellees"), by counsel, hereby notice their appeal of this Court's May 22, 2002 Order denying their petition for rehearing of the Court's April 2, 2002 judgment in this matter.

Respectfully submitted,

COMMONWEALTH OF VIRGINIA,
STATE WATER CONTROL BOARD AND
DEPARTMENT OF ENVIRONMENTAL QUALITY

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CERTIFICATE OF TRANSMISSION AND SERVICE

I hereby certify that, on June 19, 2002, I mailed a copy of the foregoing to William B.

Ellis. Esquire, IV, ELLIS & THORP, P.L.L.C., 1046 Confederate Avenue, Richmond, Virginia
23227.

By: _____

Counsel

RECEIVED

OCT 25 2002

NAT. RES. SECTION
OFFICE OF THE ATTY GENERAL

VIRGINIA:

*In the Supreme Court of Virginia held at the Supreme Court Building in the
City of Richmond on* Wednesday the 23rd day of October, 2002.

State Water Control Board,
Department of Environmental
Quality, et al.

against Record No. 021507
Court of Appeals No. 1095-01-2

Frances Broadus Crutchfield, et al.,

RECEIVED
Appellants,

OCT 24 2002

CRIMINAL LITIGATION SECTION
OFFICE OF THE ATTORNEY GENERAL

From the Court of Appeals of Virginia

Upon the petition of the State Water Control Board and
another an appeal is awarded them from a judgment rendered by the
Court of Appeals on the 2nd day of April, 2002; no security being
required.

Reference is made to the said petition for the names of
all the appellants and all the appellees involved in this appeal.

A Copy,

Teste:

D. B. Paul
Clerk

CERTIFICATE OF APPEAL

Pursuant to Rule 5:23, I, David B. Beach, Clerk of the Supreme Court of Virginia, do hereby certify that on October 23, 2002 an appeal was awarded as described in the order to which this certificate is appended. A copy of this certificate and a copy of the order to which it is appended were this day mailed to the lower court indicated in the order and to all counsel of record.

Given under my hand this 23rd day of October, 2002.


Clerk

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