VPDES PERMIT FACT SHEET

This document gives pertinent information concerning the reissuance of the VPDES permit listed below. This permit is being processed as a major, municipal permit. The effluent limitations contained in this permit will maintain the Water Quality Standards of 9 VAC 25-260 et seq. The discharge results from the operation of a municipal wastewater treatment facility. This permit action includes revised effluent limitations and special conditions, the addition of an upgrade tier for Outfall 001, the addition of Outfall 041 and formatting updates to the permit.

1. Facility Name and Mailing Address: Richmond WWTP
Department of Public Utilities
730 E. Broad Street
Richmond, VA 23219

Location: 1400 Brander Street, Richmond, VA 23224-2399

2. SIC Code: 4952

3. Permit No. VA0063177 Permit Expiration Date: March 20, 2010

4. Owner: City of Richmond
Contact Name: Robert Steidel
Title: Director of Public Utilities
Telephone No.: 804/646-5200
Address: 730 E. Broad St, Richmond, VA 23219

5. Application Complete Date: November 18, 2009
Permit Drafted By: Gina Kelly, Emilee Adamson — Date: November 19, 2009; revised December 8, 2009, January 7, 2010, July 28, 2010, November 23, 2010, November 24, 2010, August 4, 2011, October 5, 2011, August 30, 2012, December 17, 2012

DEQ Regional Office: Piedmont Regional Office
Reviewed By: Emilee Adamson — Date: November 25, 2009
Curt Linderman — Date: July 8, 2010, September 23, 2010, April 6, 2012
Central Office — Date: November 24, 2010, January 22, 2013
Kyle Winter — Date: November 29, 2010, January 7, 2013

6. Receiving Stream:

	Outfall 001
Name:	James River
River Mile:	2-JMS108.83
Basin:	James River (Lower)
Subbasin:	N/A
Section:	1
Class:	II
Special Standards:	bb
1-Day, 10-Year Low Flow:	300 MGD*
7-Day, 10-Year Low Flow:	355 MGD*
30-Day, 5-Year Low Flow:	567 MGD*
30-Day, 10-Year Low Flow:	496 MGD*
Harmonic Mean Flow:	1962 MGD*
Tidal?	Yes
On 303(d) list?	Yes

* Adjusted flows (see **Attachment C**)

7. Operator License Requirements: The recommended attendance hours by a licensed operator and the minimum daily hours that the treatment works should be manned by operating staff are contained in the Sewage Collection and Treatment Regulations (SCAT) 9 VAC 25-790 et seq. A Class I licensed operator is required for the facility.

8. Reliability Class: Reliability is a measurement of the ability of a component or system to perform its designated function without failure or interruption of service. The reliability classification is based on the water quality and public health consequences of a component or system failure. The permittee is required to maintain Class I Reliability for the existing facility.

9. Permit Characterization:
(X) Existing Discharge
(X) Reissuance
(X) Water Quality Limited
(X) Municipal
SIC Code(s): 4952
(X) Publically Owned Treatment Works (POTW)
(X) Whole Effluent Toxicity Program Required
(X) Discharge to 303(d) Listed Segment

10. Wastewater Flow and Treatment: Table 1

Outfall Number	Wastewater Source	Treatment	Flow
001	Henrico County, Goochland County, Chesterfield County and City of Richmond residents; 53 industrial contributors, including 15 Categorical Industrial Users (CIUs)	Primary screening & grit removal, secondary screening & grit removal, primary settling with hydro degritting, aeration basins (step aeration mode), secondary settling, denitrification filters, filtration, UV disinfection and post aeration. Sludge is anaerobically digested, dewatered, and land applied.	45 MGD (dry weather flow) 75 MGD (wet weather flow)
041		Primary screening & grit removal, secondary screening & grit removal, primary settling with hydro degritting, UV disinfection and post aeration.	65 MGD (wet weather flow)

See **Attachment A** for facility diagrams illustrating several possible modes of operation. Additional details regarding the Combined Sewer System (CSS) and the Combined Sewer Outfalls (CSOs) can be found in **Attachment J**.

11. Sludge Disposal: The City of Richmond currently contracts Recyc Systems, Inc. to land-apply the sludge generated by the facility (Pollutant Concentration Sewage Sludge). The sludge meets Class B pathogen reduction Alternative 2 by employing Option 1 vector attraction reduction and anaerobic digestion. Recyc Systems, Inc. is currently operating under several BUR permits and a DEQ VPA permit.

12. Discharge Location Description: This facility discharges to the James River and various tributaries.
Name of USGS topo map: Richmond (126C) (See **Attachment B**)

13. Material Storage: The POTW employs and stores a variety of chemicals in the treatment process. Some regularly utilized and stored chemicals include methanol, lime, oil, ferric chloride, polymer, and bicarbonate. Chemicals are stored in buildings with appropriate spill containment. The dewatered, digested sludge is stored on a curbed concrete pad which drains back into the head works of the plant. Wastewater and collections system grit and screenings are stored on a curbed concrete pad which drains back into the headworks of the treatment plant.

14. Ambient Water Quality Information: Ambient water quality data from an upstream station at river mile 2-JMS110.30 was used in this analysis for Outfall 001; this station was selected due to the close proximity of the discharge site (i.e. approximately 1.5 miles upstream of the discharge point, near the Mayo Bridge). See **Attachment C**.

15. Antidegradation Review and Comments: The State Water Control Board's Water Quality Standards includes an antidegradation policy (9 VAC 25-260-30). All state surface waters are provided one of three levels of antidegradation protection. For Tier 1 or existing use protection, existing uses of the water body and the water quality to protect those uses must be maintained. Tier 2 water bodies have water quality that is better than the water quality standards. Significant lowering of the water quality of Tier 2 waters is not allowed without an evaluation of the economic and social impacts. Tier 3 water bodies are exceptional waters and are so designated by regulatory amendment. The antidegradation policy prohibits new or expanded discharges into exceptional waters.

    The antidegradation review begins with a Tier determination. The receiving stream, James River, is determined to be a Tier 1 waterbody. The Richmond-Crater Water Quality Management Plan fully allocates BOD and ammonia to multiple dischargers in the segment for the purposes of limiting adverse affects to both dissolved oxygen and ammonia ambient concentrations. Also see TMDL discussion in # 28 below. The waterbody is therefore, classified as Tier 1.

16. Site Inspection: Charlie Stitzer; August 11, 2009. See **Attachment D.**

17. Effluent Screening (Outfall 001):

    Effluent Data
    See **Attachment E** for effluent data submitted with the permit application and obtained from DMRs and other submitted reports.

    Mixing Zone Analysis and Model
    The permittee previously submitted a mixing model for the Richmond WWTP discharge to the James River, and this model was approved by M. Dale Philips in 1996. A complete mix should be assumed using 100% of the 7Q10 stream flow for chronic exposure and a mix using 50% of the 1Q10 stream flow should be assumed for acute conditions. The corresponding CORMIX model approval memorandum is included in **Attachment F**.

    As per agency direction, the 30Q5 and harmonic mean flow frequencies were set equivalent to that of the chronic flow mix.

    Reasonable Potential Evaluation
    A review of the effluent data indicated a need to examine the potential effects of radionuclides, chloroform, dichlorobromomethane, chlorodibromomethane, copper, cadmium, zinc, and chloride. All other parameters were considered absent for the purposes of the reasonable analyses. Evaluations for chloride, copper, cadmium, and zinc are included in **Attachment G**.

    Attachment G also presents the evaluation of the need for ammonia and TRC limitations in the draft permit. Included in Attachment G are MSTRANTI input data sources, MSTRANTI printouts with WLAs, and STATS.exe analyses for the appropriate parameters.

    A design flow of 45 MGD was used in MSTRANTI for wasteload allocation (WLA) calculations. While the wet weather flow of 75 MGD would provide more conservatism in the calculated WLAs, the dry weather flow of 45 MGD was selected because this flow would be the design flow under instream low flow conditions (i.e. low flow 1Q10 and 7Q10). Alternatively, the facility would not be operating under wet flow scenarios (at 75 MGD) when the receiving stream is at critical low flow conditions. This rationale was also applied when selecting the design flow for performing the Whole Effluent Toxicity (WET) Tests evaluations and corresponding spreadsheets.

The Human Health WLAs were established, using MSTRANTI, based on the applicable human health standards. A comparison of the measured concentration to the corresponding human health standard is tabulated below.

Parameter	Human Health Standard (µg/L)	WLA_{HH} (µg/L)	Concentration at Outfall 001 (µg/L)
Zinc	26,000	350,000	50, 41, 42
Chloroform	11,000	150,000	13.1, <10, 11.7
Dichlorobromomethane	170	7,600	11.5, <10, <10
Chlorodibromomethane	130	5,800	11.5, <10, <10

As indicated above, zinc, chloroform, dichlorobromomethane, and chlorodibromomethane do not present a reasonable potential to cause or contribute to a water quality standard violation.

Parameter	Human Health Standard	WLA_{HH}	Concentration at Outfall 001
*Beta Particle & Photon Activity	4 mrem/yr	54 mrem/yr	8.94 pCi/L
*Uranium	30 µg/L	410 µg/L	<0.7 pCi/L ≈ <1.0 µg/L
*Gross Alpha	15 pCi/L	300 pCi/L	1.95 pCi/L
*Combined Radium 226 & 228	5 pCi/L	68 pCi/L	0.9 pCi/L
**Strontium-90	8 pCi/L	-	<2 pCi/L
**Tritium	20,000 pCi/L	-	177 pCi/L

* NOTE: The Human Health Standard for this parameter is only applicable in Public Water Supply (PWS) designated waters.

** The 2010 Triennial Review removed the human health water quality standards for this parameter.

In the application, the values reported for Beta Particle and Photon Activity are in units of activity (i.e. pCi/L) whereas the applicable water quality standard is an exposure in terms of mrem/yr. The EPA has established this same standard for community potable water systems. EPA guidance states that compliance with the potable water standard may be assumed if the average annual concentration of Beta Particle and Photon Activity is less than 50 pCi/L (Radionuclides in Drinking Water: A Small Entity Compliance Guide. EPA 815-R-02-001, February 2002.; http://www.epa.gov/safewater/radionuclides/compliancehelp.html). Consequently, the reported concentrations of Beta Particle and Photon Activity are considered to meet the applicable water quality standards. The application reported uranium in terms of activity, pCi/L whereas the standard is in terms of mass, µg/L. EPA has suggested conversion factors for activity to mass ranging from 0.67 to 1.5 pCi/µg (USEPA 2000. National Primary Drinking Water Regulations; Final Rule 65 FR 236; December 7, 2000.). To provide the most conservative estimate of mass-based concentration, the 0.67 pCi/µg conversion factor was used, resulting in an estimated <1.0 µg/L Uranium. As indicated above, these parameters do not present a reasonable potential to cause or contribute to a water quality standard violation.

18. Effluent Limitation Development:

On December 20, 2012 a Certificate to Operate for the ultraviolet (UV) disinfection facility at Richmond WWTP was issued. With this reissuance, the sampling location for Outfall 001 will change from the Outfall Structure to the discharge from the UV disinfection process for full treatment. In accordance with a future Long Term Control Plan (LTCP) project from the Special Order by Consent, a new outfall (Outfall 041) will be established between the discharge from the UV disinfection process for full treatment and the Outfall Structure from which maximized wet weather flow will receive treatment under the Combined Sewer Overflow (CSO) Policy and as shown in **Attachment A**, Exhibits 7-11. The concentration discharge limits in the table below are to be met at the new Outfall 001sampling location identified above.

Outfall 001:

Table 2. Basis For Effluent Limitations at Outfall 001

PARAMETER		BASIS FOR LIMITS	DISCHARGE LIMITS					
			MO AVG		7-DAY ROLLING or WEEKLY AVG		MIN	MAX
Flow (MGD)		NA	NL		NA		NA	NL
pH (standard units)		2	NA		NA		6.0 S.U.	9.0 S.U.
$cBOD_5$	June – October	4	NL mg/L	NL kg/d	8.0 mg/L	1361 kg/d	NA	NA
	November – May	4	14.3 mg/L	2434 kg/d	21.4 mg/L	3651 kg/d	NA	NA
Total Suspended Solids (TSS)	June – October	3	NL mg/L	NL kg/d	10 mg/L	1703 kg/d	NA	NA
	November – May	3	18 mg/L	3066 kg/d	27 mg/L	4599 kg/d	NA	NA
Ammonia as N	June – October	4, 1	6.4 mg/L	1090 kg/d	9.36 mg/L		NA	NA
	November – May	4, 3	15.2 mg/L	2588 kg/d	22.8 mg/L		NA	NA
Total Phosphorus (as P)	Current CTO	5	2.0 mg/L	NL kg/d	NA		NA	NA
	new CTO issuance	5	0.50 mg/L (calendar year average) NL (calendar YTD avg)		NA		NA	NA
Total Nitrogen (as N)	new CTO issuance	5	8.0 mg/L (calendar year average) NL (calendar YTD avg)		NA		NA	NA
Dissolved Oxygen (mg/L)		4	NA		NA		5.6 mg/L	NA
Total Residual Chlorine (TRC)		1	36 µg/L		38 µg/L		NA	NA
*TRC Contact (Parameter 157)		3	NA		NA		1.0 mg/L	NA
*TRC Contact (Parameter 213)		3	NA		NA		0.60 mg/L	NA
E. coli		2	126 N/100 mL (geometric mean)		NA		NA	NA

1. Water Quality Based Effluent Limitation (WQBEL)
2. Water Quality Standards
3. Best Engineering Judgment (BEJ)
4. Richmond Crater Water Quality Management Plan
5. Nutrient Regulations and DEQ Related Guidance

* Samples are taken prior to dechlorination.

Conventional Pollutants

The $cBOD_5$ and TSS limitations are based on the Richmond Crater Interim Water Quality Management Plan (RCWQMP) from 1989, the 2010 table, and Best Engineering Judgment, respectively; the 208 Plan is included in **Attachment H**.

Several of the $cBOD_5$ limitations were revised to become in accordance with the RCWQMP Loading Limitations; in order to do so, all loading calculations required rounding down. Per the plan, a summer load of 3002 lb/d and a winter load of 5367 lb/d were allotted. The calculations were as follows:

June – October, 7-Day Rolling Average

3002 lb/d x 0.4536 kg/lb = 1361.71 kg/d ≈ 1361 kg/d

$$\frac{3002 \text{ lb/d} \times 0.4536 \text{ kg/lb}}{45 \text{ MGD} \times 3.785 \text{ L/gal}} = 7.99 \text{ mg/L} \approx 8.0 \text{ mg/L}$$

November - May, Monthly Average

5367 lb/d x 0.4536 kg/lb = 2434.47 kg/d ≈ 2434 kg/d

$$\frac{5367 \text{ lb/d} \times 0.4536 \text{ kg/lb}}{45 \text{ MGD} \times 3.785 \text{ L/gal}} = 14.29 \text{ mg/L} \approx 14.3 \text{ mg/L}$$

November - May, 7-Day Rolling Average

5367 lb/d x 0.4536 kg/lb x 1.5 = 3651.71 kg/d ≈ 3651 kg/d

$$\frac{5367 \text{ lb/d} \times 0.4536 \text{ kg/lb}}{45 \text{ MGD} \times 3.785 \text{ L/gal}} \times 1.5 = 21.44 \text{ mg/L} \approx 21.4 \text{ mg/L}$$

Guidance Memorandum 06-2016, Significant Figures for DMRs, was not applied to $cBOD_5$. The $cBOD_5$ loading and concentration limitations were written as expressed in the governing regulation (the Richmond Crater Water Quality Management Plan).

During the summer months and when influent flows are 45 MGD or less, the City of Richmond does not have monthly average limitations but rather meets a more restrictive 7-day running average for $cBOD_5$ and TSS concentrations and mass loadings (thus meeting the required secondary treatment standards).

When influent flows are between 45 MGD and 75 MGD, the plant is required to meet the concentration values but not the loading values for $cBOD_5$, TSS, and Total Phosphorus. The facility is required to comply with all other effluent limitations regardless of flow.

Dissolved Oxygen (DO)

The 2005 permit requires a minimum DO of 5.6 mg/L based on the Richmond Crater plan (9VAC25-720-60). The limitation is carried forward in this reissuance. See Part. 28 of the fact sheet for further discussion of dissolved oxygen.

Nutrients

The 2005 permit established loading limits for Total Nitrogen (TN) and Total Phosphorus (TP) based on Guidance Memorandum 04-2017, "Nutrient Monitoring and Maximum Annual Loads." This guidance has been superseded, and the nutrient general permit loading limitations became effective 1/1/2011 and supersedes previous loading limitations. Consequently, nutrient loading limitations are not addressed in the 2012 permit reissuance.

Part I.A.2 of the permit contains a tier for nutrients. The permit was tiered with respect to TN and TP Annual Average Concentration limitations to allow for the issuance of a CTO for the nutrient upgrades. This addition negates the need to modify the permit to include the appropriate nutrient limitations once the CTO for the upgrade is granted. The Virginia Administrative Code (9VAC25-40-70) requires technology-based effluent concentration limitations for any facility that has installed nutrient removal technology. The numeric limitations for these annual average concentrations were selected based on the Certificate-to-Construct (CTC) issued for the project (PT Log 24093). To avoid antibacksliding, the monthly average TP limitation was left in place in Part I.A.1 until it is superseded by the annual average TP limitation in Part I.A.2.

Monitoring and reporting requirements for the individual components of the nutrients (i.e. TKN, NO_3-NO_2, orthophosphate, etc) as well as the monthly average concentrations for total nitrogen and total phosphorus were not included as these parameters are already reported on the nutrient general permit Discharge Monitoring Report (DMR). However, TN and TP year-to-date

and annual average concentration reporting requirements were included in the individual permit as these calculations are not performed or reported on the nutrient general permit DMR.

Ammonia

When evaluating ammonia for monthly average limitations, the RCWQMP must be considered in addition to reasonable potential to exceed the applicable water quality standards; the more stringent limit is the applicable limit. Consistent with PRO staff decisions (3/27/12), the seasonal tier monthly ranges are determined by the RCWQMP. A table illustrating this comparison is below; the basis for the contents of the table can be found in Attachment G.

Time Period	RCWQMP Limit	WQBEL	Limit
June – October	6.4 mg/L (1090 kg/d)	7.60 mg/L	6.4 mg/L (1090 kg/d)
November – May	15.2 mg/L (2588 kg/d)	NL	15.2 mg/L (2588 kg/d)

The weekly average water quality-based limit of 9.36 mg/L is more stringent than the limits in the 2005 permit and will be required June – October. No WQBEL for the weekly average is necessary for the November – May tier; however, to avoid antibacksliding concerns, the 2005 permit limitation was carried forward. The 2005 limitation is based on the BEJ of 1.5 times the monthly average limitation.

Monthly average ammonia mass loading limitations were retained with this reissuance based on the inclusion of loading limitations in the RCWQMP. To avoid unfairly penalizing dischargers covered in the RCWQMP, all monthly average mass limitations were established based on the plan's mass limits (i.e. not based on the WQBEL).

The monthly average winter loading limitation was revised to become in accordance with the plan's limitations. Per the plan, a summer load of 2403 lb/d and a winter load of 5707 lb/d were allotted. The calculation was as follows:

Winter season, Monthly Average

$$5707 \text{ lb/d} \times 0.4536 \text{ kg/lb} = 2588.7 \text{ kg/d} \approx 2588 \text{ kg/d}$$

The weekly average ammonia loading limitation was removed from the permit as mass loading limitations are not generally applied to toxic parameters (GM00-2011), and the RCWQMP does not provide such a limitation.

Guidance Memorandum 06-2016, Significant Figures for DMRs, was not applied to the ammonia June – October monthly average concentration or the monthly average mass loading limitations; these limitations were written as expressed in the governing regulation (the Richmond Crater Water Quality Management Plan). As the basis for the weekly average limitation is the water quality standards which express ammonia in three significant digits, the weekly average limitation is also expressed in three significant digits (Guidance Memorandum 06-2016).

TRC

See Attachment G for further discussion related to the inclusion of monitoring and/or limitations for these parameters.

Monitoring Frequencies

Sampling frequencies for flow, pH, $cBOD_5$, ammonia, DO, and TRC were selected based on the 2010 permit manual recommendations. As per the June 2003 Water Permit Managers' Meeting Minutes, the baseline monitoring frequency for TSS is 1/Month for all facilities. The Nutrient General Permit was used to establish the monitoring frequencies for the nutrient parameters. Sampling requirements for *E. coli* were carried forward from the 1997 and 2005 permit reissuances; the 1/D frequency addresses the nature of the Combined Sewer System (CSS) and the potential to exceed the design flows for the facility. The alternative sampling time for

bacteria (i.e. between 7:30am and 1:30pm as compared to the recommended 10 am to 4pm) was carried forward from the 2005 permit; the permittee requested to continue with this condition so as to address the laboratory needs. As the City of Richmond is an E3 facility in the Virginia Environmental Excellence Program (VEEP), the DEQ accommodated this request.

Outfall 041:

In accordance with the City of Richmond's 2009 permit application, this permit reissuance authorizes Outfall 041 for the treatment of an additional 65 MGD of combined sewer wastewater. Outfall 041 is an anticipated CSO-bypass outfall consistent with the approved LTCP (December 2006). The EPA CSO Policy (EPA 830-B-94-001; April 1994) requires implementation of the Nine Minimum Controls, one of which is maximization of flow to the POTW for treatment. The policy recognizes that when primary treatment capacity exceeds the secondary treatment capacity at a POTW, maximizing the use of available facilities is beneficial for water quality. Consequently, the policy allows for permit authorized CSO-related bypass discharges under certain conditions. Such a permit must define under what specific wet weather conditions a CSO-related bypass is allowed and also specify what treatment or what monitoring and effluent limitations apply to the bypass flow. Part I.A.3.a.(1) outlines the specific wet weather conditions under which a CSO-related bypass (i.e. discharge through Outfall 041) is authorized. Part I.A.3 establishes the required minimum treatment and Part I.A.3.a establishes the required monitoring that applies to the bypass flow. Requirements for Outfall 041 were modeled after Outfall 001 in NPDES permit DC0021199, District of Columbia Water and Sewer Authority Waste Water Treatment Facility at Blue Plains and Associated Combined Sewer System Collection System (Blue Plains). Effluent limitations are not appropriate at this time; however, monitoring and subsequent performance evaluation is required in Parts I.A.3 and I.H.1.d.(4) of the permit.

Per EPA's CSO Policy, the permit should also provide that approval for the CSO-related bypass will be reviewed and may be modified or terminated if there is a substantial increase in the volume or character of pollutants being introduced to the POTW. This requirement is addressed in Part I.H.1.d.(3).iii. Furthermore, the permit should make clear that all wet weather flows passing the headworks of the POTW will receive at least primary clarification and solids and floatables removal and disposal, and disinfection, where necessary, and any other treatment that can reasonably be provided. This requirement is addressed in Part I.H.1.d.(3).iv.

In order for DEQ to approve a CSO-related bypass, the POTW has to meet the requirements of the bypass regulation at 40 CFR 122.41(m) (4):

Prohibition of bypass: 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.

The CSO Policy provides that for the purposes of applying this regulation to CSO permittees, "severe property damage" could include situations where flows above a certain level wash out the POTW's secondary treatment system. That is the situation with the Richmond WWTP. The CSO Policy goes on to state that "EPA further believes that the feasible alternatives requirement can be met if the record shows that the secondary treatment system is properly operated and maintained, that the system has been designed to meet secondary limits for flows greater than the peak dry weather flow, plus an appropriate quantity of wet weather flow, and that it is either technically or financially infeasible to provide secondary treatment at the existing facilities for greater amounts of wet weather flow ..... As part of its consideration of possible adverse effects resulting from the bypass, the permitting authority should also ensure that the bypass will not cause exceedances of WQS." The Richmond WWTP facility also meets those requirements, as

the secondary treatment system is properly operated and maintained, it is technically infeasible to provide secondary treatment for additional wet weather flow due to space constraints, and the bypass is not expected to cause exceedances of WQS.

With respect to establishing no feasible alternatives to bypass, the City of Richmond demonstrated that it conducted an adequate no feasible alternatives analysis for the Outfall 041 bypass through its LTCP development process. Section 8 of the City of Richmond's approved LTCP presents a detailed alternatives and cost-benefit analysis which determined that increasing the excess wet weather flow treatment is an effective CSO control element that will improve the water quality in the James River. DEQ's entry into the March 17, 2005 Consent Special Order was an acceptance of the no feasible alternatives to the bypass outfall. Further, DEQ determined that the record supported the CSO-related bypass in the selected LTCP controls and included its determination in the Consent Special Order Requirements (Nos. 14 and 15).

With respect to notification cited in part 3 of the federal regulation above (40 CFR 122.41(m)(4)), Part I.A.3.b of the proposed permit, requires that the permittee provide notice to the DEQ-PRO with the submittal of each DMR.

19. Basis for Sludge Use & Disposal Requirements –
Required by 9 VAC 25-31-540, 560 and 570. Also, the 2010 VPDES Permit Manual (GM10-2003), MN-4 provides additional guidance on sludge monitoring requirements. Applicable land application requirements are addressed by the facility that receives the sludge.

20. Antibacksliding: All limitations in the proposed permit are the same or more stringent than the limitations in the 2005 permit. While the weekly average loading limitation for ammonia was removed in this reissuance, the weekly average concentration limitations effectively address any backsliding concerns.

21. Compliance Schedules: Analysis of effluent data (see Attachment G) indicated the need to establish more stringent effluent limitations for TRC and ammonia. As these are more restrictive effluent limitations, it is appropriate to allow a period of time for the permittee to achieve compliance. However, the facility is already complying with the newly established permit limits for all of these parameters, so no additional time is needed to achieve compliance. Consequently, a compliance schedule for these parameters was not given.

22. Alternate Disinfection Limitations and Monitoring Requirements – Part I.B.
This condition is only applicable if chlorine is used for disinfection and is included in the permit to allow the permittee to change disinfection methods mid permit term without a modification. Chlorine residuals are required by Sewage Collection and Treatment Regulations, 9 VAC 25-790. Also, 40 CFR 122.41(e) requires the permittee, at all times, to properly operate and maintain all facilities and systems of treatment in order to comply with the permit. This special condition ensures proper operation of chlorination equipment, if used, to maintain adequate disinfection. The condition also assigns TRC effluent limits that protect against aquatic toxicity in the receiving stream.

23. Special Conditions
Part I.C.1: O&M Manual Requirement
Rationale: Required by Code of Virginia §62.1-44.19; Sewage Collection and Treatment Regulations, 9 VAC 25-790; VPDES Permit Regulation, 9 VAC 25-31-190 E.

Part I.C.2: Licensed Operator Requirement
Rationale: The VPDES Permit Regulation, 9 VAC 25-31-200 C and the Code of Virginia § 54.1-2300 et seq., Rules and Regulations for Waterworks and Wastewater Works Operators and Onsite Sewage System Professionals (18 VAC 160-20-10 et seq.), require licensure of operators.

Part I.C.3: Reliability Class
Rationale: Required by Sewage Collection and Treatment Regulations, 9 VAC 25-790 for all municipal facilities.

Part I.C.4: Sludge Use and Disposal
Rationale: VPDES Permit Regulation, 9 VAC 25-31-100 P, 220 B 2, and 420 through 720; and 40 CFR Part 503 require all treatment works treating domestic sewage to submit information on sludge use and disposal practices and to meet specified standards for sludge use and disposal.

Part I.C.5: Sludge Reopener
Rationale: Required by VPDES Permit Regulation, 9 VAC 25-31-220 for all permits issued to treatment works treating domestic sewage.

Part I.C.6: Compliance Reporting
Rationale: Authorized by VPDES Permit Regulation, 9 VAC 25-31-190 J 4 and 220 I. This condition is necessary when pollutants are monitored by the permittee and a maximum level of quantification and/or a specific analytical method is required in order to assess compliance with a permit limitation or to compare effluent quality with a numeric criterion. The condition also establishes protocols for calculation of reported values. QLs are based on the revised Permit Manual (8-25-11).

Part I.C.7: Materials Handling/Storage
Rationale: 9 VAC 25-31-50 A prohibits the discharge of any wastes into State waters unless authorized by permit. Code of Virginia §62.1-44.16 and 62.1-44.17 authorizes the Board to regulate the discharge of industrial waste or other waste.

Part I.C.8: Reopeners
Rationale:

a. Section 303(d) of the Clean Water Act requires that total maximum daily loads (TMDLs) be developed for streams listed as impaired. This special condition is to allow the permit to be reopened if necessary to bring it into compliance with any applicable TMDL approved for the receiving stream. The re-opener recognizes that, according to section 402(o)(1) of the Clean Water Act, limits and/or conditions may be either more or less stringent than those contained in this permit. Specifically, they can be relaxed it they are the result of a TMDL, basin plan, or other wasteload allocation prepared under section 303 of the Act.
b. 9 VAC 25-40-70 A authorizes DEQ to include technology-based annual concentration limits in the permits of facilities that have installed nutrient control equipment, whether by new construction, expansion or upgrade.
c. 9 VAC 25-31-390 A authorizes DEQ to modify VPDES permits to promulgate amended water quality standards.

Part I.C. 9: Indirect Dischargers
Rationale: Required by VPDES Permit Regulation, 9 VAC 25-31-200 B.1 and B.2 for POTWs and PVOTWs that receive waste from someone other than the owner of the treatment works.

Part I.C. 10: CTO, CTC Requirement
Rationale: Required by Code of Virginia § 62.1-44.19; Sewage Collection and Treatment Regulations, 9 VAC 25-790-50. 9 VAC 25-40-70.A authorizes DEQ to include technology-based annual concentration limitations in the permits of facilities that have installed nutrient control technology, whether by new construction, expansion, or upgrade.

Part I.C.11: Nutrient Reporting Calculations
Rationale: §62.1-44.19:13 of the Code of Virginia defines how annual nutrient loads are to be calculated; this definition is carried forward in 9 VAC 25-820-70. As annual concentrations (as opposed to loads) are limited in the individual permit, this special condition is intended to

reconcile the reporting calculations between the permit programs, as the permittee is collecting a single set of samples for the purpose of ascertaining compliance with two permits.

Part I.C.12: Suspension of Annual Average Concentration Limitations for E3/E4 Facilities
Rationale: 9 VAC 25-40-70 B authorizes DEQ to approve an alternate compliance method to the technology-based effluent concentration limitations as required by subsection A of this section. Such alternate compliance method shall be incorporated into the permit of an Exemplary Environmental Enterprise (E3) facility or an Extraordinary Environmental Enterprise (E4) facility to allow the suspension of applicable technology-based effluent concentration limitations during the period the E3 or E4 facility has a fully implemented environmental management system that includes operation of installed nutrient removal technologies at the treatment efficiency levels for which they were designed.

Part I.C.13: Retention Basin Maintenance
Rational: To maintain the volume for retention of CSO overflows and to allow maintenance operations to proceed in the safest, shortest and most cost effective manner.

Part I.C.14: Closure Plan
Rationale: Code of Virginia § 62.1-44.19 of the State Water Control Law. This condition establishes the requirement to submit a closure plan for the wastewater treatment facility if the treatment facility is being replaced or is expected to close.

Part I.C.15: Water Quality Criteria Reopener
Rationale: VPDES Permit Regulation, 9VAC25-31-220 D requires effluent limitations to be established which will contribute to the attainment or maintenance of water quality criteria.

Part I.D: Pretreatment
Rationale: VPDES Permit Regulation, 9 VAC 25-31-730 through 900, and 40 CFR part 403 require certain existing and new sources of pollution to meet specified regulations.

Part I.E: Whole Effluent Toxicity (WET) Monitoring Program
Rationale: VPDES Permit Regulation, 9 VAC 25-31-210 and 220 I, requires monitoring in the permit to provide for and assure compliance with all applicable requirements of the State Water Control Law and the Clean Water Act. See **Attachment I** for the WET evaluation.

Part I.F. and Part I.G—Sewage Sludge Land Application Limitations and Monitoring Requirements
Rationale: VPDES Permit Regulation, Part VI-Subpart B.

Part I.H: Combined Sewer System
Rationale: CSO's are point sources subject to NPDES permit requirements including both technology-based and water quality based requirements of the Clean Water Act (CWA). This special condition is in accordance with EPA's CSO Control Policy, Final Policy (40 CFR Part 122) which is written to ensure that no dry weather overflows occur and to bring all wet weather CSO's into compliance with the technology based and water quality based requirements of the CWA. These controls are necessary to minimize CSO impacts on water quality, aquatic biota, and human health.

In accordance with the Special Order issued to the permittee by the Board on January 6, 1992 and amended April 2, 1996, the permittee submitted to DEQ a Long Term CSO Control Plan Reevaluation – Final Report, dated January 2002. The Reevaluation Report comprises a Long Term Control Plan (LTCP) for the combined sewer system pursuant to the CSO Policy and was made available for public review and comment.

Under the January 6, 1992 Special Order (prior to adoption of the CSO Policy in 1994), the permittee completed CSO Project Nos. 1 through 5. These projects offered increased control of most CSO discharges to the James River above the fall line. The Reevaluation Report recommends that additional controls be provided to meet state water quality standards in

conformance with the Demonstration approach criteria at Section II.C.4.b. of the CSO Policy. The LTCP is referred to as Control Plan E in the Reevaluation Report.

The Board accepted the permittee's January 2002 LTCP and approved Control Plan E as described in the LTCP subject to the Board completing its ongoing water quality standards coordination process pursuant to Section III of the CSO Policy. Implementation of CSO Control Plan E is designed to provide capture of approximately 87% volume and achieve removals of BOD and TSS that exceed the 85% rule in the average year. In the water quality standards coordination process, the Board will address the demonstration criteria in the CSO Policy at II.C.4.b.i and ii. The Board's review will include the information provided in the Reevaluation Report and subsequent reports as well as the Board's findings in connection with the bacteria TMDL for the James River approved by EPA November 4, 2010.

Until completion of the water quality standards coordination process, the permittee shall implement parts of Control Plan E determined by the Board as appropriate in continuing efforts to control CSO discharges in conformance with the water quality standards compliance demonstration called for at Section II.C.4.b.i and ii of the CSO Policy. Therefore, during the term of this permit, implementation of the LTCP shall be in accordance with the current Special Order by Consent between the permittee and the Board.

Part II, Conditions Applicable to All VPDES Permits
The VPDES Permit Regulation at 9 VAC 25-31-190 requires all VPDES permits to contain or specifically cite the conditions listed.

24. Changes to 2005 Permit:

Table 3: Part I.A.1 and 2. Outfall 001

Parameter Changed		Effluent Limits Changed		Monitoring Requirement Changed		Reason for Change	Date
		From	To	From	To		
$cBOD_5$ – 7-Day Avg		1362 kg/d 3653 kg/d	1361 kg/d 3651 kg/d	-	-	Revised to be in accordance with the RCWQMP (see Item 18 above)	7/10
NH_3	Tier Months	-	-	June - Oct Nov - May	May - Oct Nov- April	See Attachment G and Item 18 above. *See subsequent change table for reversal of the tier month change.*	7/10
	Weekly Avg	9.6 mg/L 1635 kg/d 3883 kg/d	9.36 mg/L - -	-	-		
	Monthly Avg	2589 kg/d	2588 kg/d				
DO Minimum		5.6 mg/L	6.0 mg/L	-	-	The limitation was revised to address the revised Water Quality Standards (9 VAC 25-260-185). While this limitation is more stringent than required by the various regulations, this approach minimizes the chance of reporting errors. *See subsequent change table for removal of this monitoring.*	7/10

Parameter Changed		Effluent Limits Changed		Monitoring Requirement Changed		Reason for Change	Date
		From	To	From	To		
TRC	Monthly Average	0.07 mg/L (70 µg/L)	36 µg/L	-	-	Re-evaluation indicates the need to revise TRC limitations. See Attachment G.	7/10
	Weekly Average	0.07 mg/L (70 µg/L)	38 µg/L				
Total Phosphorus (as P)		-	-	1/Day	1/Week	Monitoring was set at 1/Week to correspond to the monitoring frequencies established in the Watershed General Permit (WGP). See subsequent change table for updates to this monitoring frequency.	7/10
TN, NO_2-NO_3, TKN, Orthophosphate,		NL	-	1/Day	-	Monitoring for these parameters was removed from the individual permit to avoid duplicative reporting (i.e. they are monitored and reported in the WGP).	7/10
TP and TN Monthly Average Loading		NL	-	1/Month	-	Monitoring removed because annual loading is addressed in the GP with limitations effective 1/1/11.	11/24
TP and TN Annual Average Loading		49,000 kg/yr And 760,000 kg/yr	-	1/Month	-	2005 permit loading limitations are superseded by the GP loading limitations effective 1/1/11	11/24
Dissolved Sulfide		-	NL	-	1/6 Months	Re-evaluation indicates the need to monitor this parameter. See Attachment G. *See Subsequent change table for removal of this mornitoring.*	7/10

Table 4: Special Condition Changes

From	To	Special Condition Changed	Reason for Change	Date
Cover page	Cover page	-	Revised in accordance with current regulations and DEQ policy; specifically, the formatting, and special standards were revised. Signatory revised in accordance with DEQ Policy 2-09.	1/10
Part I.A.1	Part I.A.1	Preamble	Revised due to current plans to install nutrient removal technology; a PER for this upgrade has been submitted and the CTC issued.	1/10
Various notes			TIRE definition removed; 7-day rolling average note updated to reflect changes in referenced footnotes; NL clarified to mean both monitoring and reporting.	1/10

From	To	Special Condition Changed	Reason for Change	Date
-	Footnote (1)	Design Flow	New; defines the dry-weather design flow	1/10
-	Footnote (2)	Nutrient Reporting	New; added for clarity	1/10
Part I.A.1.b	Footnote (3)	Additional TRC Requirements	Revised for clarity	1/10
Part I.A.1.e	Footnote (4)	TN Calculation	Revised for clarity	1/10
Part I.A.1.g	-	Nutrient Loading	Removed as loading limitations were superseded by the limitations in VAN040085, effective 1/1/11.	1/10
Part I.A.1.h	Footnote (5)	$cBOD_5$, TSS, NH_3 limits	No changes	1/10
-	Footnote (6) & (7)	Significant Digits	New to specify the intended significant digits	1/10
Part I.A.3	Part I.A.1.b	Discharge of Foam & Solids	No changes	1/10
-	Part I.A.2	Nutrient Upgrade Tier	New, reflects the permittee's intentions to upgrade the plant per the submitted PER; this addition negates the need to modify the permit to include the appropriate nutrient limitations once the CTO for the upgrade is granted. New limitations were included to address new nutrient regulations (i.e. 9 VAC 25-720 and 820)	1/10
-	Part I.A.3	Added Outfall 041	See Part 18 of the FS for rationale.	1/3/13
Part I.G.1	Part I.A.4	Sewage Sludge Limitations and Monitoring Requirements	Revised to reflect agency guidance (January 27, 2010 Permit Manual) and 9 VAC 25-31-660; the 1/ 2 month definition was added and composite sampling specification revised.	1/10
Part I.B.	Part I.B.	TRC Limitations and Monitoring Requirements	Revised to reflect January 27, 2010 permit manual; specialized permit language was included in B.2 to simplify the permit terms and reduce redundancy should chlorination not be utilized as the mode of disinfection. The continuation of this customized special condition language was requested by the permittee on June 11, 2010, and DEQ is accommodating this request due to the facility being a VEEP participant at the E3 level. The bacteria references in Part I.B.2 were revised from 235 N/100 mL to 126 N/100 mL to reflect changes in the WQS regulations. The word "operating" was included in the term "each *operating* chlorine contact…" for clarity and consistency; this change differs from the permit manual.	1/10
Part I.C.2	Part I.C.1	O & M Manual	Revised to reflect January 27, 2010 permit manual	1/10

From	To	Special Condition Changed	Reason for Change	Date
Part I.C.3	Part I.C.2	Licensed Operator	Revised to reflect the 2009 name change of the governing DPOR Board.	1/10
Part I.C.4	Part I.C.3	Reliability Class	No changes	1/10
Part I.C.12	Part I.C.4	Sludge Use and Disposal	Revised to remove VDH references	1/10
Part I.C.7	Part I.C.5	Sludge Reopener	Revised to reflect January 27, 2010 permit manual	1/10
Part I.C.9	Part I.C.6	Compliance Reporting	Revised to reflect January 27, 2010 permit manual and a January 12, 2010 phone conversation with Elleanore Daub (CO). Also, section b was revised to address the 7-day rolling average, and section f was added in accordance with the June 2010 PRO VPDES Staff meeting decisions. *See subsequent change table for removal of section f.*	1/10
Part I.C.13	Part I.C.7	Materials Handling/Storage	Updated boilerplate special condition language to be consistent with GM10-2003.	1/10
Part I.C.5, 8	Part I.C.8	Reopeners	Revised to reflect GM07-2008, Amendment 2	1/10
Part I.C.1	Part I.C.9	Indirect Dischargers	No changes	1/10
Part I.C.16	Part I.C.10	CTC, CTO Requirement	Revised to reflect draft 2009 permit manual and GM07-2008, Amendment 2. The guidance contains an additional sentence which was not included as it references the issuance of a CTC; this facility has been issued the referenced CTC and this permit was written taking that into account.	1/10
	Part I.C.11	Nutrient Reporting Calculations	New, reflects GM07-2008, Amendment 2 The Nutrient Reporting calculation varies from guidance in that it clarifies where the monthly average concentrations are reported (i.e. the nutrient general permit DMR).	1/10
	Part I.C.12	Annual Average Concentrations		1/10
Part I.C.11	Part I.C.13	Retention Basin Cleaning	No changes	1/10
	Part I.C.14	Closure Plan	New, to reflect January 27, 2010 permit manual	1/10
Part I.C.6	Part I.C.15	Water Quality Criteria Reopener	No changes	1/10
Part I.E	Part I.D	Pretreatment	Revised to reflect January 27, 2010 permit manual and for clarity and enforceability of the special conditions	1/10
Part I.D	Part I.E	Whole Effluent Toxicity	Revised per TMP coordinator (D. Debiasi). Specifically, acute testing was removed from the permit and replaced with chronic testing of 2 species. These testing criteria match more closely the requirements of the CWA via the EPA Form 2A WET Testing and no acute toxicity has been observed in the past 5 years. Additionally, this revision makes the permit more consistent with other major municipal dischargers in the area.	1/10
Part I.G.2	Part I.F	Sludge Records	Updated to reflect changes in the special condition numbering	1/10
Part I.G.3	Part I.G	Sludge Reporting		

From	To	Special Condition Changed	Reason for Change	Date
Part I.F	Part I.H	Combined Sewer System	H.4 was added to address the requirements of the James River bacterial TMDL. See #23 above for additional details.	1/10
Attachment A	Attachment A	Table of CSOs	Updated latitude and longitude coordinates in accordance with the reissuance application; this change from the 2005 permit is a result of switching from GPS to GIS to determine the coordinates.	1/10
Part I.A.1.a, c, d, and f	[deleted]	Various footnotes	These footnotes were removed as their contents were either incorporated into the Part I.A.1 limits table or the note was no longer necessary.	1/10
Part I.A.2	[deleted]	85% Removal of Conventional Pollutants	40 CFR 133.103(a) provides consideration be given to CSS where a defined percent removal may not be achievable under all flow conditions.	1/10
Part I.C.10	[deleted]	Bypass	This special condition is no longer required per permit manual; bypasses are adequately addressed in Part II of the permit.	1/10
Part I.C.14	[deleted]	Basis of Design Report	These special conditions are no longer required in accordance with GM07-2008, Amendment 2.	1/10
Part I.C.15	[deleted]	Interim Optimization Plan		

Table 5: Changes following Owner Review

Permit Section	Change	Reason for Change	Date
Part I.A.1 and 2. Dissolved Sulfide Monitoring	Dissolved Sulfide Monitoring removed.	In a letter dated April 5, 2011, the City of Richmond submitted revised lab results that acknowledged inappropriate reporting of the original QL. Microbac reissued the lab report with the appropriate QL, in which case the result is less than the QL of 1 mg/L. Given the correction, monitoring is no longer necessary.	8/4/11
Part I.A.1 and 2 Preamble	Clarified CTO issuance to pertain to all five contracts and the associated CTCs in PTLog	Additional detail added to clearly convey that the nutrient limitations become effective January 1st of the year following the issuance of a CTO for the last of the 5 contracts.	8/4/11
Part I.A.2	TN and TP calendar year to date average monitoring added.	Inadvertent omission was recognized at meeting with owner 2/28/11. Added to be consistent with GM07-2008 Amendment 2.	8/4/11
Part I.A.1 and 2. Footnote (8)	Added footnote (8) to specify the point of compliance.	Clarity	8/4/11
Pat I.C.6	Removed dissolved sulfide QL from subpart a. Added reference to Part I.C.11 in subpart f. QL for cBOD5 revised to 2 mg/L.	QL is unnecessary because dissolved sulfide monitoring is removed. Subpart f needed to be clarified so that it didn't conflict with Part I.C.11. cBOD5 QL revised in accordance with VPDES Permit Manual Revision (8-25-11)	8/4/11

Permit Section	Change	Reason for Change	Date
Part I.C.13	Retention Basin Cleaning Condition: Revised language to replace "clean" with "maintain" and to remove phrase "within CSO system."	The language revisions broaden the applicability of the condition to meet the City of Richmond's needs.	8/4/11
Part I.D.12 and 13	Removed requirements to submit facility inspections and permit actions to PRO and renumbered subsequent conditions.	Requirements were removed in response to permittee request. The decision was supported by recent cooperation in information sharing.	8/4/11
Part I.H.1.b	Revised 6th section to require monthly inspection to tide gates and adjustment and repair as needed.	The condition as written previously required monthly adjustment and repair regardless of need. Condition clarified to not require action when it's not needed.	8/4/11
Part I.H.1.g	Removed color coding references associated with the retired government threat level notification.	Sentence revised to: "Facility tours may be suspended when the United States Government's National Terrorism Advisory System announces elevated or imminent threat levels," to reflect the new governmental threat notification strategy. Also removed "Adopt a Spot" and "Clean City Business Awards" references because the programs are no longer active.	8/4/11
Part I.H.4	Revised due date for the supplement to the LTCP.	Original due date was based on the issuance of the bacteria TMDL. As the TMDL was issued 11/4/11, the due date for the addendum was postponed to 180 days following the effective date of the permit.	10/5/11
Part II.A.4	Added VELAP condition.	In accordance with the latest Permit Manual update 8/25/11	10/5/11
Part I.A.1 and 2	Ammonia Tier Months changed back to June – October and November - May	In accordance with PRO Staff decision 3/27/12 that seasonal tier periods should be derived from the RCWQMP rather than ambient data. This reverses the earlier change documented in the table above and represents no change from the 2005 permit.	4/3/12
Part I.A.1 and 2	DO minimum limitation changed from 6.0 mg/L to 5.6 mg/L	In accordance with OWPCA directive. See Part 28 of the Fact Sheet.	4/3/12
Part I.A.1 and 2	TP monitoring frequency revised from "2/Month" to "3 Days/Week."	To be consistent with the Nutrient GP	4/3/12
Part I.A NOTES	Removed "1/6 Months" and "2/Month" definitions.	No longer applied as a monitoring frequency and therefore irrelevant.	4/3/12
Part I.C.1.	O&M Special Condition Updated	In accordance with Central Office directive (4/3/12).	4/3/12
Part I.C.2	Licensed Operator requirement narrative revised.	To reflect the new name of the Board as "Board for Waterworks and Wastewater Works Operators *and Onsite Sewage System Professionals*."	4/3/12
Part I.C.6.f	Compliance Reporting additional instructions	Deleted in accordance with 1/31/12 PRO Staff Decisions.	4/3/12

Permit Section	Change	Reason for Change	Date
Part I.C.7	Materials Storage/Handling: added "consistent with Best Management Practices."	In accordance with GM10-2003; IN-2.	4/3/12
Part I.H.4	Supplement to the LTCP removed.	Because this condition is not required for the permit to be consistent with the TMDL.	5/2/12
Part I.A.1 and 2	TRC limitation	Deleted limitation and monitoring as chlorine disinfection replaced UV disinfection in December 2012.	9/26/12
Part I.A. Footnote (3)	Reference to Part I.B	Footnote revised to reflect new Alternate Disinfection condition, and the footnote was transferred from the deleted TRC parameters to the *E. coli* parameters in the Part I.A.1 and 2 tables,	9/26/12
Part I.B	Alternate Disinfection Limitations and Monitoring Requirements	Revised this condition to reflect UV disinfection as the existing method of disinfection and providing an alternate option for TRC disinfection.	9/26/12
Part I.H.1.d	Combined Sewer System – Maximize Flow to the WWTP for Treatment	Expanded special condition to address alternate operating scenarios and authorized bypasses.	1/3/13
Part I.A.3	Added Outfall 041.	See Part 18 of the FS for rationale	1/3/13

25. Variances/Alternate Limits or Conditions:

a. Waivers for testing requirements of the EPA Form 2A: Total recoverable metals testing replaced with dissolved metals testing

A waiver request for the above item was received on November 26, 2007. In accordance with the MOU regarding permit and enforcement programs, the Regional Administrator for US EPA Region III was advised via letter dated December 4, 2007 that the State Water Control board intended to grant waivers for three testing requirements (see **Attachment K**). Since no comments or objections were received within 29 days, the application process was deemed acceptable to the Regional Administrator, and in accordance with the VPDES permit Regulations 9 VAC 25-31-100.E.4, DEQ has granted the waiver.

b. The "95% Flow" provisions contained in 9 VAC 25-31-200, B.4. were waived prior to the 1997 permit cycle in lieu of the provisions in the permit and Consent Special Order requiring that the permittee maximize flow to the POTW during wet weather conditions. This waiver is continued on the original basis as well as the EPA CSO Policy issued on April 11, 1994.

c. The storm water provisions for major POTW's was not considered to be applicable because all storm water from the site enters the Gordon Ave. sewer which runs to the head of the plant or overflows through a permitted outfall (outfall #021).

26. Public Notice Information required by 9 VAC 25-31-280 B:

Comment period: Publishing Newspaper: *Richmond Times- Dispatch & Richmond Free Press*
Publication Dates: 5/30/13 and 6/6/13
Start Date: 5/30/13 End Date: 7/1/13

All pertinent information is on file and may be inspected and copied by contacting Emilee Adamson at:

Virginia Department of Environmental Quality (DEQ)
Piedmont Regional Office
4949-A Cox Road
Glen Allen, Virginia 23060-6296

Telephone Number 804/527-5072
Facsimile Number 804/527-5106
Email Emilee.Adamson@deq.virginia.gov

DEQ accepts comments and requests for public hearing by e-mail, fax or postal mail. All comments and requests must be in writing and be received by DEQ during the comment period. Submittals must include the names, mailing addresses and telephone numbers of the commenter/requester and of all persons represented by the commenter/requester. A request for public hearing must also include: 1) The reason why a public hearing is requested. 2) A brief, informal statement regarding the nature and extent of the interest of the requester or of those represented by the requester, including how and to what extent such interest would be directly and adversely affected by the permit. 3) Specific references, where possible, to terms and conditions of the permit with suggested revisions. A public hearing may be held, including another comment period, if public response is significant, based on individual requests for public hearing, and there are substantial, disputed issues relevant to the permit. The public may review the draft permit and application at the DEQ Piedmont Regional Office by appointment or may request copies of the documents from the contact person listed above.

Public Notice Comments: None received.

27. Additional Comments:

a. Previous Board Action: A series of Special Consent Orders and amendments have been issued to the City of Richmond. The orders address how the City of Richmond will implement various plans to control discharges from CSOs.

b. Staff Comments:

- As this facility is under an active Special Consent Order, performance-based monitoring reduction is not appropriate with this permit reissuance per the permit manual. See Attachment L.

- This facility discharges to a receiving stream section with the special standards “a,” “z,” “EWS-11” and “bb.” The facility does not discharge to shellfish waters, therefore, special condition “a" does not apply. Because the location of outfall 001 is not within the designated boundaries, special standards “z” and “EWS-11” do not apply. Special standard “bb” involves chlorophyll a. The nutrient general permit and Richmond Crater WQMP allocations adequately address chlorophyll a concerns while a TMDL is under development (see Item 28 below).

- Financial assurance does not apply to this facility because it is a POTW.

- A registration statement for the nutrient general permit has been received and the associated general permit issued as VAN040085.

- In accordance with an email received from CO staff on April 24, 2008, Part I.E.2 was revised to require only one copy of the WET test be submitted with the original; two copies (as per GM 00-2012) are no longer necessary.

- Due to the nature of the flow tiering in this permit, the permittee is not able to report through the Agency's eDMR system. Hard copy DMR will be distributed with the permit reissuance.

- 2012 annual fees were deposited September 12, 2012.

- The discharge is in conformance with the existing planning documents for the area.

- The permittee is a participant in the Virginia Environmental Excellence Program with E3 status.

- This permit action is not controversial and the permittee is currently meeting all required effluent limitations.

- The permit expiration date is set as the last day of the month just shy of a five year permit duration. This change is in accordance with a regional initiative to adjust permit cycles to include complete calendar months. The initiative will facilitate smoother monitoring transitions between cycles.

- The City of Richmond Chief Administrative Office, President of the Richmond City Council, and Executive Director of the Richmond Regional Planning District Commission were notified of the public comment period on June 4, 2013 in accordance with the Code of Virginia, §62.1-44.15:01.

- Notification of the expanding discharge (Outfall 041) was sent January 3, 2013 to the Henrico County Manager, City of Richmond Chief Administrative Officer and riparian landowners ½ mile downstream and ¼ mile upstream of the discharge. This local government and riparian owner notification was performed in accordance Section 62.1-44.15:4 D of the State Water Control Law.

c. Owner Comments: Owner comments on the draft permit were received March 7, 2011, September 5, 2012 and December 6, 2012. See Table 5 for changes made to the permit in response to owner comments.

d. EPA Comments: The draft permit was sent to EPA for review February 18, 2013. A general objection from EPA dated March 20, 2013 was received on March 25, 2013. The general objection provided a 90 day review extension. Final comments were received via email May 16, 2013. EPA commented in regard to Part I.C.12 of the permit, acknowledging that technology based concentration limitation are based on Virginia regulations (9VAC25-40-70) and do not supersede any requirements established to comply with the Clean Water Act, including Virginia's General Permit for Nutrients in the Chesapeake Bay, or local or Chesapeake Bay TMDLs. EPA indicated that they would not be providing a specific objection to the draft permit; consequently, no revisions to the draft permit were necessary.

e. VDH Comments: By letter received September 24, 2009, the VDH stated that there are no public water supply intakes within 15 miles downstream of the discharge. They also indicated that the aquifer recharge area from the wells in eastern Henrico is immediately east of the City of Richmond and downstream from the Richmond WWTP discharge.

f. Integrated Planning: In the EPA "Integrated Municipal Stormwater and Wastewater Planning Approach Framework" Memorandum dates June 5, 2012, EPA establishes guidance and a framework for an integrated approach to compliance with the Clean Water Act (CWA) for municipalities. The memo provides principles, scope and plan elements to ensure compliance with state and federal water quality objectives. The City of Richmond intends to use the integrated planning process in section III of the memo that will identify a

prioritized critical path to achieve CWA water quality objectives. The City of Richmond plans to identify efficiencies in implementing competing requirements that may arise from separate wastewater and stormwater projects, including capital investments and operation and maintenance requirements. The City of Richmond also intends to include more sustainable and comprehensive solutions, such as green infrastructure in the plan. The City of Richmond's approach will consider wastewater treatment plant upgrades, combined sewer operations, stormwater and CWA projects applicable to drinking water. The City of Richmond intends to utilize the principles and elements outlined in the planning guidance during the term of this permit.

28. 303(d) Listed Segments (TMDL): This facility discharges directly to the James River. The James River stream segment receiving the effluent is listed for not supporting the Recreation, Aquatic Life, and Fish Consumption Uses in Category 5A of the 2010 approved 303(d) list. The segment is listed as impaired for *E.coli*, Submerged Aquatic Vegetation, chlorophyll a, and PCBs. See Attachment C for additional details regarding the assessment, impairments and TMDL fact sheets.

The James River – City of Richmond TMDL was approved 11/4/10 by the EPA. The WWTP received an *E. coli* WLA of 4.44E+14 cfu/year. An *E. coli* limitation of 126N/100mL, consistent with the TMDL is assigned in Part I.A of the permit. The CSOs received several WLAs to address the multiple locations: 3.08E+12cfu/year for Almond Creek; 2.23E+12 cfu/year for Gillie Creek; 2.99E+15cfu/year for lower nontidal James River segment; and 3.04E+13 cfu/year for the tidal James River segment. Per the approved TMDL: "The WLAs associated with the combined sewer system will be addressed through the performance standards for the facilities in the approved LTCP in the City of Richmond. If WQS are not attained after the completion of the CSO LTCP as determined by post-construction monitoring, additional steps may be required per EPA's CSP Policy at IV.B.2.g." Therefore, the permit is consistent with the TMDL.

No limit for PCBs is included in the permit because the facility has provided analytical data using EPA approved method 608 indicating PCBs were not detected at quantification levels in the effluent. To date, the City has not participated in reporting PCBs using low level method 1668, as part of the PCB TMDL development process.

The permit contains a re-opener condition that may allow these limits to be modified, in compliance with Section 303(d)(4) of the Act once a TMDL is approved.

This facility discharges directly to the James River in the Chesapeake Bay watershed in the Upper Tidal Freshwater James River segment (JMSTF2). The receiving stream has been addressed in the Chesapeake Bay TMDL, approved by EPA on December 29, 2010. The TMDL addresses dissolved oxygen (DO), chlorophyll a, and submerged aquatic vegetation (SAV) impairments in the main stem Chesapeake Bay and its tidal tributaries by establishing non-point source load allocations (LAs) and point-source waste load allocations (WLAs) for Total Nitrogen (TN), Total Phosphorus (TP) and Total Suspended Solids (TSS) to meet applicable Virginia Water Quality Standards contained in 9VAC25-260-185. This facility is considered a Significant Chesapeake Bay wastewater discharge. All Significant Chesapeake Bay wastewater discharges in the Upper Tidal Freshwater James River segment (JMSTF2) have been assigned aggregate WLAs of 4,454,769.63 pounds per year TN, 370,167.48 pounds per year TP, and 45,474,581.82 pounds per year TSS.

Implementation of the Chesapeake Bay TDML is currently accomplished in accordance with the Commonwealth of Virginia's Phase I Watershed Implementation Plan (WIP), approved by EPA on November 29, 2010. The approved WIP recognizes that the TMDL nutrient WLAs for Significant Chesapeake Bay wastewater dischargers are set in two regulations: 1) the Water Quality Management Planning Regulation (9VAC25-720); and 2) the "General VPDES Watershed Permit Regulation for Total Nitrogen and Total Phosphorus Discharges and Nutrient Trading in the Chesapeake Bay Watershed of Virginia" (9VAC25-820). The WIP further outlines that since TSS discharges from wastewater facilities represent an insignificant portion of the

Bay's total sediment load, they may be considered in the aggregate. The WIP also states that wastewater discharges with technology-based TSS limits are considered consistent with the TMDL. In accordance with the WIP, Combined Sewer System (CSS) allocations are to be set at Long Term Control Plan (LTCP) levels with adjustments for future urban storm water management actions that may reduce the amount of CSS loadings.

40 CFR 122.44(d)(1)(vii)(B) requires permits to be written with effluent limits necessary to meet water quality standards and to be consistent with the assumptions and requirements of applicable WLAs. DEQ has provided coverage under the VPDES Nutrient General Permit (GP) for this facility under permit **VAN040085**. The requirements of the Nutrient GP currently in effect for this facility are consistent with the Chesapeake Bay TMDL. This individual permit includes technology-based TSS limits not exceeding 27 mg/L that are also consistent with the Chesapeake Bay TMDL and WIP.

For Combined Sewer Systems, Appendix X of the Chesapeake Bay TMDL allows for a staged implementation approach only within the James River in order to meet the aggregate WLAs since existing information suggests that these loads may not be achieved prior to 2018. Since this will be beyond the reissued permit term, monitoring & reporting only is required for the CS-C load in this permit renewal. In order to comply with the TMDL WLAs, the loads from the DWF and CS-C flow will be converted into annual average concentration based effluent limits for TN and TP. These concentrations will be applied to the total flow from the WWTP and will be consistent with the EPA Chesapeake Bay model input data necessary to meet water quality standards for the critical time period and critical flow condition evaluated by the TMDL. These limits will be incorporated into the next individual permit renewal in order to comply with the aggregate WLAs, and compliance will be required as soon as possible pursuant to 40 CFR 122.47.

In addition, the individual permit has limits for cBOD5, ammonia and DO consistent with the RCWQMP that provide protection of instream DO concentrations to at least 5.0 mg/L. However, implementation of the full Chesapeake Bay WIP, including GP reductions combined with actions proposed in other source sectors, is expected to adequately address ambient conditions such that the proposed effluent limits of this individual permit are consistent with the Chesapeake Bay TMDL, and will not cause an impairment or observed violation of the standards for DO, chlorophyll a, or SAV as required by 9VAC25-260-185.

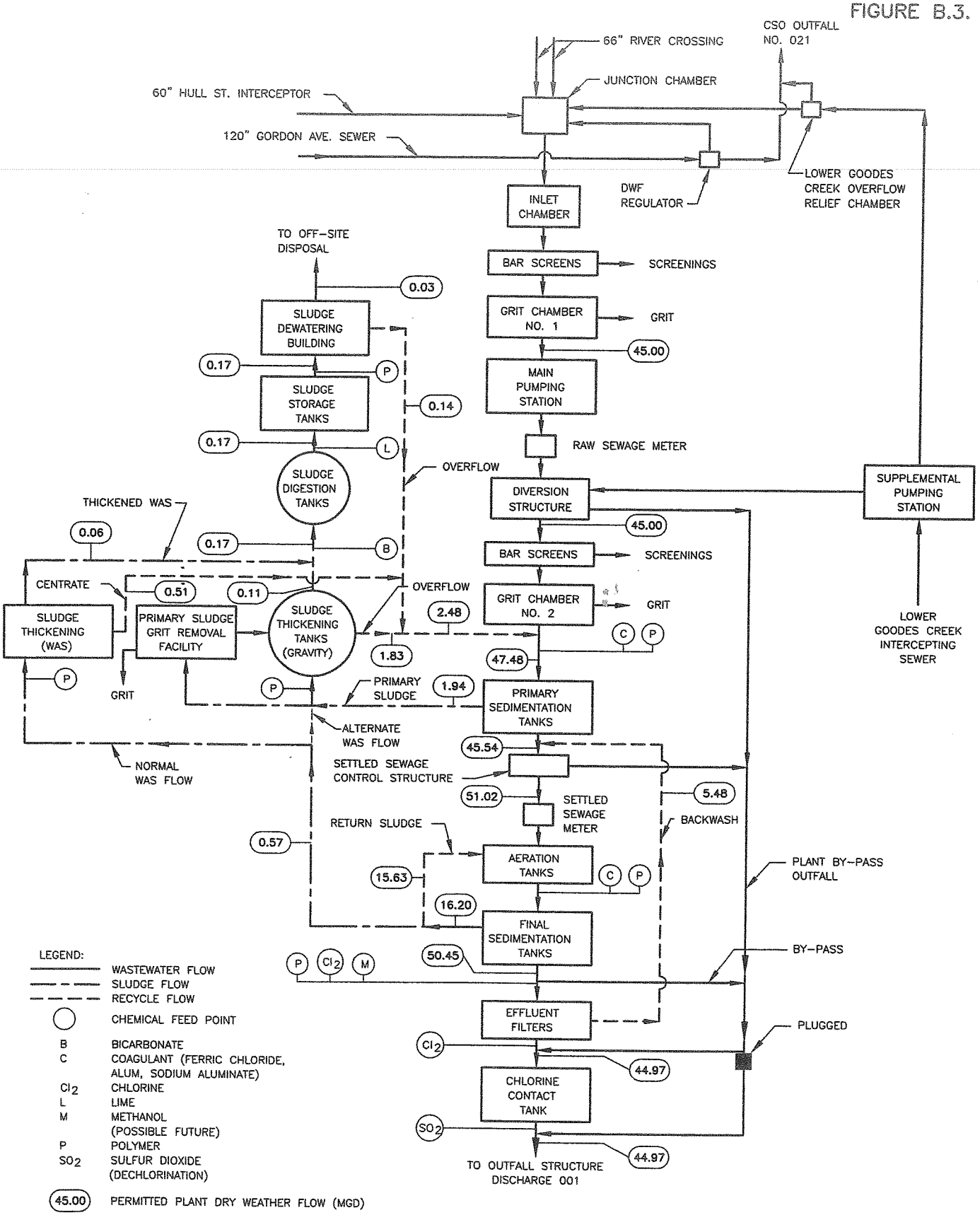
29. Summary of attachments to this Fact Sheet:

Attachment A	Facility Diagrams
Attachment B	Location
Attachment C	Ambient Data
Attachment D	Site Visit
Attachment E	Effluent Data
Attachment F	CORMIX Model Approval Memorandum
Attachment G	Effluent Limitation Analysis
Attachment H	Richmond Crater Water Quality Management Plan
Attachment I	WET Testing Evaluation and Memorandum
Attachment J	CSS Maps
Attachment K	Application Waivers
Attachment L	Consent Order

Attachment A

Facility Diagrams

FIGURE B.3.



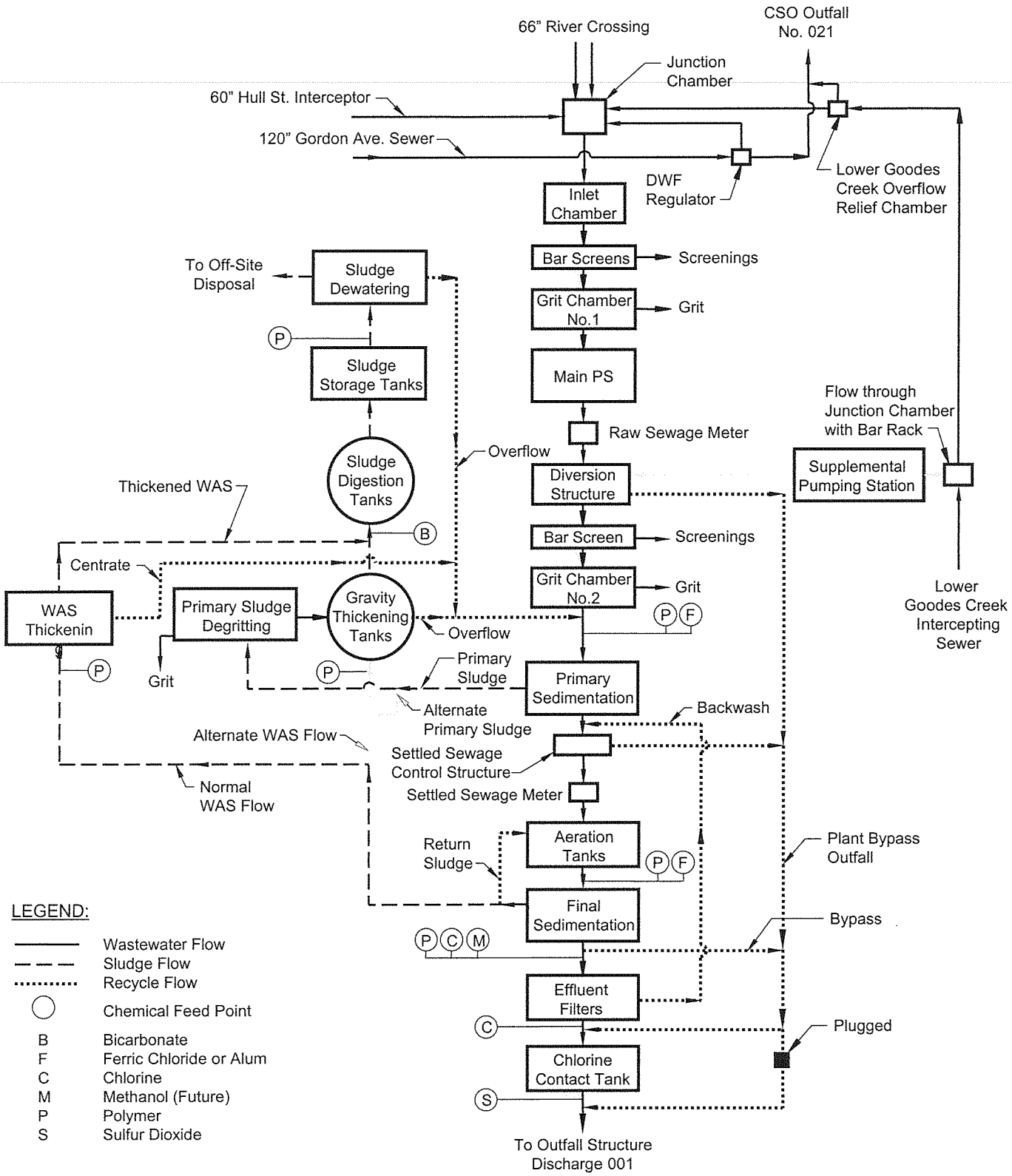
WWTP FLOW DIAGRAM AND WATER BALANCE

CITY OF RICHMOND, VIRGINIA
DEPARTMENT OF PUBLIC UTILITIES
VPDES PERMIT REISSUANCE APPLICATION

GREELEY AND HANSEN LLC

FILE: S:\CLIENTS\RICH\0217E\VPDES\DWGS\FIGURE B.3 1:1 05/20/02 11:57 GH-F

Appendix A - Exhibit 1

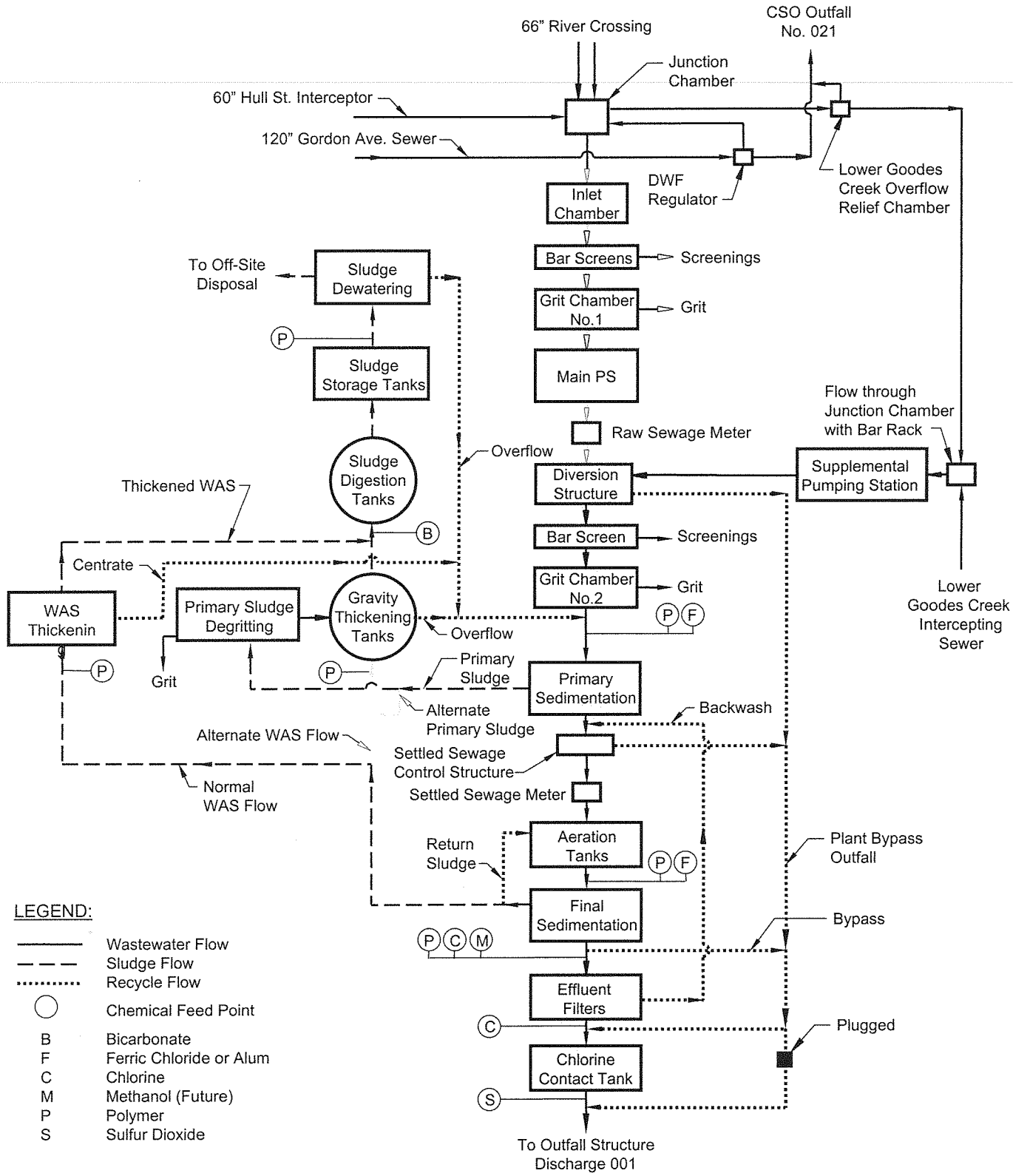


Richmond Wastewater Treatment Plant
Flow Sheet: Normal Operation

City of Richmond, Virginia
Department of Public Utilities
August 2009

Greeley and Hansen LLC

Appendix A - Exhibit 2

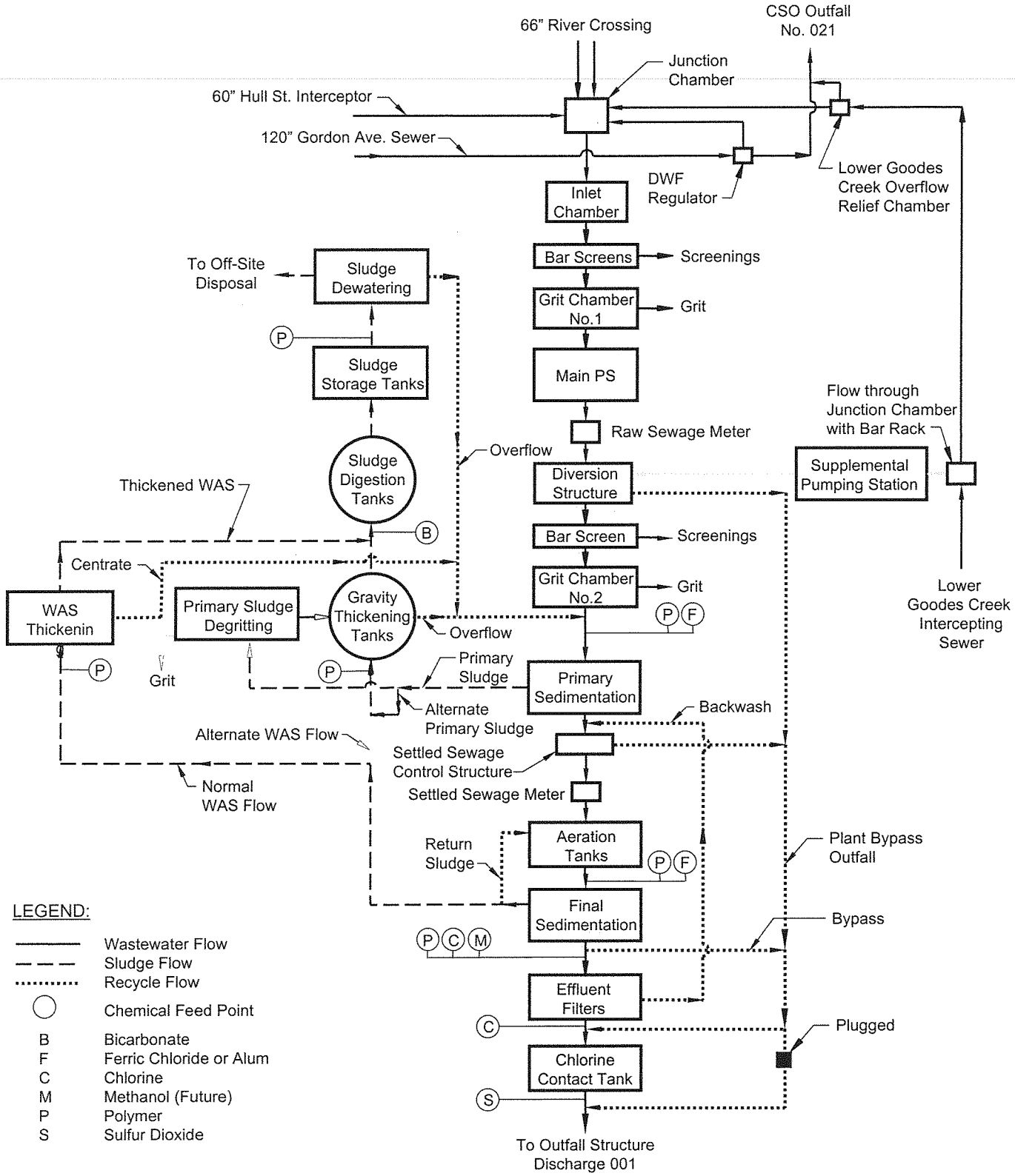


Richmond Wastewater Treatment Plant
Flow Sheet: Main Pumping Station Out of Service

City of Richmond, Virginia
Department of Public Utilities
August 2009

Greeley and Hansen LLC

Appendix A - Exhibit 3



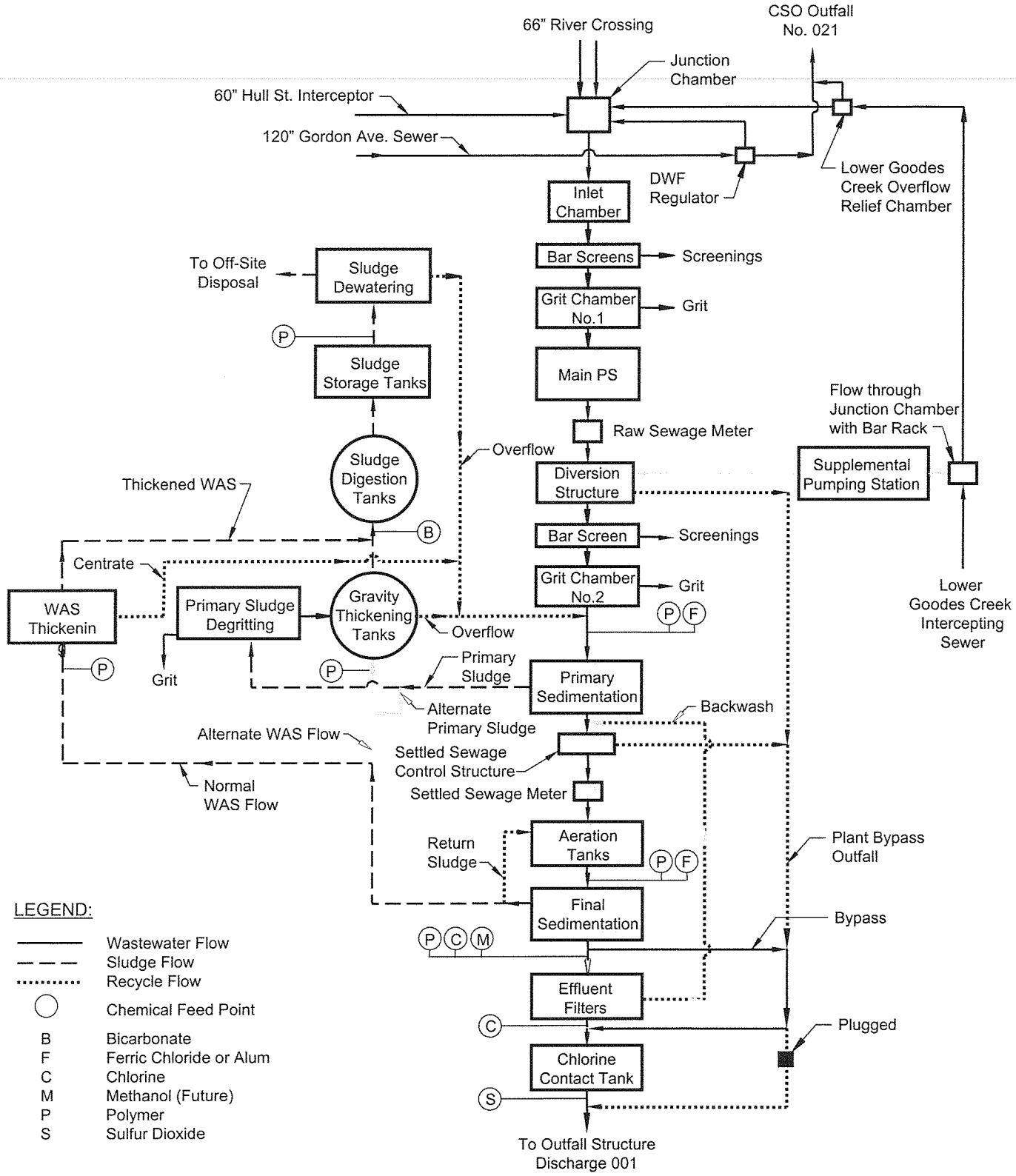
Richmond Wastewater Treatment Plant

Flow Sheet: Primary Sludge Degritting Out of Service

City of Richmond, Virginia
Department of Public Utilities
August 2009

Greeley and Hansen LLC

Appendix A - Exhibit 4

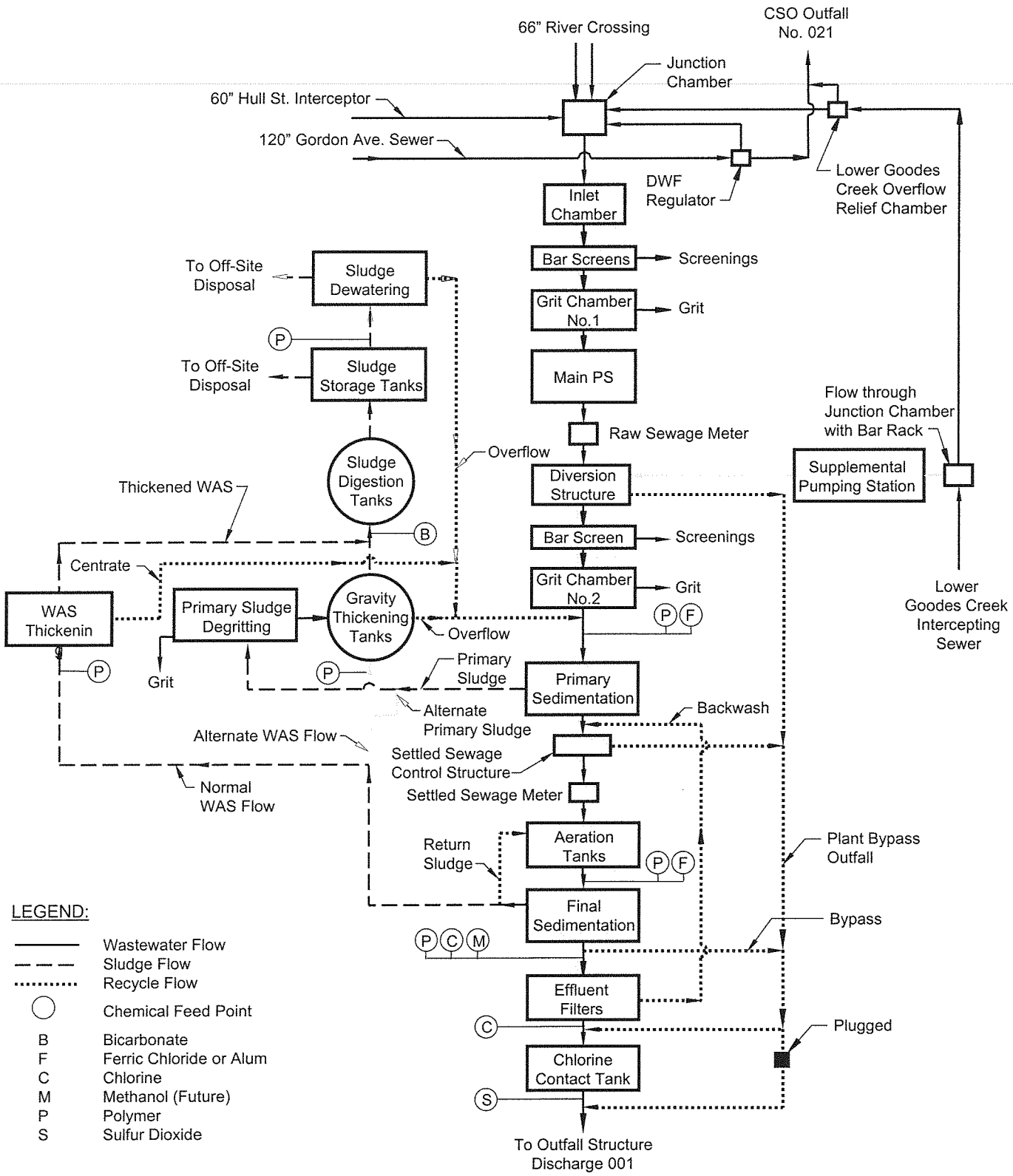


Richmond Wastewater Treatment Plant
Flow Sheet: Bypass Effluent Filter

City of Richmond, Virginia
Department of Public Utilities
August 2009

Greeley and Hansen LLC

Appendix A - Exhibit 5

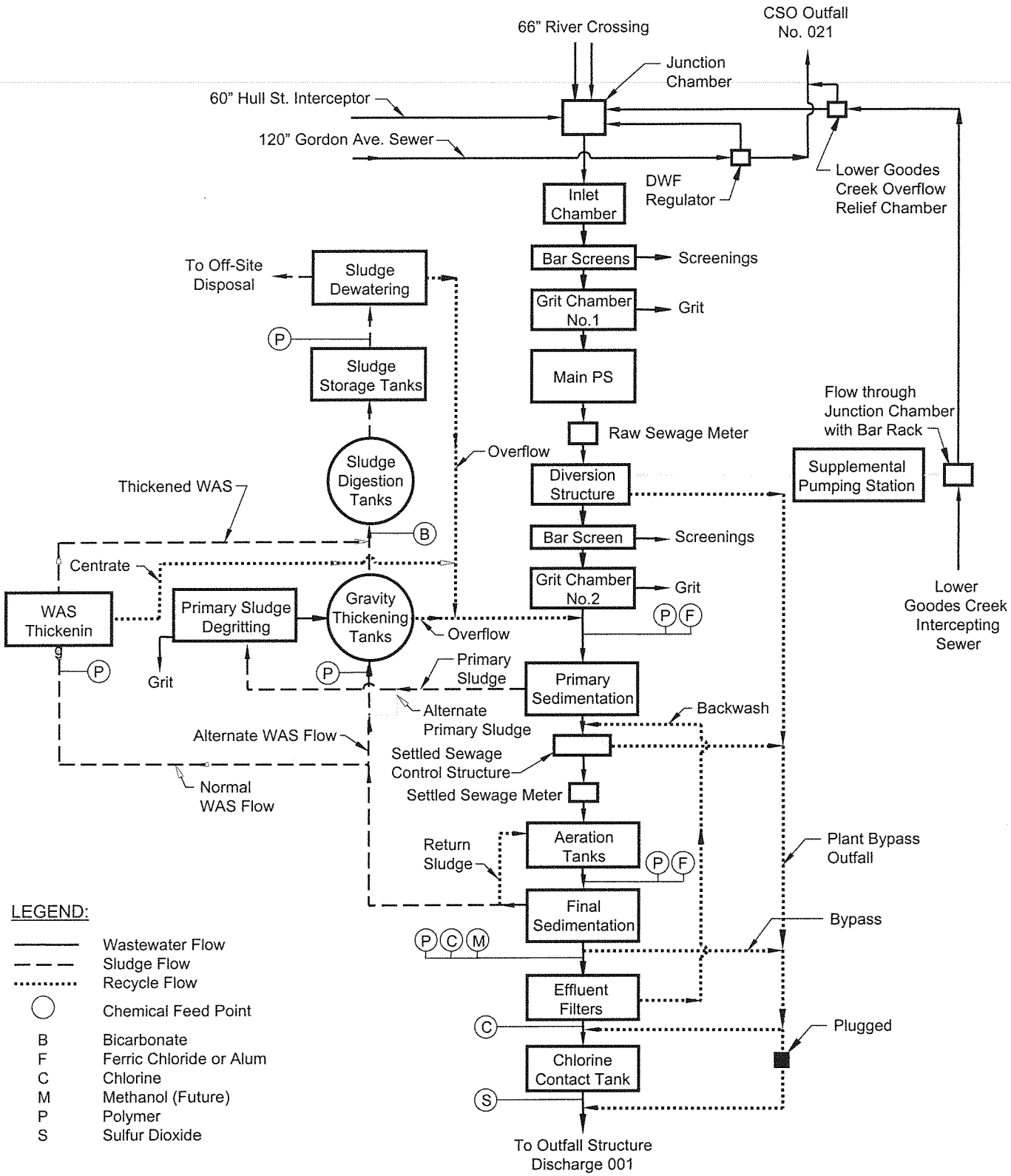


Richmond Wastewater Treatment Plant
Flow Sheet: Sludge Dewatering Out of Service

City of Richmond, Virginia
Department of Public Utilities
August 2009

Greeley and Hansen LLC

Appendix A - Exhibit 6

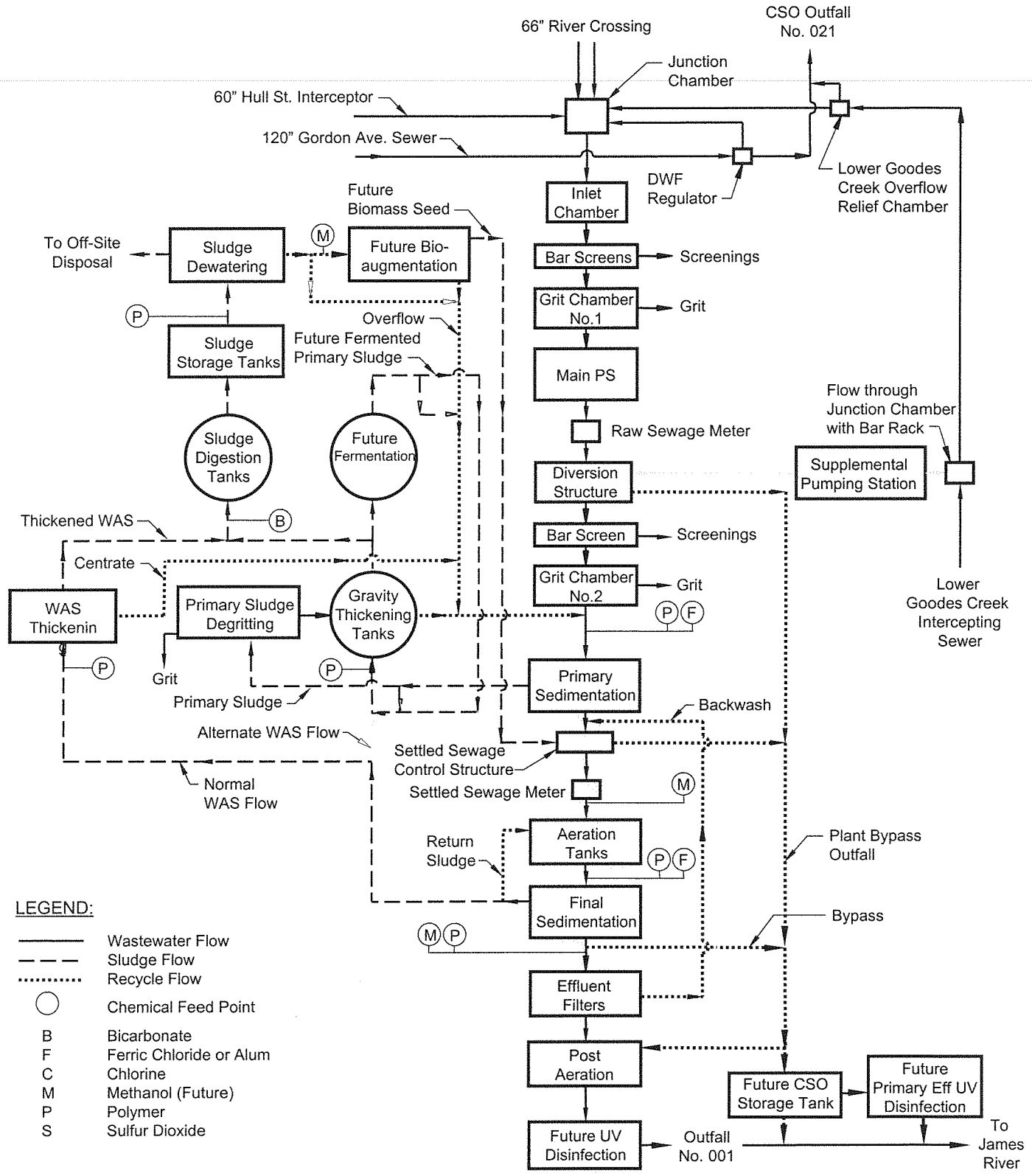


Richmond Wastewater Treatment Plant
Flow Sheet: WAS Thickening Out of Service

City of Richmond, Virginia
Department of Public Utilities
August 2009

Greeley and Hansen LLC

Appendix A - Exhibit 7

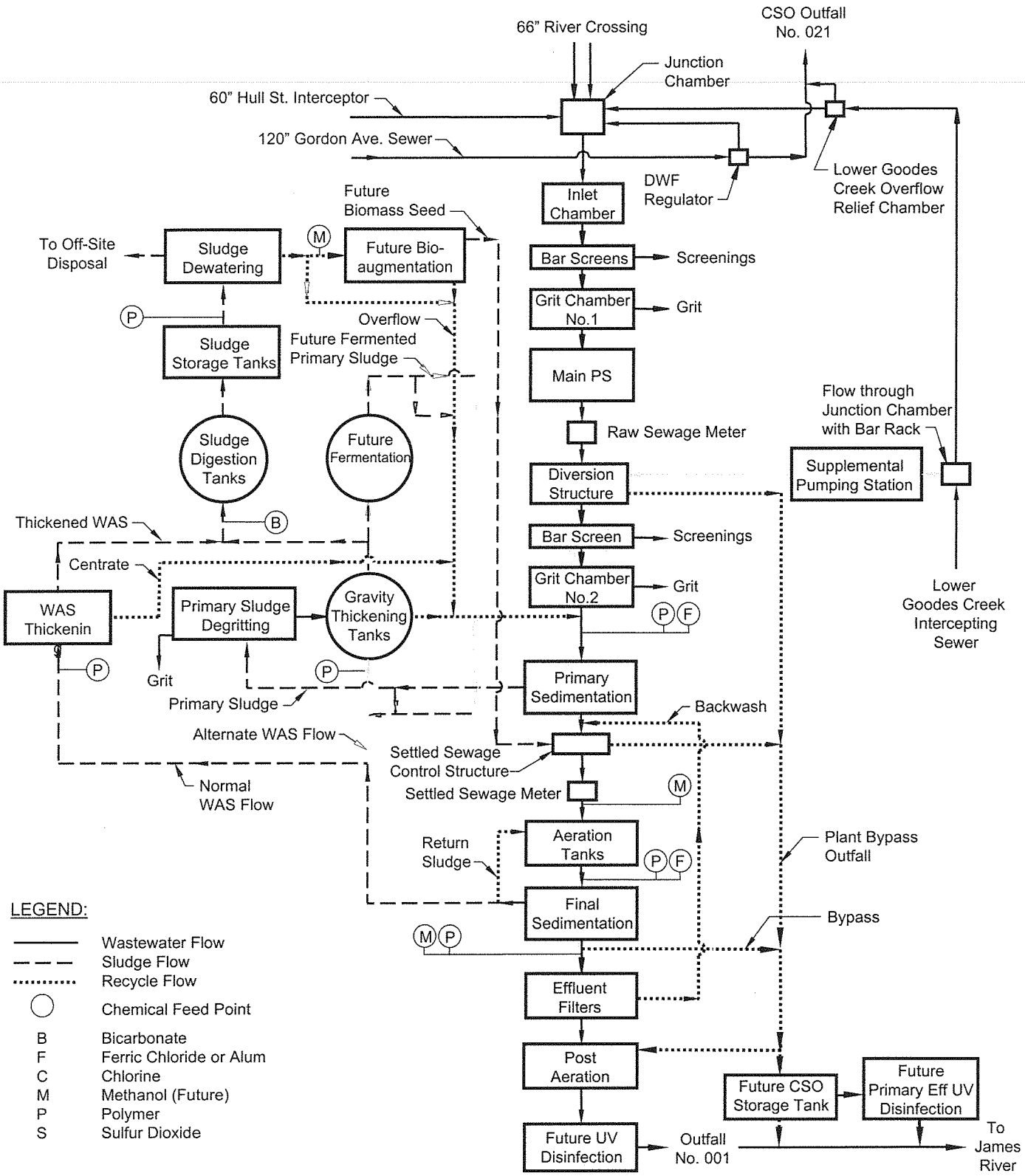


Richmond Wastewater Treatment Plant
Flow Sheet: Future Normal Operation

City of Richmond, Virginia
Department of Public Utilities
August 2009

Greeley and Hansen LLC

Appendix A - Exhibit 8

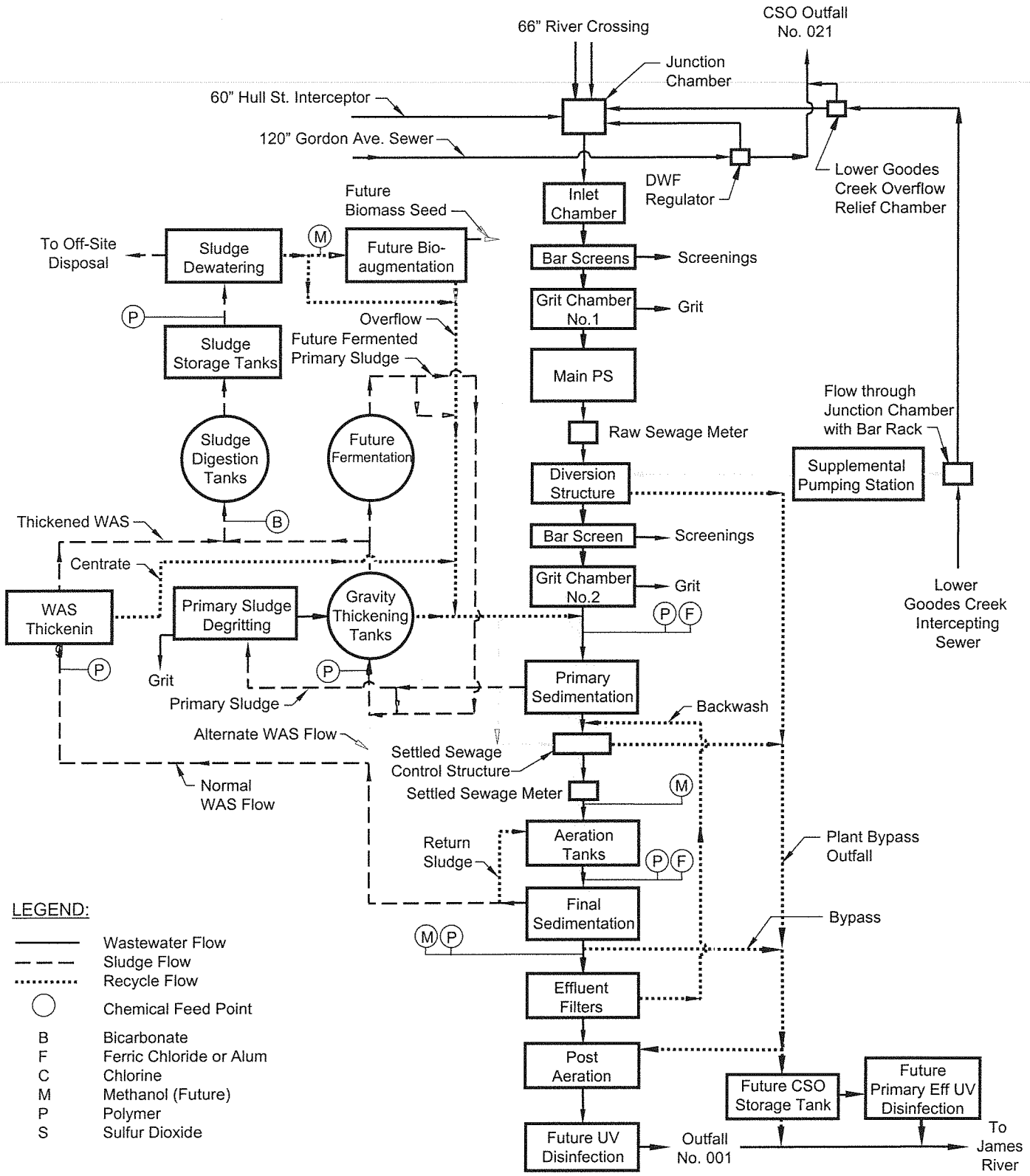


Richmond Wastewater Treatment Plant
Flow Sheet: Future with Fermentation Out of Service

City of Richmond, Virginia
Department of Public Utilities
August 2009

Greeley and Hansen LLC

Appendix A - Exhibit 9

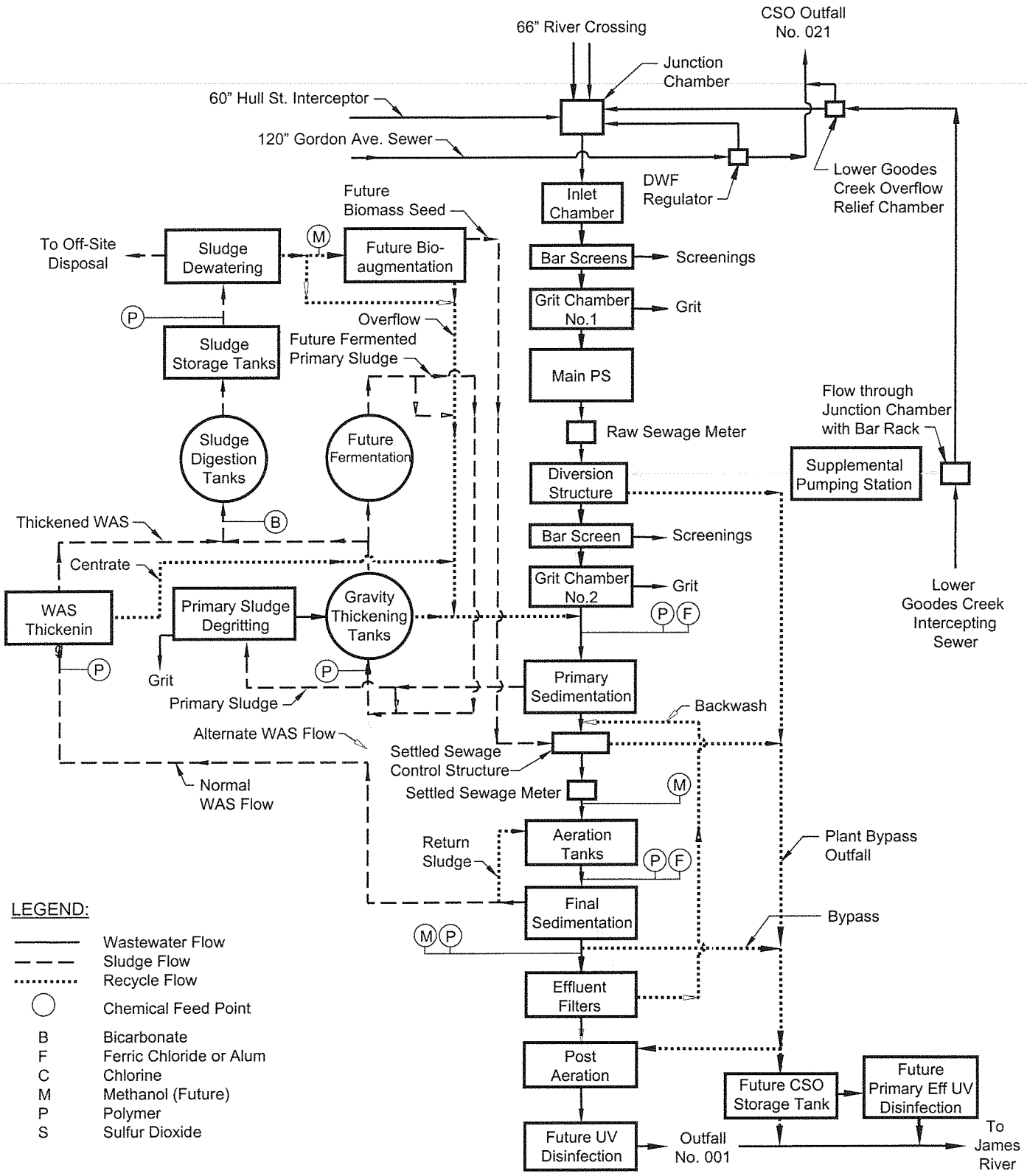


Richmond Wastewater Treatment Plant
Flow Sheet: Future with Bioaugmentation Out of Service

City of Richmond, Virginia
Department of Public Utilities
August 2009

Greeley and Hansen LLC

Appendix A - Exhibit 10

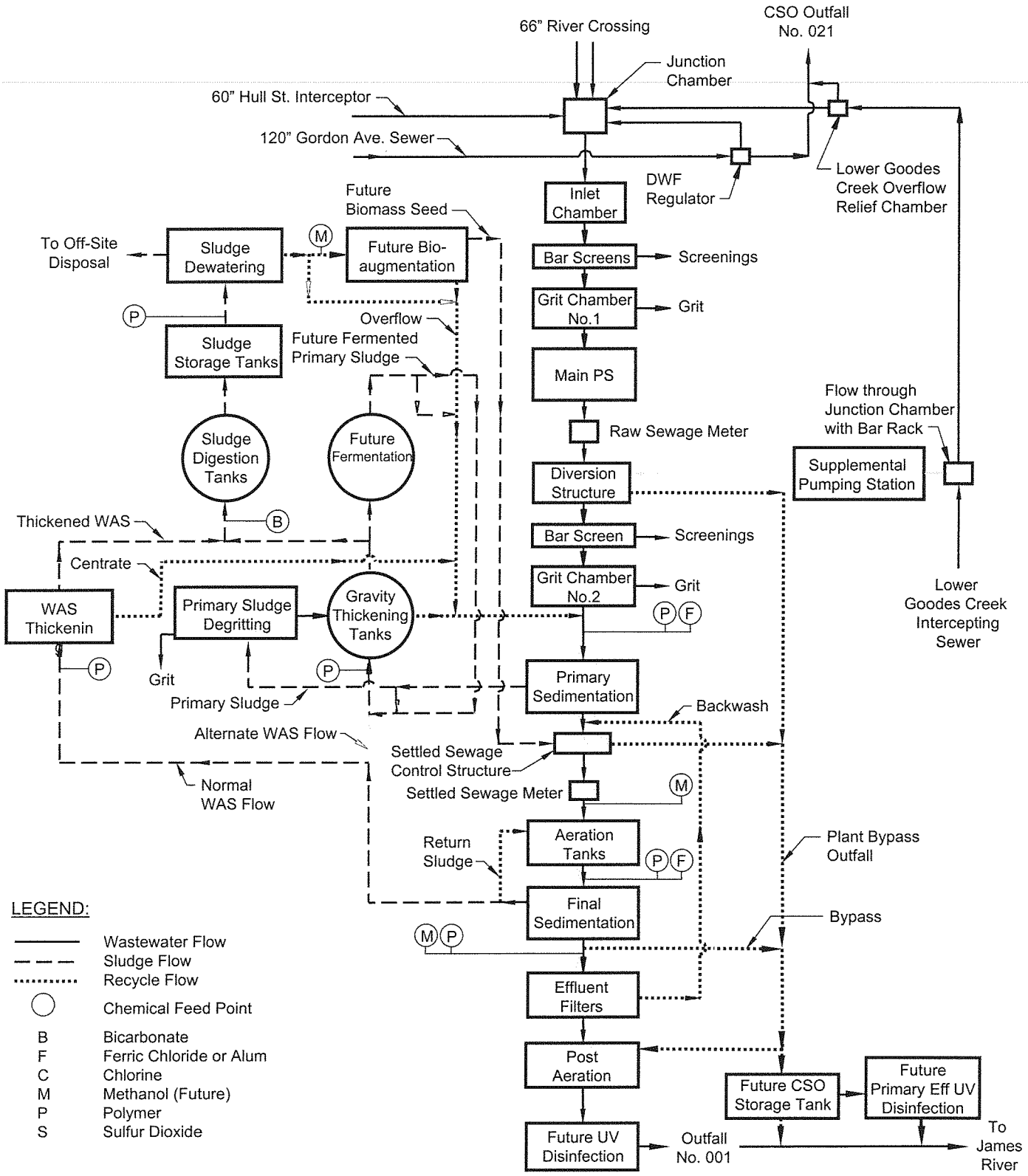


Richmond Wastewater Treatment Plant
Flow Sheet: Future with Filters Out of Service

City of Richmond, Virginia
Department of Public Utilities
August 2009

Greeley and Hansen LLC

Appendix A - Exhibit 11



Richmond Wastewater Treatment Plant

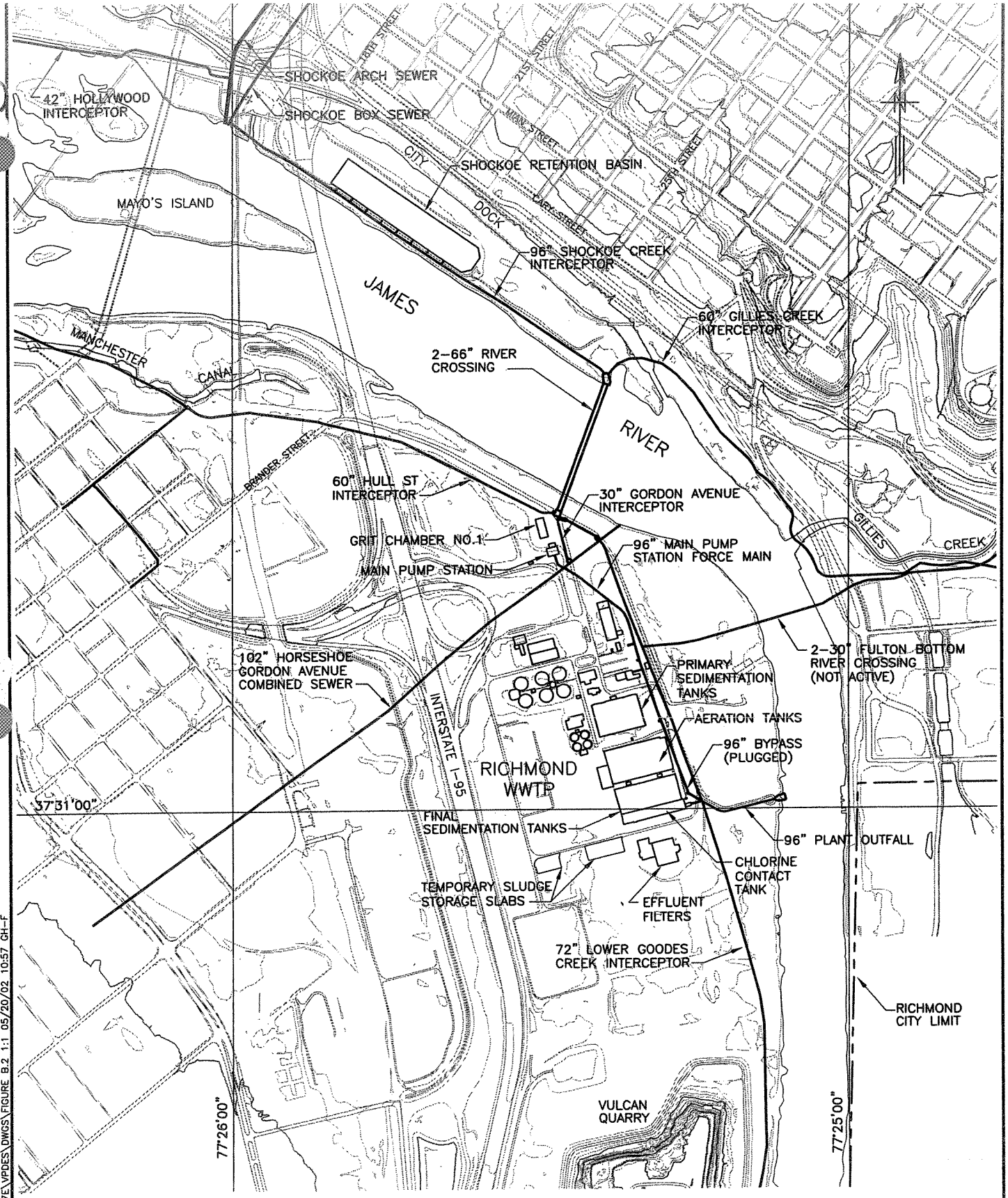
Flow Sheet: Future with Testing of Primary Effluent UV Disinfection

City of Richmond, Virginia
Department of Public Utilities
August 2009

Greeley and Hansen LLC

Attachment B

Location



TOPOGRAPHICAL MAP OF RICHMOND WWTP

SCALE: 1"=1000'

CITY OF RICHMOND, VIRGINIA
DEPARTMENT OF PUBLIC UTILITIES
VPDES PERMIT REISSUANCE APPLICATION

GREELEY AND HANSEN LLC

FILE: 0217E\VPDES\DWGS\FIGURE B.2 1:1 05/20/02 10:57 GH-F

Attachment C

Ambient Data

MEMORANDUM

DEPARTMENT OF ENVIRONMENTAL QUALITY
Piedmont Regional Office
4949-A Cox Road Glen Allen, Virginia 23060

SUBJECT: Flow Frequency Determination
City of Richmond WWTP – VA0063177

TO: Gina Kelly, P.E.

FROM: Jennifer Palmore, P.G.

DATE: October 6, 2009

COPIES: File

The City of Richmond's wastewater treatment plant discharges to the James River in Richmond, VA. Outfall 001 is located at rivermile 2-JMS108.83. Flow frequencies have been requested at this site for use in developing effluent limitations for the VPDES permit.

The flow frequencies were developed based on a drainage area comparison between the fall line and the USGS continuous record gage on the James River at the Route 45 bridge in Cartersville (#02035000). Because the discharge is in close proximity to the fall line, the flow is considered approximately equal. The Cartersville gage has been in operation from 1898 through present. However, because the flow in the James is currently regulated by guaranteed released from Gathwright Dam (Lake Moomaw), the flow frequencies for the gage were developed by the Charlottesville office based on data since 1979 only. The data for the reference gage and the fall line are presented below.

James River at Cartersville, VA (#02035000):
Statistical period: 1980-2003
High Flow months: January - May
Drainage area: 6,257 mi^2

1Q30 = 540 cfs	High Flow 1Q10 = 1530 cfs
1Q10 = 638 cfs	High Flow 7Q10 = 1810 cfs
7Q10 = 717 cfs	High Flow 30Q10 = 2220 cfs
30Q10 = 918 cfs	HM = 3020 cfs
30Q5 = 1020 cfs	

James River at fall line:
Drainage Area: 6,755 mi^2

1Q30 = 583 cfs (377 MGD)	High Flow 1Q10 = 1652 cfs (1068 MGD)
1Q10 = 689 cfs (445 MGD)	High Flow 7Q10 = 1954 cfs (1263 MGD)
7Q10 = 774 cfs (500 MGD)	High Flow 30Q10 = 2397 cfs (1549 MGD)
30Q10 = 991 cfs (641 MGD)	HM = 3260 cfs (2107 MGD)
30Q5 = 1101 cfs (712 MGD)	

This analysis does not address withdrawals, discharges, or springs influencing the flow of the James River between Cartersville and the fall line.

The segment of the James River to which the city discharges was considered a Category 5A water (impaired and needing a TMDL) during the 2008 Water Quality Assessment. The applicable fact sheets are attached. The river is impaired for the Recreation Use due to E. coli violations; this TMDL is currently under development and includes draft wasteload allocations of 1.48E+14 E. coli cfu/year and 4.06E+11 E. coli cfu/day for the wastewater plant outfall 001. (The Combined Sewer Overflows receive separate, additional allocations.) The Fish Consumption Use is impaired due to a VDH Fish Consumption Advisory for PCBs; this TMDL is due in 2014. The Aquatic Life Use is impaired due to inadequate submerged aquatic vegetation (SAV) in the upper tidal freshwater James River estuary and high chlorophyll a in the James mainstem; the TMDLs are due by 2010 and will be addressed as part of the Chesapeake Bay TMDL.

In addition, mercury exceeded the screening value for fish tissue and the river is under a VDH Fish Consumption Advisory for kepone. These are non-impairing "observed effects". The Wildlife Use was assessed as fully supporting.

The James River between Richmond and Hopewell is considered a Tier 1 water because existing water quality management plans allow the dissolved oxygen to drop to 5.0 mg/L at critical conditions.

Monitoring data for station 2-JMS110.30 is attached. The station is located at Mayo's Bridge, approximately 1.5 miles upstream of the outfall.

If you have any questions concerning this analysis, please let me know.

Adjusted Flows Illustrating Richmond and Henrico Water Treatment Plants (WTPs) Withdrawals

Adjusted Flow = Unadulterated Flow – Withdrawals + Discharges

Ex. Adjusted Flow = 445 MGD – 106.2 MGD Richmond WTP – 38.6 MGD Henrico WTP = 300 MGD

Flow Type	Flow	Adjusted Flow
	Low Flows	
1Q10	445	300
7Q10	500	355
30Q10	641	496
30Q5	712	567
	High Flows	
1Q10	1068	923
7Q10	1263	1118
30Q10	1549	1404
HM	2107	1962

Low flows are from June – December while high flows are from January – May.

City of Richmond Water Withdrawals (MG)

Year	Jan	Feb	Mar	April	May	June	July	Aug	Sept	Oct	Nov	Dec	Annual	Max Day
2003	2549	2253	2447	2425	2460	2461	3028	2852	2670	2783	2345	2269	30542	114.1
2004	2363	2203	2405	2448	2413	2380	2364	2241	2219	2116	1961	2006	27119	108.4
2005	2035	1807	1996	2056	2063	2618	2786	2696	2720	2373	2070	2036	27256	108.6
2006	1897	1687	1938	2154	2416	2584	2620	2813	2160	2016	1762	1820	25867	106.6
2007	1750	1687	1812	1895	2136	2348	2619	2637	2526	2391	1871	1828	25500	98.3
2008	1805	1646	1814	1893	2059	2633	2673	2777	2318	2201	1895	1826	25540	100.9
Mo avg	2066.5	1880.5	2068.7	2145.2	2257.8	2504.0	2681.7	2669.3	2435.5	2313.3	1984.0	1964.2		106.2

Avg Max Day = 106.2 MGD

Henrico County Water Withdrawals (MG)

Year	Jan	Feb	Mar	April	May	June	July	Aug	Sept	Oct	Nov	Dec	Annual	Max Day
2003	0	0	0	5.7	0	0	48.1	467.1	312.5	459.1	523.9	548.8	2365.2	20.6
2004	439	469	354	462	644	623	581	528	496	585	518	465	6164	30
2005	440.4	416.2	439.1	476.2	651.9	858.6	964.5	929.2	1153.1	828.6	640.1	503.7	8301.6	42.6
2006	559.4	537	621.4	749.8	906.5	956.2	1086.1	1202.5	885.9	784.9	612.8	578.5	9481	50.1
2007	574.9	561.6	630.2	740.7	964.4	1056.5	1166	1109.1	1166.2	1126.3	681.8	613.6	10391.3	43.7
2008	611.9	537	604.5	636	795.6	1139.3	1107.4	1180.4	863.5	819.2	556.1	499.6	9350.5	44.7
Mo avg	437.6	420.1	441.5	511.7	660.4	772.3	825.5	902.7	812.9	767.2	588.8	534.9		38.6

Avg Max Day = 38.6 MGD

Summed Avg Max Days = 144.8 MGD

Station ID	Collection Date	Depth	Depth	Temp Celcius	Field Ph	Do Probe	Salinity	Do Winkler
2-JMS110.30	2/18/1968	S	0.3	2.78	8			10.5
2-JMS110.30	4/23/1968	S	0.3	20.56	8.5			7.5
2-JMS110.30	6/18/1968	S	0.3	25.56	8			7.5
2-JMS110.30	7/21/1968	S	0.3	30	8.4			15
2-JMS110.30	8/20/1968	S	0.3	29.44	8			8.3
2-JMS110.30	9/6/1968	S	0.3	25.56	8.5			7.5
2-JMS110.30	10/7/1968	S	0.3	17.78	8.5			5.5
2-JMS110.30	1/20/1969	S	0.3	2.22	7.3			14
2-JMS110.30	4/17/1969	S	0.3	20	7.5			8.2
2-JMS110.30	7/16/1969	S	0.3	27.78	7.7			7.4
2-JMS110.30	2/9/1970	S	0.3	4.44	7.3			12.39
2-JMS110.30	3/24/1970	S	0.3	8.89	6.2			11.19
2-JMS110.30	4/22/1970	S	0.3	14.44	6.8			8.84
2-JMS110.30	5/6/1970	S	0.3	14.44	7.2			8.5
2-JMS110.30	6/29/1970	S	0.3	25	7.9			8.2
2-JMS110.30	7/10/1970	S	0.3	25.56	7.4			7.6
2-JMS110.30	8/20/1970	S	0.3	24.44	7.5			7.8
2-JMS110.30	9/21/1970	S	0.3	26.67	7.5			9.8
2-JMS110.30	10/27/1970	S	0.3	16.67	8.5			10.59
2-JMS110.30	11/23/1970	S	0.3	3.33	5.5			9
2-JMS110.30	12/15/1970	S	0.3	5.56	6.7			12.39
2-JMS110.30	1/18/1971	S	0.3	4.44	7			12
2-JMS110.30	2/14/1971	S	0.3					
2-JMS110.30	3/15/1971	S	0.3	12.78	7.6			11
2-JMS110.30	4/28/1971	S	0.3	14.44	7.3			8.4
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2-JMS110.30	7/8/1971	S	0.3	27.78	8			7.6
2-JMS110.30	8/2/1971	S	0.3	27.78	8.7			8.4
2-JMS110.30	9/23/1971	S	0.3	21.11	8.2			8.2
2-JMS110.30	10/5/1971	S	0.3	22.22	8.1			9.8
2-JMS110.30	11/29/1971	S	0.3	5.56	7.3			13.19
2-JMS110.30	12/20/1971	S	0.3	4.44	7			10.59
2-JMS110.30	1/20/1972	S	0.3	5	7.3			10.39
2-JMS110.30	2/10/1972	S	0.3	1.11				
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2-JMS110.30	4/4/1972	S	0.3	12.22	7.5			10.59
2-JMS110.30	5/5/1972	S	0.3	13.33	6.7			8.4
2-JMS110.30	7/14/1972	S	0.3	27.22	7.8			8.1
2-JMS110.30	8/17/1972	S	0.3	25.56	7.7			9
2-JMS110.30	9/26/1972	S	0.3	24.44	8.2			7.8
2-JMS110.30	10/26/1972	S	0.3	13.33	8.8			10
2-JMS110.30	11/27/1972	S	0.3	6.11	7.2			10.39
2-JMS110.30	12/12/1972	S	0.3	8.89	7			11.39
2-JMS110.30	1/29/1973	S	0.3	6.67	7.2			12.39
2-JMS110.30	2/20/1973	S	0.3	3.33	7.5			13.39
2-JMS110.30	3/30/1973	S	0.3	11.11	7.5			11
2-JMS110.30	4/18/1973	S	0.3	14.44	7.3			9.8
2-JMS110.30	7/2/1973	S	0.3	28.89	7.1			8.8
2-JMS110.30	9/19/1973	S	0.3	22.22	8			8
2-JMS110.30	10/19/1973	S	0.3	17.22	8.6			10.19
2-JMS110.30	10/24/1973	S	0.3	20	8.5			10
2-JMS110.30	11/26/1973	S	0.3	11.67	8.5			10.59
2-JMS110.30	12/5/1973	S	0.3	13.33	7.4			10
2-JMS110.30	1/13/1974	S	0.3	11.11	7.7			11.19
2-JMS110.30	1/22/1974	S	0.3	10	7.4			11.19

Station ID	Collection Date	Depth	Depth	Temp Celcius	Field Ph	Do Probe	Salinity	Do Winkler
2-JMS110.30	3/18/1974	S	0.3	7.22	7			11.39
2-JMS110.30	4/2/1974	S	0.3	14.44	7.5			10.39
2-JMS110.30	5/26/1974	S	0.3	21.11	8.5			8.3
2-JMS110.30	5/27/1974	S	0.3	18.89	7.5			8
2-JMS110.30	6/2/1974	S	0.3		7.5			10.39
2-JMS110.30	6/7/1974	S	0.3	21.67	7.5			8.6
2-JMS110.30	6/27/1974	S	0.3	23.89	8			9
2-JMS110.30	7/21/1974	S	0.3	26.67	8.5			9.6
2-JMS110.30	8/22/1974	S	0.3	27.78	7.7			7.4
2-JMS110.30	9/25/1974	S	0.3	17.78	8			9.2
2-JMS110.30	10/15/1974	S	0.3	18.89	7.5			11.59
2-JMS110.30	11/26/1974	S	0.3	6.67	7			15
2-JMS110.30	1/23/1975	S	0.3	5.56	7.5			14.19
2-JMS110.30	2/7/1975	S	0.3	6.67	7.5			12
2-JMS110.30	3/24/1975	S	0.3	13.33	7			8
2-JMS110.30	4/17/1975	S	0.3	13.89				9.6
2-JMS110.30	5/12/1975	S	0.3	21.11	7.7			9.6
2-JMS110.30	6/9/1975	S	0.3	25.56	8.5			8.2
2-JMS110.30	7/13/1975	S	0.3	24.44	7.5			7.8
2-JMS110.30	8/6/1975	S	0.3		7.8			7.2
2-JMS110.30	9/21/1975	S	0.3	25.56	8.7			8
2-JMS110.30	10/25/1975	S	0.3	17.22	7.9			9.3
2-JMS110.30	11/18/1975	S	0.3	12.22	9			11.39
2-JMS110.30	12/4/1975	S	0.3	10	8			12.79
2-JMS110.30	1/15/1976	S	0.3	4.44	7			14.5
2-JMS110.30	2/11/1976	S	0.3	6.67	7.5			12.79
2-JMS110.30	3/2/1976	S	0.3	14.44	8			10.79
2-JMS110.30	4/7/1976	S	0.3	14.44	8.2			10
2-JMS110.30	5/7/1976	S	0.3	20	9			9.3
2-JMS110.30	6/29/1976	S	0.3		8			8.2
2-JMS110.30	7/16/1976	S	0.3	28.89	8.2			7.9
2-JMS110.30	8/19/1976	S	0.3	25.56	9			9.5
2-JMS110.30	9/17/1976	S	0.3	25	8.8			8.5
2-JMS110.30	10/1/1976	S	0.3	20	7.5			8.2
2-JMS110.30	11/22/1976	S	0.3	7.22	9			12.39
2-JMS110.30	12/17/1976	S	0.3	6.11	7.5			10.19
2-JMS110.30	1/28/1977	S	0.3	3	8.7			13
2-JMS110.30	3/8/1977	S	0.3	11	8			10.19
2-JMS110.30	4/15/1977	S	0.3	13	7.5			8.7
2-JMS110.30	5/27/1977	S	0.3	2.1	8.9			7.6
2-JMS110.30	6/15/1977	S	0.3					
2-JMS110.30	6/17/1977	S	0.3					
2-JMS110.30	7/18/1977	S	0.3	3.3	9			9
2-JMS110.30	8/25/1977	S	0.3	2.5	9			8.6
2-JMS110.30	11/21/1977	S	0.3	0	8			11
2-JMS110.30	3/23/1978	S	0.3	17	7.8			9.8
2-JMS110.30	4/25/1978	S	0.3	16	8.9			8.9
2-JMS110.30	5/23/1978	S	0.3	3	8.5			8.6
2-JMS110.30	6/7/1978	S	0.3	1	9			7.6
2-JMS110.30	8/8/1978	S	0.3		7.5			7
2-JMS110.30	9/8/1978	S	0.3	29	9.3			7.5
2-JMS110.30	10/25/1978	S	0.3	15.5	8			11.6
2-JMS110.30	11/1/1978	S	0.3	17	8.7			8.8
2-JMS110.30	11/1/1978	S	0.3	17	8.7			8.8
2-JMS110.30	1/17/1979	S	0.3	4.5	7.1			11.8
2-JMS110.30	3/16/1979	S	0.3	6	8			11.3

Station ID	Collection Date	Depth	Depth	Temp Celcius	Field Ph	Do Probe	Salinity	Do Winkler
2-JMS110.30	4/5/1979	S	0.3	9	8.8			9.2
2-JMS110.30	6/7/1979	S	0.3	22	7.9			8.7
2-JMS110.30	8/15/1979	S	0.3	26	7.5			9
2-JMS110.30	9/11/1979	S	0.3	22.5	7.8			8.2
2-JMS110.30	10/25/1979	S	0.3	15.5	8.6			9.2
2-JMS110.30	11/27/1979	S	0.3	14	8.4			9.1
2-JMS110.30	12/13/1979	S	0.3	10.5	8			15.2
2-JMS110.30	1/23/1980	S	0.3	6	6.5			11.2
2-JMS110.30	2/5/1980	S	0.3	2.5	8			12.4
2-JMS110.30	3/11/1980	S	0.3	10.5	7.8			10.3
2-JMS110.30	4/8/1980	S	0.3	13.5	7.5			10.8
2-JMS110.30	5/7/1980	S	0.3	17.5	8.2			10.2
2-JMS110.30	6/11/1980	S	0.3	24	8.8			8.1
2-JMS110.30	7/9/1980	S	0.3	24	7.5			7.2
2-JMS110.30	8/7/1980	S	0.3	32.5	9			7
2-JMS110.30	9/11/1980	S	0.3	23	9			9.3
2-JMS110.30	10/9/1980	S	0.3	19.5	9			10.5
2-JMS110.30	12/11/1980	S	0.3	7.5	9			13
2-JMS110.30	2/12/1981	S	0.3	3	8.6			13
2-JMS110.30	3/12/1981	S	0.3	6	7.5			12
2-JMS110.30	4/9/1981	S	0.3	15	8.9			9.7
2-JMS110.30	5/6/1981	S	0.3	20	8.5			8.7
2-JMS110.30	6/9/1981	S	0.3	28	8.4			7.9
2-JMS110.30	7/7/1981	S	0.3	25	8			7.6
2-JMS110.30	8/18/1981	S	0.3	26	8.6			8.5
2-JMS110.30	9/8/1981	S	0.3	26	8.5			8.5
2-JMS110.30	10/20/1981	S	0.3	15	8.7			8.2
2-JMS110.30	11/4/1981	S	0.3	15	8.3			7
2-JMS110.30	12/1/1981	S	0.3	5	7.5			9.7
2-JMS110.30	1/12/1982	S	0.3	0.5	6.8			10.4
2-JMS110.30	2/16/1982	S	0.3	8	7.5			9.7
2-JMS110.30	3/17/1982	S	0.3	12	7.5			9.1
2-JMS110.30	4/21/1982	S	0.3	17.5	7.9			7.6
2-JMS110.30	5/18/1982	S	0.3	26	7.8			6.9
2-JMS110.30	6/22/1982	S	0.3	24	7			6.5
2-JMS110.30	7/19/1982	S	0.3	31	8			7
2-JMS110.30	8/15/1982	S	0.3	26	7.8			6.9
2-JMS110.30	9/22/1982	S	0.3	21	8.8			9.4
2-JMS110.30	10/27/1982	S	0.3	14	7			10.8
2-JMS110.30	11/23/1982	S	0.3	13	8.9			11.7
2-JMS110.30	12/20/1982	S	0.3	12	7.2			12.2
2-JMS110.30	1/20/1983	S	0.3	1	9.3			14.8
2-JMS110.30	2/24/1983	S	0.3	7.5	7.3			12.1
2-JMS110.30	3/10/1983	S	0.3	10	7.3			10.8
2-JMS110.30	4/12/1983	S	0.3	12.5	7.5			10.8
2-JMS110.30	5/10/1983	S	0.3	20.5	9			12.6
2-JMS110.30	6/16/1983	S	0.3	30	8.7			8.5
2-JMS110.30	7/20/1983	S	0.3	33	8			8
2-JMS110.30	7/28/1983	S	0.91					
2-JMS110.30	8/16/1983	S	0.91	25.5	8.6			9.9
2-JMS110.30	8/30/1983	S	0.91					
2-JMS110.30	9/20/1983	S	0.91					
2-JMS110.30	9/21/1983	S	0.3	22.5	9			9.4
2-JMS110.30	9/27/1983	S	0.91					
2-JMS110.30	10/3/1983	S	0.91	20.5	8			6.5
2-JMS110.30	10/12/1983	S	0.91					

Station ID	Collection Date	Depth	Depth	Temp Celcius	Field Ph	Do Probe	Salinity	Do Winkler
2-JMS110.30	11/29/1983	S	0.3	10				11.5
2-JMS110.30	12/22/1983	S	0.3	4	7			13.6
2-JMS110.30	2/14/1984	S	0.3	10.5	7.9			10.9
2-JMS110.30	3/19/1984	S	0.3	11	6.9			10.8
2-JMS110.30	5/25/1984	S	0.3	28	8.1			8.6
2-JMS110.30	5/29/1984	S	0.3	23.5	6.6			9.1
2-JMS110.30	7/11/1984	S	19	24		0.8		
2-JMS110.30	7/11/1984	S	1	24		7.9		
2-JMS110.30	7/12/1984	S	1	29	7.4	8		
2-JMS110.30	7/30/1984	S	0.3	24.5	7.1			8.5
2-JMS110.30	7/31/1984	S	1	26	8.4	9.6	0	
2-JMS110.30	8/2/1984	S	1	25.2	8.5	9.1		
2-JMS110.30	8/15/1984	S	1	25	7.4	8.8		
2-JMS110.30	8/27/1984	S	0.3	25.5	8.5			
2-JMS110.30	8/29/1984	S	1	25.1	8.5	9.1		
2-JMS110.30	9/12/1984	S	1	24	8.2	8.2		
2-JMS110.30	9/25/1984	S	1	24	7.6	9.1		
2-JMS110.30	10/11/1984	S	1	18.5	8.2	9.8	0	
2-JMS110.30	10/18/1984	S	1	19.5		9.5		
2-JMS110.30	10/22/1984	S	0.3	22	6.4			8.8
2-JMS110.30	11/2/1984	S	1	19	8.1	9.5	0	
2-JMS110.30	11/16/1984	S	1		7.6	10.4		
2-JMS110.30	12/12/1984	S	1	4	6.5	13.7	0	
2-JMS110.30	1/29/1985	S	0.3	1.2	7.4			14.2
2-JMS110.30	2/4/1985	S	1	0	6.7	13.8	0	
2-JMS110.30	2/27/1985	S	0.3	12.5	7.1			10.8
2-JMS110.30	3/11/1985	S	1	9	7.8	11.6	0	11.6
2-JMS110.30	3/11/1985	B	2	9		11.6	0	
2-JMS110.30	3/27/1985	S	1	13	8.7	11.1	0	10.4
2-JMS110.30	3/28/1985	S	0.3	16	8.7			11.1
2-JMS110.30	4/10/1985	B	1.5	14		11	0	
2-JMS110.30	4/10/1985	S	1	14	7.3	11	0	10.8
2-JMS110.30	4/22/1985	S	0.3	24.5	8.3			11
2-JMS110.30	4/24/1985	S	1	25	8.4	8.6	0	8.3
2-JMS110.30	5/8/1985	S	1	23	6.9	9	0	8.4
2-JMS110.30	5/22/1985	S	1	23.3	8.1	11.1	0	8.5
2-JMS110.30	5/29/1985	S	0.3	19.5	6.7			9.1
2-JMS110.30	6/19/1985	S	1	27	8.9	8.6	0	8.4
2-JMS110.30	7/2/1985	S	1	25	8.22	8.9	0	8
2-JMS110.30	7/17/1985	S	1	27.5		8.4	0	
2-JMS110.30	7/31/1985	S	0.3	28	8.2			8.4
2-JMS110.30	8/5/1985	S	1	27	8.3	8.4	0	
2-JMS110.30	8/15/1985	S	1	30.5	8.3	7.8	0	7.5
2-JMS110.30	8/20/1985	S	0.3	24.5	6.6			8.4
2-JMS110.30	9/4/1985	S	1	29	7.7	8.2	0	
2-JMS110.30	9/16/1985	S	0.3	22.5	8.4			10.1
2-JMS110.30	9/17/1985	S	1	23.1	8.2	9.8	0	
2-JMS110.30	10/2/1985	S	1	21	7	11.1	0	8.8
2-JMS110.30	10/9/1985	S	0.3	18	6.8			10.6
2-JMS110.30	10/16/1985	S	1	23	7.8	9.8	0.1	
2-JMS110.30	11/18/1985	S	1		7.91			
2-JMS110.30	11/18/1985	B	2	14.5		10	0	
2-JMS110.30	11/26/1985	S	0.3	12	7.2			10.8
2-JMS110.30	12/4/1985	S	1	9	7.86	10.6	0	10.6
2-JMS110.30	12/17/1985	S	0.3	7	6.5			11.8
2-JMS110.30	1/15/1986	S	1	2	7.3	14	0	13.8

Station ID	Collection Date	Depth	Depth	Temp Celcius	Field Ph	Do Probe	Salinity	Do Winkler
2-JMS110.30	1/22/1986	S	0.3	8	7.4			13
2-JMS110.30	2/12/1986	S	1	5	6.45	12.8	0	12
2-JMS110.30	2/18/1986	S	0.3	6	6.74			12.6
2-JMS110.30	3/12/1986	S	1	11	6.66	12	0	11.4
2-JMS110.30	3/18/1986	S	0.3	12	6.4			10.8
2-JMS110.30	3/26/1986	S	1	14	7.2	10.6	0	11.7
2-JMS110.30	4/10/1986	S	1	14.7	6.8	9	0	9.6
2-JMS110.30	4/16/1986	S	0.3	15	6.6			10.5
2-JMS110.30	4/28/1986	S	1	24	9.1	8.8	0	7.9
2-JMS110.30	5/8/1986	S	1	23	8.36	8.6	0	8.3
2-JMS110.30	5/19/1986	S	0.3	24.4	9			10
2-JMS110.30	5/27/1986	S	1	22	8.45	8.7	0	8
2-JMS110.30	6/9/1986	S	1	29	8.51	8.5	0	7.7
2-JMS110.30	6/19/1986	S	0.3	28	8.78			8.6
2-JMS110.30	6/24/1986	S	1	28.5	8.54	8.5	0	7.8
2-JMS110.30	7/8/1986	S	1	32	9.1	8.1	0	7.9
2-JMS110.30	7/22/1986	S	1	30	8.23	8.1	0	7.7
2-JMS110.30	7/30/1986	S	0.3	30.5	8.61			7.6
2-JMS110.30	8/6/1986	S	1	27.2	8.74	8.42		8.1
2-JMS110.30	8/20/1986	S	1	25	7.52	7.9	0	8.5
2-JMS110.30	8/25/1986	S	0.3	26.5	8.51			9
2-JMS110.30	9/9/1986	S	1		8.81			12.4
2-JMS110.30	9/23/1986	S	1	25.5	8.75	8.4	0	8.7
2-JMS110.30	9/25/1986	S	0.3	25	8.65			8.6
2-JMS110.30	10/7/1986	S	1	21	8.82	9.4	0.1	9.1
2-JMS110.30	10/20/1986	S	0.3	14	8.6			11.8
2-JMS110.30	10/28/1986	S	1	14	8.6	10.2		10.6
2-JMS110.30	11/17/1986	S	0.3	9	8.2			11.4
2-JMS110.30	11/25/1986	S	1	9	7.9	14.5	0	11.5
2-JMS110.30	12/22/1986	S	1	6	7.34	11.8	0	12.6
2-JMS110.30	12/30/1986	S	0.3	6	7.38			11.6
2-JMS110.30	1/5/1987	S	1	4	8.85	12.6	0	12.7
2-JMS110.30	2/2/1987	S	0.3	2.5	8.1			12.1
2-JMS110.30	3/4/1987	B	3	7		12		
2-JMS110.30	3/4/1987	S	1	7	6.13	12	0	12.3
2-JMS110.30	3/5/1987	S	0.3	7	7.67			11.5
2-JMS110.30	3/18/1987	S	1	10	6.54	11.6	0	11
2-JMS110.30	3/31/1987	S	0.3	15	8.08			10.9
2-JMS110.30	4/8/1987	S	1	11	8.08	11.8	0	10.6
2-JMS110.30	4/14/1987	S	1	13.5	8.89	10.5	0	9.9
2-JMS110.30	5/6/1987	S	1		8.71			
2-JMS110.30	5/6/1987	S	0.3	17	8.19			9.8
2-JMS110.30	5/18/1987	S	1	25.4	8.95	8.1	0	8.2
2-JMS110.30	6/1/1987	S	1	29	8.73	8.6	0	7.8
2-JMS110.30	6/9/1987	S	0.3	28.2	8.11			4.38
2-JMS110.30	6/15/1987	S	1	27.2	8.21	8.53	0	8.3
2-JMS110.30	6/29/1987	S	1	29.2	8.55	7.8	0	9
2-JMS110.30	7/8/1987	S	0.3	31	8.83			7.9
2-JMS110.30	7/13/1987	S	1	31	8.72	8.4	0.1	8.2
2-JMS110.30	8/11/1987	S	1	29.5	8.69	7.6		7.9
2-JMS110.30	8/12/1987	S	0.3	28	8.41			9.8
2-JMS110.30	8/25/1987	S	1	25	8.39	8.2	0	7.8
2-JMS110.30	9/9/1987	S	1	23	7.17	8.3	0	
2-JMS110.30	9/21/1987	S	0.3	24	8.24			9
2-JMS110.30	10/8/1987	S	1	16.6	8.81	11	0	10.9
2-JMS110.30	10/26/1987	S	0.3	14	8.28			10.8

Station ID	Collection Date	Depth	Depth	Temp Celcius	Field Ph	Do Probe	Salinity	Do Winkler
2-JMS110.30	10/27/1987	S	1	11	7.01	10.6	0	10.1
2-JMS110.30	11/9/1987	S	1	15.5	8.4	10.4		10.2
2-JMS110.30	11/24/1987	S	0.3	7	8.32			13.4
2-JMS110.30	12/14/1987	S	0.3	7	8.2			
2-JMS110.30	1/20/1988	S	0.3	2	6.79			14.2
2-JMS110.30	2/17/1988	S	0.3	6.5	8.07			12.7
2-JMS110.30	3/16/1988	S	0.3	9.8	8.8			12.2
2-JMS110.30	4/28/1988	S	0.3	18	7.06			9.7
2-JMS110.30	5/23/1988	S	0.3	23	9.18			8.7
2-JMS110.30	5/23/1988	B	1	23	9.18			8.7
2-JMS110.30	6/13/1988	S	0.3	23	8.42			9.5
2-JMS110.30	6/29/1988	S	1	26	7.61	7.9	0	
2-JMS110.30	7/18/1988	S	1	32	8.22	7.7	0	
2-JMS110.30	7/25/1988	S	0.3	29	8.44			7.8
2-JMS110.30	8/1/1988	S	1	30.5	8.66	7.6	0	
2-JMS110.30	8/15/1988	S	1	30	8.29	8	0	
2-JMS110.30	8/29/1988	S	0.3	27.7	8.67			8.2
2-JMS110.30	9/12/1988	S	1	21.8	8.35	9.8	0	
2-JMS110.30	9/21/1988	S	0.3	25	8.69			9.3
2-JMS110.30	9/27/1988	S	1	19.1	8.58	9.7	0	
2-JMS110.30	10/11/1988	S	1	13.6	8.8	12	0	
2-JMS110.30	10/24/1988	S	0.3	10.3	8.29			11
2-JMS110.30	10/26/1988	S	1	9.2	8.62	12.3	0	
2-JMS110.30	11/14/1988	S	1	12.4	8.05	11.65	0	
2-JMS110.30	11/29/1988	S	0.3	5.9	8.12			13.5
2-JMS110.30	12/20/1988	S	1	3	7.25	16.5	0	
2-JMS110.30	12/20/1988	B	2	3		16	0	
2-JMS110.30	1/11/1989	S	1	6.1	7.11	14.4	0	
2-JMS110.30	1/30/1989	S	0.3	8.3	7.6			14
2-JMS110.30	2/8/1989	S	1	6.5	9.03	13.5		
2-JMS110.30	3/15/1989	S	1	9.8	8.23	13.6	0	
2-JMS110.30	3/21/1989	S	0.3	10.8	7.53			12.4
2-JMS110.30	3/28/1989	S	1	16.5	7.92	10.7	0	
2-JMS110.30	4/13/1989	S	1	13.9	8.05	11.3	0	
2-JMS110.30	4/19/1989	S	0.3	17	7.73			9.5
2-JMS110.30	5/24/1989	S	0.3	21.4	8.24			9.1
2-JMS110.30	6/26/1989	S	0.3	27.4	8.25			7.8
2-JMS110.30	7/25/1989	S	0.3	28	8.15			8
2-JMS110.30	8/16/1989	S	0.3	25.2	8.38			8.7
2-JMS110.30	9/27/1989	S	0.3	15.4	8.05			10.3
2-JMS110.30	10/18/1989	S	0.3	19.2	6.76			9.8
2-JMS110.30	11/20/1989	S	0.3	9.4	8.35			12.8
2-JMS110.30	12/19/1989	S	0.3	1	8.16			16.3
2-JMS110.30	1/25/1990	S	0.3	8.2	7.97			12.9
2-JMS110.30	2/13/1990	S	1	9.1	7.64	12.2	0	
2-JMS110.30	3/13/1990	S	1	13.6	7.95	10.6	0	
2-JMS110.30	3/28/1990	S	1	11.3	8.41	11.6	0	
2-JMS110.30	4/10/1990	S	1	11.4	8.51	11.7	0	
2-JMS110.30	4/25/1990	S	1	17.1	8.38	9.5	0	
2-JMS110.30	4/30/1990	S	0.3	20.3	8.25			9.4
2-JMS110.30	5/9/1990	S	1	20.2	7.38	9.4	0	
2-JMS110.30	5/21/1990	S	0.3	23.3	7.96			
2-JMS110.30	5/31/1990	S	1	15.9	6.08	10	0	
2-JMS110.30	6/14/1990	S	1	21.9	8.04	8.46	0	
2-JMS110.30	6/20/1990	S	0.3	24	8.53			8.3
2-JMS110.30	6/27/1990	S	1	24.5	8.55	7.92	0	

Station ID	Collection Date	Depth	Depth	Temp Celcius	Field Ph	Do Probe	Salinity	Do Winkler
2-JMS110.30	7/10/1990	S	1	28.66	6.99	7.82	0	
2-JMS110.30	7/10/1990	S	0.3	28.7	6.99			7.8
2-JMS110.30	7/24/1990	S	0.3	27.9	7.8			7.5
2-JMS110.30	7/24/1990	S	1	27.9	7.8	7.5	0	
2-JMS110.30	8/7/1990	S	1	25.5	8.08	7.33	0	
2-JMS110.30	8/7/1990	S	0.3	25.5	8.08			7.3
2-JMS110.30	8/23/1990	S	1	27	8.76	8.7	0	
2-JMS110.30	9/6/1990	S	1	27	8.58	9.4	0	
2-JMS110.30	9/6/1990	B	1	27	8.6			9.4
2-JMS110.30	9/24/1990	S	1	18.95	7.61	10.19	0	
2-JMS110.30	10/9/1990	S	0.3	24.1	7.88			8.4
2-JMS110.30	10/9/1990	S	1	24.13	7.88	8.44	0	
2-JMS110.30	10/25/1990	S	1	15.67	7.33	9.64	0	
2-JMS110.30	11/7/1990	S	0.3	13.3	7.46			10.8
2-JMS110.30	11/7/1990	S	1	13.31	7.46	10.83	0	
2-JMS110.30	12/12/1990	B	1	8.7	7.72	12.72	0	
2-JMS110.30	12/12/1990	S	0.3	8.7	7.7			12.7
2-JMS110.30	1/14/1991	S	1	6.48	7.23	12.35	0	
2-JMS110.30	1/14/1991	S	0.3	6.5	7.23			12.3
2-JMS110.30	2/25/1991	S	1	8.2	7.54	11.89	0	
2-JMS110.30	2/25/1991	S	0.3	8.2	7.54			11.9
2-JMS110.30	3/6/1991	S	1	10.18	7.29	11.31	0	
2-JMS110.30	3/20/1991	S	1	10.97	7.23	11.15	0	
2-JMS110.30	4/3/1991	S	0.3	11.2	7.3			11.65
2-JMS110.30	4/23/1991	S	1	16.6	7.17	10.54	0	
2-JMS110.30	5/2/1991	S	1	21.58	8.04	9.54	0	
2-JMS110.30	5/2/1991	S	0.3	21.6	8.04			9.5
2-JMS110.30	5/16/1991	S	1	27.65	8.31	7.83	0	
2-JMS110.30	6/13/1991	S	1	26.61	8.4	8.86	0	
2-JMS110.30	6/27/1991	S	1	24.52	7.39	8.16	0	
2-JMS110.30	7/16/1991	S	1	26.77	7.37	7.96	0	
2-JMS110.30	7/16/1991	S	0.3					
2-JMS110.30	7/30/1991	S	1	24.24	7.17	8.02	0	
2-JMS110.30	8/13/1991	S	1	26.98	7.31	8.27	0	
2-JMS110.30	8/27/1991	S	1	26.02	7.68	7.76	0	
2-JMS110.30	9/12/1991	S	0.3	27.4	8.03			8.5
2-JMS110.30	9/12/1991	B	1	27.41	8.03	8.51	0	
2-JMS110.30	10/1/1991	S	1	22.26	8.59	9.76	0	
2-JMS110.30	10/10/1991	B	1	19.71	8.12	10.2	0	
2-JMS110.30	10/10/1991	S	0.3	19.7	8.12			10.2
2-JMS110.30	10/28/1991	S	1	18.44	7.67	9.06	0	
2-JMS110.30	11/18/1991	S	1	9.27	7.4	10.99	0	
2-JMS110.30	12/11/1991	S	1	8.81	7.05	11.76	0	
2-JMS110.30	12/11/1991	S	0.3	8.8	7.05			11.8
2-JMS110.30	1/9/1992	S	0.3	7.3	6.94			12.2
2-JMS110.30	1/9/1992	S	1	7.32	6.94	12.22	0	
2-JMS110.30	1/12/1992	S	0.3					
2-JMS110.30	2/10/1992	S	1	3.45	7	13.38	0	
2-JMS110.30	2/10/1992	S	0.3	4	7	13.4		
2-JMS110.30	3/10/1992	S	0.3	13.8	6.94			10.2
2-JMS110.30	3/24/1992	S	1	8.79	6.25	11.77	0	
2-JMS110.30	4/7/1992	S	1	10.37	7.02	11.05	0	
2-JMS110.30	4/7/1992	S	0.3	10.4	7.02			11
2-JMS110.30	4/21/1992	S	1	19.1	7.32	8.95	0	
2-JMS110.30	4/23/1992	S	0.3	19.1	6.6			8.9
2-JMS110.30	5/6/1992	S	0.3	17.3	7.17	9.4		

Station ID	Collection Date	Depth	Depth	Temp Celcius	Field Ph	Do Probe	Salinity	Do Winkler
2-JMS110.30	5/27/1992	S	1	18.6	7	9.6	0	
2-JMS110.30	6/4/1992	S	0.3	20.4	7.25			9.5
2-JMS110.30	6/18/1992	S	1	22.72	7.41	8.61	0	
2-JMS110.30	7/6/1992	S	1	26.5	7.33	7.53	0	
2-JMS110.30	7/6/1992	S	0.3	26.5	7.33	7.5		
2-JMS110.30	7/20/1992	S	1	28.26	7.54	7.47	0	
2-JMS110.30	8/18/1992	S	0.3	25.6	7.8	8.4		
2-JMS110.30	9/1/1992	S	1	24.96	7.82	7.71	0	
2-JMS110.30	9/15/1992	S	0.3	22.5	7.7	8.4		
2-JMS110.30	10/8/1992	S	1	16.25	7.72	9.7	0	
2-JMS110.30	11/2/1992	S	1	13.88	7.72	10.14	0	
2-JMS110.30	11/2/1992	S	0.3	13.9	7.6	10.1		
2-JMS110.30	11/17/1992	S	0.3	7.8	7.53	11.9		
2-JMS110.30	11/17/1992	S	1	7.76	7.53	11.93	0	
2-JMS110.30	12/15/1992	S	0.3	5.3	7.15	12.5		
2-JMS110.30	12/15/1992	S	1	5.35	7.15	12.55	0	
2-JMS110.30	1/12/1993	S	0.3	6.3	7.07	12.4		
2-JMS110.30	1/17/1993	S	0.3	15	8.04			10.3
2-JMS110.30	2/9/1993	S	0.3	4.5	7.65	13.1		
2-JMS110.30	2/9/1993	S	1	4.51	7.65	13.08	0	
2-JMS110.30	3/10/1993	S	1	8.34	7	11.35	0	
2-JMS110.30	3/10/1993	S	0.3	8.4	7	11.3		
2-JMS110.30	4/8/1993	S	0.3	12		10.8		
2-JMS110.30	4/8/1993	S	1	11.98	7.22	10.8	0	
2-JMS110.30	4/28/1993	S	1	17.72	7.07	9.48	0	
2-JMS110.30	5/6/1993	S	1	22.32	8.19	9.23	0	
2-JMS110.30	6/2/1993	S	1	23.41	7.84	8.73	0	
2-JMS110.30	6/7/1993	S	1	25.09	7.55	8.53	0	
2-JMS110.30	6/7/1993	S	0.3	25.1	7.55			8.5
2-JMS110.30	6/22/1993	S	1	29.6	8.43	8.22	0	
2-JMS110.30	7/7/1993	S	0.3	29.3	7.36			7.3
2-JMS110.30	7/7/1993	S	1	29.28	7.36	7.28	0	
2-JMS110.30	7/21/1993	S	1	28.46	7.34	7.54	0	
2-JMS110.30	8/4/1993	S	1	27.25	7.41	7.8	0	
2-JMS110.30	8/18/1993	S	1	28.46	7.96	8.71	0	
2-JMS110.30	9/2/1993	S	0.3	31.3	8.61			
2-JMS110.30	9/2/1993	S	1	31.33	8.61	8.13	0	
2-JMS110.30	9/20/1993	S	1	22.27	8.23	8.23	0	
2-JMS110.30	10/5/1993	S	1	20.98	9.29	9.57	0	
2-JMS110.30	12/2/1993	S	1	8.38	6.92	12.25	0	
2-JMS110.30	12/27/1993	S	0.3	2.7	7.72			14.2
2-JMS110.30	1/12/1994	S	0.3	2.4	7.29			13.7
2-JMS110.30	1/26/1994	S	1	2.11	7.58	13.76		
2-JMS110.30	2/1/1994	S	0.3	4.3	7.23			13.9
2-JMS110.30	2/17/1994	S	1	4.79	7.22	13.24	0	
2-JMS110.30	3/21/1994	S	1	10.12	7.56	11.38	0	
2-JMS110.30	4/14/1994	S	1	17.94	8.25	9.85	0	
2-JMS110.30	5/23/1994	S	1	23.11	9.15	9.42	0	
2-JMS110.30	6/9/1994	S	1	27.06	8.81	8.39	0	
2-JMS110.30	6/27/1994	S	0.3	27.9	8.03	8.1		
2-JMS110.30	7/7/1994	S	1	32.77	8.76	8.89	0	
2-JMS110.30	7/13/1994	S	0.3	30.55	8.18	6.88		
2-JMS110.30	7/14/1994	S	0.3	30.69	8.49	8.37		
2-JMS110.30	7/28/1994	S	0.3	27.97	7.99	7.87		
2-JMS110.30	8/11/1994	S	1	29.75	8.7	8.34	0	
2-JMS110.30	8/17/1994	S	0.3	25.89	7.89	8.21		

Station ID	Collection Date	Depth	Depth	Temp Celcius	Field Ph	Do Probe	Salinity	Do Winkler
2-JMS110.30	8/30/1994	S	0.3	27.68	8.69	8.5		
2-JMS110.30	9/8/1994	S	1	25.66	8.91	8.66	0	
2-JMS110.30	9/13/1994	S	0.3	25.17	8.76	9.77		
2-JMS110.30	9/22/1994	S	0.3	21.92	8.02	8.29		
2-JMS110.30	9/26/1994	S	0.3	22.33	8.05	8.89		
2-JMS110.30	10/12/1994	S	0.3	16.65	8.33	11.19		
2-JMS110.30	10/17/1994	S	1	16.62	8.57	11.34		
2-JMS110.30	10/25/1994	S	0.3	16.92	8.15	10.71		
2-JMS110.30	11/30/1994	S	1	9.43	8.17	11.82	0	
2-JMS110.30	12/6/1994	S	1	10.88	8.4	11.81	0	
2-JMS110.30	1/25/1995	S	1	5.98	7.58	12.93	0	
2-JMS110.30	2/22/1995	S	1	7.5	7.9	12.75	0	
2-JMS110.30	3/23/1995	S	1	14.41	8.33	10.44	0	
2-JMS110.30	4/18/1995	S	1	17.67	8.7	10.46		
2-JMS110.30	5/2/1995	S	0.3	16.4	7.69	9.65		
2-JMS110.30	5/18/1995	S	0.3	22.54	7.51	8.72		
2-JMS110.30	5/23/1995	S	1	25.57	8.52	8.95	0	
2-JMS110.30	6/1/1995	S	0.3	24.11	8.14	9.19		
2-JMS110.30	6/20/1995	S	1	27.04	8.41	8.78	0	
2-JMS110.30	7/18/1995	S	1	32.35	8.49	8.32	0	
2-JMS110.30	7/31/1995	S	0.3	30.7	8.19	8.31	0	
2-JMS110.30	8/14/1995	S	0.3	30.41	8.32	7.78		
2-JMS110.30	8/23/1995	S	1	29.11	7.55	8.25	0	
2-JMS110.30	8/28/1995	S	0.3	27.13	8.31	8.47		
2-JMS110.30	9/11/1995	S	0.3	24.98	8.59	9.74		
2-JMS110.30	9/20/1995	S	0.3	22.8	8.5	9.6		
2-JMS110.30	9/21/1995	S	1	23.28	8.37	9.24	0	
2-JMS110.30	10/5/1995	S	0.3	22.2	7.71	8.86		
2-JMS110.30	10/19/1995	S	1	18.38	8.58	9.38	0	
2-JMS110.30	10/24/1995	S	0.3	14.97	7.4	10.34		
2-JMS110.30	11/20/1995	S	1	7.6	7.85	12.43	0	
2-JMS110.30	12/14/1995	S	1	3.81	6.82	14.29	0	
2-JMS110.30	1/29/1996	S	1	4.49	7.06	14.71	0	
2-JMS110.30	2/20/1996	S	1	5.07	6.52	13.16	0	
2-JMS110.30	3/25/1996	S	1	9.63	7.71	11.89	0	
2-JMS110.30	4/30/1996	S	1	19.62	8.27	9.15	0	
2-JMS110.30	5/6/1996	S	0.3	21.71	8.63	9.79		
2-JMS110.30	5/15/1996	S	1	19.24	8.6	9.9	0	
2-JMS110.30	5/28/1996	S	0.3	18.57	7.71	9.7		
2-JMS110.30	6/3/1996	S	0.3	21.93	8.08	9.27		
2-JMS110.30	6/11/1996	S	0.3	26.42	7.75	8.11		
2-JMS110.30	6/18/1996	S	1	28.81	8.08	7.83	0	
2-JMS110.30	7/1/1996	S	0.3	27.57	7.88	8.18		
2-JMS110.30	7/15/1996	S	0.3	27.29	7.64	8.99		
2-JMS110.30	7/23/1996	S	1	28.15	7.14	7.42	0	
2-JMS110.30	8/1/1996	S	0.3	26.81	7.67	6.67		
2-JMS110.30	8/15/1996	S	0.3	24.98	7.64	8.28		
2-JMS110.30	8/20/1996	S	1	28.16	8.58	8.43	0	
2-JMS110.30	9/16/1996	S	0.3	21.84	7.71	9.23		
2-JMS110.30	9/24/1996	S	1	21.12	7.92	9.02	0	
2-JMS110.30	9/30/1996	S	0.3	21.17	8.63	11.3		
2-JMS110.30	10/9/1996	S	0.3	15.44	7.66	9.64		
2-JMS110.30	10/22/1996	S	1	14.9	8.42	10.63	0	
2-JMS110.30	10/30/1996	S	0.3	16.34	8.27	10.08		
2-JMS110.30	11/19/1996	S	1	6.77	7.79	12.28	0	
2-JMS110.30	12/10/1996	S	1	5.13	7.09	12.83	0	

Station ID	Collection Date	Depth	Depth	Temp Celcius	Field Ph	Do Probe	Salinity	Do Winkler
2-JMS110.30	1/21/1997	S	1	0.76	6.74	16	0	
2-JMS110.30	2/18/1997	S	1	6.42	7.61	12.75	0	
2-JMS110.30	3/18/1997	S	1	10.38	7.84	11.33	0	
2-JMS110.30	4/22/1997	S	1	13.81	8.37	10.63	0	
2-JMS110.30	5/21/1997	S	0.3	22.2	8.2	10.57		
2-JMS110.30	5/27/1997	S	0.3	21.86	8.11	9.2		
2-JMS110.30	5/28/1997	S	1	22.32	8.63	9.33	0	
2-JMS110.30	6/3/1997	S	0.3	21.21	7.61	9.14		
2-JMS110.30	6/23/1997	S	0.3	28.3	7.95	8.16		
2-JMS110.30	6/24/1997	S	1	30.75	8.91	8.49	0	
2-JMS110.30	7/9/1997	S	0.3	29.94	8.8	8.47		
2-JMS110.30	8/7/1997	S	0.3	27.79	8.71	8.69		
2-JMS110.30	8/19/1997	S	1	29.19	8.52	8.23	0	
2-JMS110.30	8/21/1997	S	0.3	27.75	8.44	9.36		
2-JMS110.30	9/4/1997	S	0.3	22.55	8.34	8.67		
2-JMS110.30	9/23/1997	S	1	24.07	8.97	9.99	0	
2-JMS110.30	10/2/1997	S	0.3	19.62	8.77	9.93		
2-JMS110.30	10/20/1997	S	0.3	15.19	8.33	10.42		
2-JMS110.30	10/21/1997	S	1	15.43	8.36	10.45	0	
2-JMS110.30	11/18/1997	S	1	7.83	8	12.33		
2-JMS110.30	12/10/1997	S	1	5.46	7.73	11.82		
2-JMS110.30	1/21/1998	S	1	5.95	7.53	12.72		
2-JMS110.30	2/18/1998	S	1	7.9	7.14	11.91		
2-JMS110.30	3/17/1998	S	1	7.09	7.75	12.56		
2-JMS110.30	4/21/1998	S	1	14.7	7.37	10.04		
2-JMS110.30	5/18/1998	S	0.3	23.2	8.3	9.17		
2-JMS110.30	5/19/1998	S	1	25.07	8.54	8.81		
2-JMS110.30	5/26/1998	S	0.3	24.66	8.82	9.14		
2-JMS110.30	6/16/1998	S	0.3	26.13	8.71	8.75		
2-JMS110.30	6/23/1998	S	1	29.98	8.94	8.68		
2-JMS110.30	6/30/1998	S	0.3	29.51	8.63	8.3		
2-JMS110.30	7/14/1998	S	0.3	27.81	8.54	8.79		
2-JMS110.30	7/21/1998	S	1	32.26	8.93	7.99		
2-JMS110.30	7/28/1998	S	0.3	28.57	8.75	8.48		
2-JMS110.30	8/11/1998	S	0.3	29.37	8.29	8.07		
2-JMS110.30	8/18/1998	S	1	29.43	8.92	8.13		
2-JMS110.30	8/25/1998	S	0.3	28.87	8.44	7.96		
2-JMS110.30	9/14/1998	S	0.3	25.55	8.52	9.12		
2-JMS110.30	9/22/1998	S	1	28.08	8.76	8.93	0	
2-JMS110.30	9/29/1998	S	0.3	24.88	8.41	9.37		
2-JMS110.30	10/13/1998	S	0.3	19.44	8.19	9.58		
2-JMS110.30	10/20/1998	S	1	20.35	8.67	9.79		
2-JMS110.30	10/26/1998	S	0.3	15.97	8.46	10.85		
2-JMS110.30	11/18/1998	S	1	12.55	8.22	10.78		
2-JMS110.30	12/15/1998	S	1	8.45	7.91	13.14		
2-JMS110.30	1/19/1999	S	1	5.96	7.69	12.18		
2-JMS110.30	2/23/1999	S	1	5.86	8.22	13.66		
2-JMS110.30	3/23/1999	S	1	9.67	7.14	11.44		
2-JMS110.30	4/20/1999	S	1	17.41	8.92	10.19		
2-JMS110.30	5/11/1999	S	0.3	24.91	8.44	8.7		
2-JMS110.30	5/20/1999	S	1	21.64	8.17	8.91		
2-JMS110.30	5/25/1999	S	0.3	22.44	7.79	8.58		
2-JMS110.30	6/7/1999	S	0.3	28.08	8.88	9.68		
2-JMS110.30	6/21/1999	S	0.3	21.58	7.81	9.11		
2-JMS110.30	6/22/1999	S	1	23.63	8.54	9.9		
2-JMS110.30	7/12/1999	S	0.3	26.67	8.11	8.39		

Station ID	Collection Date	Depth	Depth	Temp Celcius	Field Ph	Do Probe	Salinity	Do Winkler
2-JMS110.30	7/20/1999	S	1	31.29		8.8		
2-JMS110.30	7/21/1999	S	0.3	29.74	8.46	9.08		
2-JMS110.30	8/10/1999	S	0.3	28.61	8.44	9.31		
2-JMS110.30	8/17/1999	S	1	31.08	9.01	9.43		
2-JMS110.30	8/31/1999	S	0.3	22.22	8.38	9.51		
2-JMS110.30	9/13/1999	S	0.3	24.38	8.12	8.85		
2-JMS110.30	9/21/1999	S	1	17.32	7.17	10.63	0	
2-JMS110.30	9/27/1999	S	0.3	22.38	8.13	9.57	0	
2-JMS110.30	10/13/1999	S	0.3	19.18	8.41	10.15	0	
2-JMS110.30	10/25/1999	S	0.3	13.73	8.74	12.73	0	
2-JMS110.30	10/28/1999	S	1	12.68	8.43	11.16	0	
2-JMS110.30	11/18/1999	S	1	10	7.8	11.1	0	
2-JMS110.30	12/21/1999	S	1	7.8	6.61	10.7	0	
2-JMS110.30	1/18/2000	S	1	2.99	6.36	15.33	0	
2-JMS110.30	2/23/2000	S	1	7.86	6.62	12.77	0	
2-JMS110.30	3/28/2000	S	1	14.54	7.37	10.68	0	
2-JMS110.30	4/24/2000	S	1	17.42	6.48	9.9	0	
2-JMS110.30	5/1/2000	S	0.3	17.93	8.14	9.98	0	
2-JMS110.30	5/22/2000	S	0.3	22.8	8.04	8.9	0	
2-JMS110.30	5/23/2000	S	1	23.08	7.54	8.81	0	
2-JMS110.30	6/5/2000	S	0.3	23.57	7.99	8.36	0	
2-JMS110.30	6/20/2000	S	1	27.22	7.22	8.5	0	
2-JMS110.30	6/22/2000	S	0.3	28.71	9.11	7.11	0	
2-JMS110.30	7/11/2000	S	0.3	29.69	8.59	7.74	0	
2-JMS110.30	7/18/2000	S	1	28.6	7.49	7.4	0	
2-JMS110.30	7/26/2000	S	0.3	24.13	7.82	8.33	0	
2-JMS110.30	8/7/2000	S	0.3	28.94	8.25	8.22	0	
2-JMS110.30	8/22/2000	S	1	25.89	7.45	7.1	0	
2-JMS110.30	8/22/2000	S	0.3	26.48	8.88	8.67	0	
2-JMS110.30	9/13/2000	S	0.3	26.38	8.58	8.06	0	
2-JMS110.30	9/26/2000	S	1	19.99	8.28	9.28	0.1	
2-JMS110.30	10/2/2000	S	0.3	20.54	8.69	11.35	0	
2-JMS110.30	10/16/2000	S	0.3	18.11	8.68	11.41	0	
2-JMS110.30	10/24/2000	S	1	18.28	8.39	9.69	0	
2-JMS110.30	10/30/2000	S	0.3	15.26	8.61	10.99	0	
2-JMS110.30	11/28/2000	S	1	6.25	7.59	13.69	0	
2-JMS110.30	1/23/2001	S	1	2.33	6.93	14	0	
2-JMS110.30	2/20/2001	S	1	8.61	7.8	12.89	0	
2-JMS110.30	3/27/2001	S	1	9.23	7.55	12.31	0	
2-JMS110.30	4/24/2001	S	1	19.02	8.19	9.64	0	
2-JMS110.30	5/7/2001	S	0.3	23.23	8.69	10.76		
2-JMS110.30	5/24/2001	S	1	21.02		8.9	0	
2-JMS110.30	5/30/2001	S	0.3	20.14	7.6	9.91		
2-JMS110.30	6/13/2001	S	0.3	28.95	8.47	9.73	0	
2-JMS110.30	6/19/2001	S	1	27.11	7.88	9.52	0	
2-JMS110.30	6/28/2001	S	0.3	29.25	8.55	9.25		
2-JMS110.30	7/5/2001	S	0.3	29.3	8.67	10.86		
2-JMS110.30	7/24/2001	S	1	27.79	7.85	7.35	0	
2-JMS110.30	7/30/2001	S	0.3	25.98	8.34	8.27		
2-JMS110.30	8/6/2001	S	0.3	29.94	8.7	8.93		
2-JMS110.30	8/21/2001	S	1	30.14	8.89	8.59	0	
2-JMS110.30	8/23/2001	S	0.3	29.03	8.79	8.93		
2-JMS110.30	9/18/2001	S	1	24.4	8.84	8.58	0.3	
2-JMS110.30	10/16/2001	S	1	19.92	8.49	10.13	0	
2-JMS110.30	11/27/2001	S	1	12.69	7.97	10.06	0	
2-JMS110.30	12/12/2001	S	1	10.76	7.69	11.22	0.2	

Station ID	Collection Date	Depth	Depth	Temp Celcius	Field Ph	Do Probe	Salinity	Do Winkler
2-JMS110.30	1/22/2002	S	1	4.34	7.94	13.44	0.1	
2-JMS110.30	2/19/2002	S	1	6.49	7.84	12.19	0.09	
2-JMS110.30	3/19/2002	S	1	12.19	7.68	12.34	0.13	
2-JMS110.30	4/16/2002	S	1	20.71	7.4	8.9	0.8	
2-JMS110.30	5/28/2002	S	1	24.54	7.43	7.41	0	
2-JMS110.30	6/25/2002	S	1	29.49	7.61	5.92	0	
2-JMS110.30	7/23/2002	S	1	29	7.65	6.73		
2-JMS110.30	8/13/2002	S	1	28.35	7.93	6.49	0	
2-JMS110.30	9/24/2002	S	1	22.46	8.33	7.68	0	
2-JMS110.30	10/22/2002	S	1	15.25	7.76	10.44	0	
2-JMS110.30	11/19/2002	S	1	9.83	7.13	12.35	0	
2-JMS110.30	12/10/2002	S	1	1.37	7.42	15.33	0	
2-JMS110.30	1/21/2003	S	1	0.47	7.31	18.31	0	
2-JMS110.30	2/25/2003	S	1	4.5	6.82	13.42	0	
2-JMS110.30	3/18/2003	S	1	11.38	7.61	10.72	0	
2-JMS110.30	4/15/2003	S	1	12.81	7.29	12.75	0	
2-JMS110.30	5/27/2003	S	1	17.01	7.22	10.22	0	
2-JMS110.30	6/24/2003	S	1	20.63	7.78	9.11	0	
2-JMS110.30	7/15/2003	S	1	26.41	7.57	8.47	0	
2-JMS110.30	8/26/2003	S	1	26.81	7.98	8.59	0	
2-JMS110.30	9/24/2003	S	1	20.36	7.12	9.02	0	
2-JMS110.30	10/28/2003	S	1	14.49	7.7	10.32	0	
2-JMS110.30	11/18/2003	S	1	11.49	7.2	10.3	0	
2-JMS110.30	12/16/2003	S	1	4.06	7.18	13.32	0	
2-JMS110.30	2/25/2004	S	1	6.1	7.51	13.41	0	
2-JMS110.30	3/23/2004	S	1	10.38	7.6	11.35	0	
2-JMS110.30	4/20/2004	S	1	17.15	7.26	10.15	0	
2-JMS110.30	5/18/2004	S	1		7.97			
2-JMS110.30	6/15/2004	S	1	24.33	7.82	7.98	0	
2-JMS110.30	8/17/2004	S	1	23.65	7.99	7.77	0	
2-JMS110.30	9/21/2004	S	1	20.91	7.9	8.95	0	
2-JMS110.30	10/19/2004	S	1	15.1	7.97	9.89	0	
2-JMS110.30	11/16/2004	S	1	9.31	7.75	11.7	0	
2-JMS110.30	12/14/2004	S	1	7.73	7.97	11.83	0	
2-JMS110.30	1/26/2005	S	1	0.99	7.38	14.57	0	
2-JMS110.30	2/15/2005	S	1	6.65	7.44	12.82	0	
2-JMS110.30	3/22/2005	S	1	10.95	7.61	11.35	0	
2-JMS110.30	4/19/2005	S	1	15.91	7.98	10.8	0	
2-JMS110.30	5/24/2005	S	1	20.12	8.8	7.78	0	
2-JMS110.30	6/21/2005	S	1	24.83	8.24	9.71	0	
2-JMS110.30	7/19/2005	S	1	29.65	7.94	7.41	0	
2-JMS110.30	8/23/2005	S	1	28.4	7.93	7.94	0	
2-JMS110.30	9/20/2005	S	1	26.5	7.93	7.66	0	
2-JMS110.30	10/18/2005	S	1	17.1	7.81	9.61	0	
2-JMS110.30	11/15/2005	S	1	13.8	7.44	11.61	0	
2-JMS110.30	12/13/2005	S	1	3.2	7.65	13.71	0	
2-JMS110.30	12/21/2005	S	1	3.2	7.65	13.71	0	
2-JMS110.30	1/17/2006	S	1	5.54	7.68	14.44	0	
2-JMS110.30	2/21/2006	S	1	5.64	7.7	12	0	
2-JMS110.30	3/20/2006	S	1	11.1	7.9	11.4		
2-JMS110.30	4/26/2006	S	1	19.9	7.7	8.9	0	
2-JMS110.30	5/15/2006	S	1	19	7.9	9.7	0	
2-JMS110.30	6/21/2006	S	0.3	30.8	8.9	8.3		
2-JMS110.30	6/29/2006	S	1	21.4	7	8.7	0	
2-JMS110.30	7/24/2006	S	1	28.5	8.1	7.8	0	
2-JMS110.30	8/22/2006	S	1	27.5	8.2	8.1	0	

Station ID	Collection Date	Depth	Depth	Temp Celcius	Field Ph	Do Probe	Salinity	Do Winkler
2-JMS110.30	9/26/2006	S	1	21.1	8.3	9.9	0	
2-JMS110.30	10/30/2006	S	1	11.5	7.4	12	0	
2-JMS110.30	11/15/2006	S	1	12.9	7.2	10.9	0	
2-JMS110.30	12/14/2006	S	1	6	7.7	13.3	0	
2-JMS110.30	1/24/2007	S	1	4.8	7.8	12.1	0	
2-JMS110.30	2/20/2007	S	1	3.5	7.6	14.7	0	
2-JMS110.30	3/19/2007	S	1	8.2	7.3	12.7	0	
2-JMS110.30	4/30/2007	S	1	20.4	8.6	9.9	0	
2-JMS110.30	5/30/2007	S	1	27.1	8.1	8.4	0	
2-JMS110.30	6/18/2007	S	1	25.7	8.5	9.6	0	
2-JMS110.30	7/23/2007	S	1	26.9	7.9	8.6		
2-JMS110.30	8/20/2007	S	1	26.6	7.2	6.9	0	
2-JMS110.30	9/24/2007	S	1	23.6	8.2	9.6	0	
2-JMS110.30	10/22/2007	S	1	20.1	8.3	9.9	0	
2-JMS110.30	11/13/2007	S	1	11.6	8.2	12.4	0	
2-JMS110.30	12/10/2007	S	1	7.8	7.6	12.8	0	
2-JMS110.30	1/23/2008	S	1	2.9	7.8	14.8	0	
2-JMS110.30	2/14/2008	S	1	5.6	7.9	12.8	0	
2-JMS110.30	3/18/2008	S	1	11.8	7.9	11.7	0	
2-JMS110.30	4/15/2008	S	1	16.1	8.1	10.6		
2-JMS110.30	5/22/2008	S	1	19.6	8.4	9.9	0	
2-JMS110.30	6/17/2008	S	1	28.9	8.3	8.2	0	
2-JMS110.30	7/15/2008	S	1	28.5	8.7	8.6	0	
2-JMS110.30	8/19/2008	S	1	28	8.3	7.8	0	
2-JMS110.30	9/16/2008	S	1	24.6	8	8.4	0	
2-JMS110.30	10/23/2008	S	1	13.4	8.2	11.1	0	
2-JMS110.30	11/24/2008	S	1	5.5	7.9	13.6	0	
2-JMS110.30	12/9/2008	S	1	4.1	7.9	15.6	0	
2-JMS110.30	1/21/2009	S	1	0.6	7.2	15.8	0	
2-JMS110.30	2/19/2009	S	1	7	7.6	12	0	
2-JMS110.30	3/17/2009	S	1	8.8	7.6	12.1	0	
2-JMS110.30	4/30/2009	S	1	20.1	7.9	9.5		
2-JMS110.30	5/19/2009	S	1	18.5	7.6	9.7		
2-JMS110.30	6/16/2009	S	1	25.5	8	8.5		
2-JMS110.30	7/21/2009	S	1	26.8	8.3	8.6		
2-JMS110.30	8/18/2009	S	1	29.4	8.4	8.1		
2-JMS110.30	9/15/2009	S	1	24.7	8.4	9.5		
90th Percentile				**28.6**	**8.7**			
10th Percentile				**5.6**	**7.1**			

Sta Id	Collection Date Time	Depth Desc	Depth	Container Id Desc	00900 HARDNESS, TOTAL (MG/L AS CACO3) Value	Com Code
2-JMS110.30	10/20/1986 14:10	S	0.3	R	88	
2-JMS110.30	11/29/1988 10:30	S	0.3	R	80	
2-JMS110.30	02/21/1989 15:00	S	0.3	R	46	
2-JMS110.30	03/21/1989 10:50	S	0.3	R	48	
2-JMS110.30	04/19/1989 10:45	S	0.3	R	54	
2-JMS110.30	05/24/1989 10:25	S	0.3	R	64	
2-JMS110.30	06/26/1989 10:40	S	0.3	R	52	
2-JMS110.30	08/16/1989 10:50	S	0.3	R	58	
2-JMS110.30	09/27/1989 11:50	S	0.3	R	30	
2-JMS110.30	10/18/1989 10:30	S	0.3	R	62	
2-JMS110.30	11/20/1989 10:45	S	0.3	R	46	
2-JMS110.30	12/19/1989 11:40	S	0.3	R	60	
2-JMS110.30	01/25/1990 10:45	S	0.3	R	58	
2-JMS110.30	02/21/1990 10:10	S	0.3	R	56	
2-JMS110.30	03/22/1990 09:40	S	0.3	R	70	
2-JMS110.30	03/22/1990 10:30	S	0.3	R	58	
2-JMS110.30	04/30/1990 11:00	S	0.3	R	58	
2-JMS110.30	05/21/1990 15:50	S	0.3	R	186	
2-JMS110.30	06/20/1990 09:40	S	0.3	R	62	
2-JMS110.30	07/10/1990 09:10	B	1	R	72	
2-JMS110.30	07/24/1990 08:10	S	0.3	R	3600	
2-JMS110.30	08/07/1990 07:05	S	0.3	R	66	
2-JMS110.30	09/06/1990 11:00	B	1	R	102	
2-JMS110.30	10/09/1990 12:40	S	0.3	R	94	
2-JMS110.30	11/07/1990 08:50	S	0.3	R	68	
2-JMS110.30	12/12/1990 14:00	S	0.3	R	74	
2-JMS110.30	01/14/1991 08:35	S	0.3	R	96	
2-JMS110.30	02/25/1991 17:00	S	0.3	R	78	
2-JMS110.30	04/03/1991 09:05	S	0.3	R	58	
2-JMS110.30	05/02/1991 12:30	S	0.3	R	78	
2-JMS110.30	06/13/1991 11:51	S	0.3	R	64	
2-JMS110.30	07/16/1991 09:00	S	0.3	R	37	
2-JMS110.30	09/12/1991 13:00	S	0.3	R	92	
2-JMS110.30	10/10/1991 13:15	S	0.3	R	116	
2-JMS110.30	12/11/1991 08:55	S	0.3	R	48	
2-JMS110.30	01/09/1992 08:40	S	0.3	R	40	
2-JMS110.30	01/12/1992 17:30	S	0.3	R	41	
2-JMS110.30	02/10/1992 08:45	S	0.3	R	72	
2-JMS110.30	03/10/1992 11:55	S	0.3	R	46	
2-JMS110.30	04/07/1992 08:50	S	0.3	R	60	
2-JMS110.30	04/23/1992 15:30	S	0.3	R	66	
2-JMS110.30	05/06/1992 09:40	S	0.3	R	68	
2-JMS110.30	06/04/1992 08:50	S	0.3	R	66	
2-JMS110.30	07/06/1992 09:15	S	0.3	R	82	
2-JMS110.30	08/18/1992 12:45	S	0.3	R	70	
2-JMS110.30	09/15/1992 08:45	S	0.3	R	60	
2-JMS110.30	11/02/1992 08:40	S	0.3	R	89	
2-JMS110.30	11/17/1992 08:45	S	0.3	R	56	
2-JMS110.30	12/15/1992 08:30	S	0.3	R	29	
2-JMS110.30	01/12/1993 17:30	S	0.3	R	41	

Sta Id	Collection Date Time	Depth Desc	Depth	Container Id Desc	00900 HARDNESS, TOTAL (MG/L AS CACO3) Value	Com Code
2-JMS110.30	02/09/1993 08:35	S	0.3	R	58	
2-JMS110.30	03/10/1993 12:10	S	0.3	R	50	
2-JMS110.30	04/08/1993 15:45	S	0.3	R	48	
2-JMS110.30	05/06/1993 14:45	S	0.3	R	50	
2-JMS110.30	09/02/1993 17:00	S	0.3	R	82	
2-JMS110.30	11/17/1993 15:55	S	0.3	R	90	
2-JMS110.30	12/27/1993 17:35	S	0.3	R	66	
2-JMS110.30	01/12/1994 18:00	S	0.3	R	74	
2-JMS110.30	01/26/1994 16:15	S	1	R	50	
2-JMS110.30	02/01/1994 17:25	S	0.3	R	38	
2-JMS110.30	02/17/1994 16:15	S	1	R	42	
2-JMS110.30	03/21/1994 16:20	S	1	R	50	
2-JMS110.30	04/14/1994 17:00	S	1	R	50	
2-JMS110.30	05/23/1994 16:55	S	1	R	52	
2-JMS110.30	06/09/1994 17:20	S	1	R	63	
2-JMS110.30	09/08/1994 17:01	S	1	R	66	
2-JMS110.30	10/17/1994 15:41	S	1	R	81	
2-JMS110.30	11/30/1994 15:44	S	1	R	69	
2-JMS110.30	12/06/1994 16:12	S	1	R	71	
2-JMS110.30	01/25/1995 15:38	S	1	R	49	
2-JMS110.30	02/22/1995 15:45	S	1	R	84	
2-JMS110.30	03/23/1995 15:57	S	1	R	54	
2-JMS110.30	04/18/1995 15:33	S	1	R	57	
2-JMS110.30	05/23/1995 15:22	S	1	R	30	
2-JMS110.30	06/20/1995 15:41	S	1	R	49	
2-JMS110.30	07/18/1995 15:41	S	1	R	62	
2-JMS110.30	08/23/1995 15:23	S	1	R	86	
2-JMS110.30	09/21/1995 15:14	S	1	R	103	
2-JMS110.30	10/19/1995 17:45	S	1	R	60	
2-JMS110.30	11/20/1995 15:17	S	1	R	52	
2-JMS110.30	12/14/1995 15:03	S	1	R	45	
2-JMS110.30	01/29/1996 15:03	S	1	R	28	
2-JMS110.30	02/20/1996 15:23	S	1	R	50	
2-JMS110.30	03/25/1996 15:33	S	1	R	66	
2-JMS110.30	04/30/1996 11:40	S	1	R	58	
2-JMS110.30	05/15/1996 15:10	S	1	R	50	
2-JMS110.30	06/18/1996 15:03	S	1	R	50	
2-JMS110.30	07/23/1996 16:01	S	1	R	60	
2-JMS110.30	08/20/1996 15:01	S	1	R	66	
2-JMS110.30	09/24/1996 15:45	S	1	R	60	
2-JMS110.30	10/22/1996 14:57	S	1	R	63	
2-JMS110.30	11/19/1996 14:34	S	1	R	59	
2-JMS110.30	12/10/1996 15:11	S	1	R	44	
2-JMS110.30	01/21/1997 15:31	S	1	R	58.2	
2-JMS110.30	02/18/1997 14:49	S	1	R	44.7	
2-JMS110.30	03/18/1997 15:21	S	1	R	53.8	
2-JMS110.30	04/22/1997 16:03	S	1	R	58.4	
2-JMS110.30	05/28/1997 15:19	S	1	R	55.2	
2-JMS110.30	06/24/1997 14:56	S	1	R	59.3	
2-JMS110.30	07/15/1997 14:41	S	1	R	77.8	

Sta Id	Collection Date Time	Depth Desc	Depth	Container Id Desc	00900 HARDNESS, TOTAL (MG/L AS CACO3) Value	Com Code
2-JMS110.30	08/19/1997 15:56	S	1	R	72.2	
2-JMS110.30	09/23/1997 14:27	S	1	R	64	
2-JMS110.30	10/21/1997 15:04	S	1	R	58.1	
2-JMS110.30	11/18/1997 15:31	S	1	R	57.9	
2-JMS110.30	12/10/1997 15:03	S	1	R	74.8	
2-JMS110.30	01/21/1998 16:03	S	1	R	44.4	
2-JMS110.30	02/18/1998 15:54	S	1	R	39.8	
2-JMS110.30	03/17/1998 15:49	S	1	R	44.3	
2-JMS110.30	04/21/1998 16:00	S	1	R	32.3	
2-JMS110.30	05/19/1998 16:06	S	1	R	41.5	
2-JMS110.30	06/23/1998 16:01	S	1	R	59.4	
2-JMS110.30	07/21/1998 16:08	S	1	R	64.8	
2-JMS110.30	08/18/1998 15:17	S	1	R	57.5	
2-JMS110.30	09/22/1998 15:59	S	1	R	88.5	
2-JMS110.30	10/20/1998 15:44	S	1	R	102	
2-JMS110.30	11/18/1998 14:59	S	1	R	94	
2-JMS110.30	12/15/1998 15:44	S	1	R	77	
2-JMS110.30	01/19/1999 15:01	S	1	R	82	
2-JMS110.30	02/23/1999 15:41	S	1	R	52	
2-JMS110.30	03/23/1999 15:44	S	1	R	54	
2-JMS110.30	04/20/1999 15:29	S	1	R	70	
2-JMS110.30	05/20/1999 12:54	S	1	R	56	
2-JMS110.30	06/22/1999 15:01	S	1	R	65	
2-JMS110.30	07/20/1999 15:51	S	1	R	88.1	
2-JMS110.30	08/17/1999 15:19	S	1	R	90.5	
2-JMS110.30	09/21/1999 16:28	S	1	R	38	
2-JMS110.30	10/28/1999 12:51	S	1	R	69.9	
2-JMS110.30	11/18/1999 13:36	S	1	R	64.7	
2-JMS110.30	12/21/1999 14:30	S	1	R	39.8	
2-JMS110.30	01/18/2000 13:01	S	1	R	67.7	
2-JMS110.30	02/23/2000 12:00	S	1	R	54	
2-JMS110.30	03/28/2000 12:01	S	1	R	40	
2-JMS110.30	04/24/2000 13:13	S	1	R	39	
2-JMS110.30	05/23/2000 13:33	S	1	R	51	
2-JMS110.30	06/20/2000 12:33	S	1	R	59.2	
2-JMS110.30	07/18/2000 12:12	S	1	R	57	
2-JMS110.30	08/22/2000 12:31	S	1	R	63.7	
2-JMS110.30	09/26/2000 12:50	S	1	R	70	
2-JMS110.30	10/24/2000 15:11	S	1	R	77.2	
2-JMS110.30	11/28/2000 12:23	S	1	R	104	
2-JMS110.30	01/23/2001 10:01	S	1	R	64	
2-JMS110.30	02/20/2001 14:31	S	1	R	55	
2-JMS110.30	03/27/2001 09:12	S	1	R	33.5	
2-JMS110.30	04/24/2001 09:15	S	1	R	30.7	
2-JMS110.30	05/24/2001 09:00	S	1	R	94.5	
2-JMS110.30	06/19/2001 09:30	S	1	R	42.4	
2-JMS110.30	07/24/2001 09:45	S	1	R	74.9	
2-JMS110.30	08/21/2001 17:30	S	1	R	63.9	
2-JMS110.30	09/18/2001 18:00	S	1	R	78	
2-JMS110.30	10/16/2001 17:00	S	1	R	56.9	

Sta Id	Collection Date Time	Depth Desc	Depth	Container Id Desc	00900 HARDNESS, TOTAL (MG/L AS CACO3) Value	Com Code
2-JMS110.30	11/27/2001 10:00	S	1	R	116	
2-JMS110.30	12/12/2001 09:45	S	1	R	103	
2-JMS110.30	01/22/2002 10:00	S	1	R	52.1	
2-JMS110.30	02/19/2002 09:33	S	1	R	46.2	
2-JMS110.30	03/19/2002 09:33	S	1	R	81.8	
2-JMS110.30	04/16/2002 07:30	S	1	R	52.2	
2-JMS110.30	05/28/2002 07:30	S	1	R	29.3	
2-JMS110.30	06/25/2002 07:15	S	1	R	91	
2-JMS110.30	07/23/2002 07:00	S	1	S1	208	
2-JMS110.30	08/13/2002 08:00	S	1	R	85	
2-JMS110.30	09/24/2002 08:00	S	1	R	27.2	
2-JMS110.30	10/22/2002 08:00	S	1	R	91.7	
2-JMS110.30	11/19/2002 08:00	S	1	R	34.4	
2-JMS110.30	12/10/2002 08:00	S	1	R	62.6	
2-JMS110.30	01/21/2003 09:50	S	1	R	63.6	
2-JMS110.30	02/25/2003 09:44	S	1	R	47.8	
2-JMS110.30	03/18/2003 09:01	S	1	R	55.4	
2-JMS110.30	04/15/2003 09:11	S	1	R	21.4	
2-JMS110.30	05/27/2003 09:44	S	1	R	39.3	
2-JMS110.30	06/24/2003 09:30	S	1	R	56.5	
2-JMS110.30	07/15/2003 09:49	S	1	R	47.8	
2-JMS110.30	08/26/2003 09:14	S	1	R	39.5	
2-JMS110.30	09/24/2003 09:19	S	1	R	27.9	
2-JMS110.30	10/28/2003 09:43	S	1	R	59.9	
2-JMS110.30	11/18/2003 09:11	S	1	R	42	
2-JMS110.30	12/16/2003 09:33	S	1	R	40	
2-JMS110.30	02/25/2004 09:34	S	1	R	68	
2-JMS110.30	03/23/2004 09:17	S	1	R	65.4	
2-JMS110.30	04/20/2004 09:15	S	1	R	45.7	
2-JMS110.30	05/18/2004 09:17	S	1	R	52	
2-JMS110.30	06/15/2004 09:30	S	1	R	49	
2-JMS110.30	07/20/2004 09:00	S	1	S1	138.2	
2-JMS110.30	08/17/2004 10:04	S	1	R	48.5	
2-JMS110.30	09/21/2004 12:48	S	1	R	78.6	
2-JMS110.30	10/19/2004 09:20	S	1	R	32	
2-JMS110.30	11/16/2004 10:22	S	1	R	49	
2-JMS110.30	12/14/2004 09:21	S	1	R	56	
2-JMS110.30	01/26/2005 11:33	S	1	R	56	
2-JMS110.30	02/15/2005 09:11	S	1	R	66	
2-JMS110.30	03/22/2005 09:33	S	1	R	56	
2-JMS110.30	04/19/2005 09:22	S	1	R	57.5	
2-JMS110.30	05/24/2005 09:54	S	1	R	50	
2-JMS110.30	06/21/2005 09:41	S	1	R	66	
2-JMS110.30	07/19/2005 09:15	S	1	R	60	
2-JMS110.30	08/23/2005 10:07	S	1	R	74	
2-JMS110.30	09/20/2005 09:52	S	1	R	94	
2-JMS110.30	10/18/2005 10:11	S	1	R	56	
2-JMS110.30	11/15/2005 09:26	S	1	R	82	
2-JMS110.30	12/13/2005 09:33	S	1	R	51	
2-JMS110.30	01/17/2006 09:33	S	1	R	74	

Sta Id	Collection Date Time	Depth Desc	Depth	Container Id Desc	00900 HARDNESS, TOTAL (MG/L AS CACO3) Value	Com Code
2-JMS110.30	02/21/2006 09:44	S	1	R	64	
2-JMS110.30	03/20/2006 09:41	S	1	R	62	
2-JMS110.30	04/26/2006 09:33	S	1	R	52	
2-JMS110.30	05/15/2006 09:22	S	1	R	50	
2-JMS110.30	06/29/2006 08:03	S	1	R	44	
2-JMS110.30	07/24/2006 09:44	S	1	S1	82	
2-JMS110.30	08/22/2006 09:30	S	1	R	90	
2-JMS110.30	09/26/2006 09:33	S	1	R	70	
2-JMS110.30	10/30/2006 09:44	S	1	R	52	
2-JMS110.30	11/15/2006 12:43	S	1	R	38	
2-JMS110.30	12/14/2006 12:33	S	1	R	62	
2-JMS110.30	01/24/2007 12:29	S	1	R	56	
Average					**79**	

Winter Season Ambient Temperatures (degrees Celsius)						
January	February	March	April	May	November	December
2.22	2.78	8.89	20.56	14.44	3.33	5.56
4.44	4.44	12.78	20	20	5.56	4.44
5		11.67	14.44	13.33	6.11	8.89
6.67	1.11	11.11	14.44	21.11	11.67	13.33
11.11	3.33	7.22	12.22	18.89	6.67	10
10	6.67	13.33	14.44	21.11	12.22	6.11
5.56	6.67	14.44	14.44	20	7.22	10.5
4.44	2.5	11	13.89	2.1	0	7.5
3	3	17	14.44	3	17	5
4.5	8	6	13	17.5	17	12
6	7.5	10.5	16	20	14	4
0.5	10.5	6	9	26	15	4
1	0	12	13.5	20.5	13	9
1.2	12.5	10	15	28	10	7
2	5	11	17.5	23.5	19	6
8	6	9	12.5	23		6
4	2.5	9	14	23.3		7
2	6.5	13	14	19.5	14.5	3
6.1	6.5	16	24.5	23	12	3
8.3	9.1	11	25	24.4	9	1
8.2	8.2	12	14.7	22	9	8.7
6.48	8.2	14	15		15.5	8.7
6.5	3.45	7	24	17	7	8.81
7.3	4	7	11	25.4	12.4	8.8
7.32	4.5	7	13.5	23	5.9	5.3
	4.51	10	18	23	9.4	5.35
6.3	4.3	15	13.9	21.4	13.3	8.38
15	4.79	9.8	17	20.2	13.31	2.7
2.4	7.5	9.8	11.4	23.3	9.27	10.88
2.11	5.07	10.8	17.1	15.9	13.88	3.81
5.98	6.42	16.5	20.3	21.58	13.9	5.13
4.49	7.9	13.6	11.2	21.6	7.8	5.46
0.76	5.86	11.3	16.6	27.65	7.76	8.45
5.95	7.86	10.18	10.37	17.3	9.43	7.8
5.96	8.61	10.97	10.4	18.6	7.6	10.76
2.99	6.49	13.8	19.1	22.32	6.77	1.37
2.33	4.5	8.79	19.1	23.11	7.83	4.06
4.34	6.1	8.34	12	16.4	12.55	7.73
0.47	6.65	8.4	11.98	22.54	10	3.2
0.99	5.64	10.12	17.72	25.57	6.25	3.2
5.54	3.5	14.41	17.94	21.71	12.69	6
4.8	5.6	9.63	17.67	19.24	9.83	7.8
2.9	7	10.38	19.62	18.57	11.49	4.1
0.6		7.09	13.81	22.2	9.31	
		9.67	14.7	21.86	13.8	
		14.54	17.41	22.32	12.9	
		9.23	17.42	23.2	11.6	
		12.19	19.02	25.07	5.5	
		11.38	20.71	24.66		
		10.38	12.81	24.91		
		10.95	17.15	21.64		
		11.1	15.91	22.44		
		8.2	19.9	17.93		
		11.8	20.4	22.8		
		8.8	16.1	23.08		
			20.1	23.23		
				21.02		
				20.14		
				24.54		
				17.01		
				20.12		
				19		
				27.1		
				19.6		
				18.5		

90th %tile \	22.51

2010 Fact Sheets for 303(d) Waters

RIVER BASIN: James River Basin

HYDROLOGIC UNIT: 02080206

STREAM NAME: **James River**

TMDL ID: **G01E-01-BAC**

2010 IMPAIRED AREA ID: CB-JMSTFU

ASSESSMENT CATEGORY: 5A

TMDL DUE DATE: 2010

IMPAIRED SIZE: 6.2581 - Sq. Mi.

Watershed: VAP-G01E

INITIAL LISTING: 1996

UPSTREAM LIMIT: Fall Line (Mayos Bridge)

DOWNSTREAM LIMIT: Appomattox River

Estuarine James River from the fall line at Mayos Bridge downstream to the Appomattox River.

CLEAN WATER ACT GOAL AND USE SUPPORT:

Recreation Use - Not Supporting

IMPAIRMENT: E.coli

The James River from the fall line to the Appomattox River has been assessed as not supporting of the Recreation use support goal based on the results of a summer special study in the fall zone. The special study was designed to monitor the effects of summertime rain and combined sewer overflow (CSO) events on water quality in the James River and to monitor the effects of Richmond's CSO abatement efforts.

The segment has been included on the Impaired Waters list for fecal coliform since 1996. During the 2004 and 2006 cycles, the bacteria standard changed to E.coli for those stations with enough data. Some of the areas in this segment had converted to the E.coli standard, for others the fecal coliform standard was still in effect. During the 2008 cycle, the impairment was converted solely to E. coli. The TMDL for bacteria is due in 2010.

Bacteria impairment is noted at the following stations during the 2010 cycle:
2-JMS110.30
2-JMS104.16
2-JMS099.30

Although station 2-JMS087.01 is currently passing (5/50), the downstream extent will remain the same for this cycle due to the historical impairment and the marginal passing rate.

Farrar Gut was mistakenly combined with the mainstem in previous assessments. The stream is a separate waterbody and should not be included in the bacterial impairment, which only included the "estuarine James River".

IMPAIRMENT SOURCE: NPS - Urban, CSO

The source of the impairment in this section of the river is believed to be urban runoff from the tributary drainage basin and from combined sewer overflow events from the City of Richmond's combined sewer system.

The City is currently undertaking CSO abatement efforts. It is recommended that the ongoing CSO special study be continued to gauge the effects of CSO abatement efforts on water quality in this segment.

RECOMMENDATION: Problem Characterization

2010 Fact Sheets for 303(d) Waters

RIVER BASIN: James River Basin

HYDROLOGIC UNIT: 02080206

STREAM NAME: **James River**

TMDL ID: **G01E-02-CHLA**

2010 IMPAIRED AREA ID: CB-JMSTFU

ASSESSMENT CATEGORY: 5A

TMDL DUE DATE: 2010

IMPAIRED SIZE: 5.5117 - Sq. Mi.

Watershed: VAP-G01E

INITIAL LISTING: 2008

UPSTREAM LIMIT: Fall Line (Mayos Bridge)

DOWNSTREAM LIMIT: Appomattox River

Mainstem James River from the fall line at Mayos Bridge downstream to the JMSTFu/JMSTFl boundary at the Appomattox River.

CLEAN WATER ACT GOAL AND USE SUPPORT:

Aquatic Life Use - Not Supporting, Open Water Subuse - Not Supporting

IMPAIRMENT: Chlorophyll

The James River from the Appomattox River to the Chickahominy River was originally listed on the 1998 list as fully supporting but threatened of the Aquatic Life Use goal based on chlorophyll_a exceedances. During the 1998 cycle, EPA extended the segment upstream to the fall line and downgraded the river to not supporting the Aquatic Life Use, citing nutrient concerns.

In previous cycles, the mainstem James River had acceptable dissolved oxygen levels. In addition the entire tidal freshwater portion (fall line to just above the Chickahominy River) has good benthic community based on the results from the Chesapeake Bay Benthic Index of Biological Community; therefore the James River from the fall line to the oligohaline boundary was considered impaired solely for Nutrients/Eutrophication Biological Indicators (EPA Overlist).

A special site-specific chlorophyll standard for the mainstem James River was adopted during the 2008 cycle. The upper tidal freshwater segment exceeds both the spring and summer seasonal means.

Farrar Gut was mistakenly combined with the mainstem in previous assessments. The stream is a separate waterbody and should not be included in the chlorophyll a impairment, which only includes the mainstem James River.

IMPAIRMENT SOURCE: Point sources, Nonpoint Sources

The James River Tributary Strategy was developed to bring the river into attainment.

RECOMMENDATION: Problem Characterization

2010 Fact Sheets for 303(d) Waters

RIVER BASIN: James River Basin **HYDROLOGIC UNIT:** 02080206

STREAM NAME: **James River and Various Tributaries**

TMDL ID: **G01E-03-PCB** **2010 IMPAIRED AREA ID:** CB-JMSTFU

ASSESSMENT CATEGORY: 5A **TMDL DUE DATE:** 2014

IMPAIRED SIZE: ~325 - Stream mile **Watershed:** VAP-G01E

INITIAL LISTING: 2002

UPSTREAM LIMIT: Fall line

DOWNSTREAM LIMIT: Hampton Roads Bridge Tunnel

Estuarine James River from the fall line to the Hampton Roads Bridge Tunnel, including several tributaries listed below.

CLEAN WATER ACT GOAL AND USE SUPPORT:

Fish Consumption Use - Not Supporting

IMPAIRMENT: Fish Tissue - PCBs, VDH Fish Consumption Restriction

During the 2002 cycle, the James River from the Fall line to Queens Creek was considered not supporting of the Fish Consumption Use due to PCBs in multiple fish species at multiple DEQ monitoring locations.

During the 2004 cycle, a VDH Fish Consumption Restriction was issued from the fall line to Flowerdew Hundred and the segment was adjusted slightly to match the Restriction. In addition, in the 2004 cycle, the Chickahominy River from Walkers Dam to Diascund Creek was assessed as not supporting the Fish Consumption Use because the DEQ screening value for PCBs was exceeded in 3 species during sampling in 2001.

During the 2006 cycle, the VDH restriction was extended on 12/13/2004 to extend from the I-95 bridge downstream to the Hampton Roads Bridge Tunnel and include the tidal portions of the following tributaries:

Appomattox River up to Lake Chesdin Dam
Bailey Creek up to Route 630
Bailey Bay
Chickahominy River up to Walkers Dam
Skiffes Creek up to Skiffes Creek Dam
Pagan River and its tributary Jones Creek
Chuckatuck Creek
Nansemond River and its tributaries Bennett Creek and Star Creek
Hampton River
Willoughby Bay and the Elizabeth R. system (Western, Eastern, and Southern Branches and Lafayette R.) and tributaries St. Julian Creek, Deep Creek, and Broad Creek

The advisory was modified again on 10/10/2006 to add Poythress Run.

The impairments were combined. The TMDL for the lower extended portion is due in 2018.

Farrar Gut was mistakenly combined with the mainstem in previous assessments. The stream is a separate waterbody and is not included in the VDH Fish Consumption Advisory.

IMPAIRMENT SOURCE: Unknown

The source of the PCBs is considered unknown.

2010 Fact Sheets for 303(d) Waters

RIVER BASIN: James River Basin **HYDROLOGIC UNIT:** 02080206

STREAM NAME: **James River Tidal Freshwater (Upper) Estuary**

TMDL ID: **JMSTFU-DO-BAY** **2010 IMPAIRED AREA ID:** CB-JMSTFU

ASSESSMENT CATEGORY: 5A **TMDL DUE DATE:** 2010

IMPAIRED SIZE: 6.5749 - Sq. Mi. **Watershed:** VAP-G01E

INITIAL LISTING: 1998

UPSTREAM LIMIT: Fall line

DOWNSTREAM LIMIT: Tidal Freshwater/Oligohaline Boundary

The James River Tidal Freshwater Upper estuary, which extends from the fall line to approximately the Appomattox River, including tributaries.

CLEAN WATER ACT GOAL AND USE SUPPORT:

Aquatic Life Use - Not Supporting

IMPAIRMENT: Dissolved Oxygen

The mainstem James River from the Appomattox River to the Chickahominy River was originally listed on the 1998 list as fully supporting but threatened of the Aquatic Life Use goal based on chlorophyll_a exceedances. During the 1998 cycle, EPA extended the segment upstream to the fall line and downgraded the river to not supporting the Aquatic Life Use, citing nutrient concerns.

In previous cycles, the mainstem James River had acceptable dissolved oxygen levels. In addition the entire tidal freshwater portion (fall line to just above the Chickahominy River) has good benthic community based on the results from the Chesapeake Bay Benthic Index of Biological Community; therefore the James River from the fall line to the oligohaline boundary was considered impaired solely for Nutrients/Eutrophication Biological Indicators (EPA Overlist).

The CB water quality standards were implemented during the 2006 cycle. The 30-day dissolved oxygen criteria was met during the 2006 and 2008 cycles; however, during the 2010 cycle, the segment failed the summer 30-day Open Water dissolved oxygen criteria. The rest-of-year standard was met.

IMPAIRMENT SOURCE: Nonpoint Source, Point Source

The tributary strategy for the James River assigned sources and allocations.

RECOMMENDATION: Problem Characterization

2010 Fact Sheets for 303(d) Waters

RIVER BASIN: James River Basin **HYDROLOGIC UNIT:** 02080206

STREAM NAME: **James River Tidal Freshwater (Upper) Estuary**

TMDL ID: **JMSTFU-SAV-BAY** **2010 IMPAIRED AREA ID:** CB-JMSTFU

ASSESSMENT CATEGORY: 5A **TMDL DUE DATE:** 2010

IMPAIRED SIZE: 6.5998 - Sq. Mi. **Watershed:** VAP-G01E

INITIAL LISTING: 1998

UPSTREAM LIMIT: Fall line

DOWNSTREAM LIMIT: Tidal Freshwater/Oligohaline Boundary

The James River Tidal Freshwater Upper estuary, which extends from the fall line to approximately the Appomattox River, including tributaries.

CLEAN WATER ACT GOAL AND USE SUPPORT:

Aquatic Life Use - Not Supporting, Shallow Water Use - Not Supporting

IMPAIRMENT: Aquatic Macrophytes

The mainstem James River from the Appomattox River to the Chickahominy River was originally listed on the 1998 list as fully supporting but threatened of the Aquatic Life Use goal based on chlorophyll_a exceedances. During the 1998 cycle, EPA extended the segment upstream to the fall line and downgraded the river to not supporting the Aquatic Life Use, citing nutrient concerns.

In previous cycles, the mainstem James River had acceptable dissolved oxygen levels. In addition the entire tidal freshwater portion (fall line to just above the Chickahominy River) has good benthic community based on the results from the Chesapeake Bay Benthic Index of Biological Community; therefore the James River from the fall line to the oligohaline boundary was considered impaired solely for Nutrients/Eutrophication Biological Indicators (EPA Overlist).

During the 2006 cycle, the CB water quality standards were implemented. The Upper Tidal Freshwater James River from the fall line to the Appomattox fails the Shallow Water Use SAV criteria.

IMPAIRMENT SOURCE: Nonpoint Source, Point Source

The tributary strategy for the James River assigned sources and allocations.

RECOMMENDATION: Problem Characterization

Attachment D

Site Visit

VIRGINIA DEPARTMENT OF ENVIRONMENTAL QUALITY

Wastewater Facility Inspection Report

Revised 08/2001

Facility Name:	Richmond WWTP	**Facility No.:**	VA0063177
City/~~County~~:	Richmond	**Inspection Agency:**	DEQ - PRO
Inspection Date:	August 11, 2009	**Date Form Completed:**	August 14, 2009
Inspector:	Charles Stitzer	**Time Spent:**	18 hrs. w/ travel & report
Reviewed By:		**Unannounced Insp.?**	No
		FY-Scheduled Insp.?	Yes

Present at Inspection: Clair Watson, Eric Whitehurst

TYPE OF FACILITY:

Domestic		Industrial	
[ ] Federal	[x] Major	[ ] Major	[ ] Primary
[x] Non-Federal	[ ] Minor	[ ] Minor	[ ] Secondary

Population Served: approx.: 215,000

Number of Connections: approx.: 58,000

TYPE OF INSPECTION:

[x] Routine — Date of last inspection: April 28, 2005

[ ] Compliance

[ ] Reinspection — Agency: DEQ/PRO

INFLUENT and EFFLUENT MONITORING: ***Please refer to the DMR File***

Last month average: BOD: ___ mg/L TSS: ____ mg/L Flow: __ MGD
(Influent) Date:
Other: _____ mg/L

Last month: CBOD: ____ mg/L TSS: ____ mg/L Flow:___ MGD
(Effluent) Date:
Other:

Quarter average: CBOD: _____ mg/L TSS: ____ mg/L Flow: ___ MGD
(Effluent) Date:
Other:

CHANGES AND/OR CONSTRUCTION

DATA VERIFIED IN PREFACE	[ ] Updated	[x] No changes
Has there been any new construction?	[ ] Yes*	[x] No
If yes, were plans and specifications approved?	[ ] Yes	[ ] No* [x] N/A
DEQ approval date:	N/A	

(A) PLANT OPERATION AND MAINTENANCE

1. Class and number of licensed operators: Class I – 16; Class II – 4; Class III – 9; Class IV – 0
2. Hours per day plant is staffed: *24 hours/day, 7 days/week*
3. Describe adequacy of staffing: [x] Good [ ] Average [ ] Poor*
4. Does the plant have an established program for training personnel? [x] Yes [ ] No
5. Describe the adequacy of the training program: [x] Good [ ] Average [ ] Poor*
6. Are preventive maintenance tasks scheduled? [x] Yes [ ] No*
7. Describe the adequacy of maintenance: [x] Good [ ] Average [ ] Poor*
8. Does the plant experience any organic/hydraulic overloading? [x] Yes* [ ] No

   If yes, identify cause and impact on plant: The plant occasionally experiences high flows, however, I&I reduction required by an existing Consent Special Order and future plant construction should alleviate some of the peak flow problems.

9. Any bypassing since last inspection? [ ] Yes* [x] No - *Not at the plant*
10. Is the on-site electric generator operational? [ ] Yes [ ] No* [x] N/A
11. Is the STP alarm system operational? [x] Yes [ ] No * [ ] N/A
12. How often is the standby generator exercised? [ ] Weekly [ ] Monthly [x] Other: N/A

    Power Transfer Switch? [ ] Weekly [ ] Monthly [x] Other:

    Alarm System? [ ] Weekly [x] Monthly [ ]Other:
13. When were the cross connection control devices last tested on the potable water service? *See comment, below*
14. Is sludge disposed in accordance with the approved sludge disposal plan? [x] Yes [ ] No* [ ] N/A
15. Is septage received by the facility? [x] Yes [ ] No

    Is septage loading controlled? [x] Yes [ ] No * [ ] N/A

    Are records maintained? [x] Yes [ ] No* [ ] N/A
16. Overall appearance of facility: [x] Good [ ] Average [ ] Poor*

Comments: #1. The plant is fully staffed. #4. Training includes OJT, safety training, individualized training on new equipment and DEQ Certification Classes. The plant has an excellent incentive/reward program for upgrading certification. #6, 7 & 13. Annual RPZ certifications for the plant's 32 backflow preventers are scheduled and tracked by a computerized system. The tracking system indicates that the RPZ maintenance records are up-to-date. #9. Sanitary Sewer overflows are reported in accordance with the Permit. #11. Alarm signals report to operator's control/enunciator panel and MIS (management maintenance system). #12. Facility maintains two power feeds. #12a. The power transfer switch is activated several times throughout the year. #14. The approved plan calls for land application by contractor (Nutriblend). #15. Septage records are maintained by the Pretreatment Office at the WWTP.

(B) PLANT RECORDS

1. Which of the following records does the plant maintain?

Operational Logs for each unit process	[x] Yes	[ ] No*	[ ] N/A
Instrument maintenance and calibration	[x] Yes	[ ] No*	[ ] N/A
Mechanical equipment maintenance	[x] Yes	[ ] No*	[ ] N/A
Industrial waste contribution **(Municipal Facilities)**	[x] Yes	[ ] No*	[ ] N/A

2. What does the operational log contain?

Visual Observations	[x] Yes	[ ] No	[ ] N/A
Flow Measurement	[x] Yes	[ ] No	[ ] N/A
Laboratory Results	[x] Yes	[ ] No	[ ] N/A
Process Adjustments	[x] Yes	[ ] No*	[ ] N/A
Control Calculations	[x] Yes	[ ] No	[ ] N/A
Other:			

3. What do the mechanical equipment records contain:

As built plans and specs?	[x] Yes	[ ] No*	[ ] N/A
Spare parts inventory?	[x] Yes	[ ] No*	[ ] N/A
Manufacturer's instructions?	[x] Yes	[ ] No*	[ ] N/A
Equipment/parts suppliers?	[x] Yes	[ ] No*	[ ] N/A
Lubrication schedules?	[x] Yes	[ ] No*	[ ] N/A
Other:			
Comments:	None		

4. What do the industrial waste contribution records contain: *(Applicable to municipal facilities only)*

Waste characteristics?	[x] Yes	[ ] No*	[ ] N/A
Locations and discharge types?	[x] Yes	[ ] No*	[ ] N/A
Impact on plant?	[x] Yes	[ ] No*	[ ] N/A
Other:	N/A		
Comments:	The pretreatment staff is responsible for managing the pretreatment permits, coordinating and conducting inspections and sampling, and maintaining septage records.		

5. Are the following records maintained at the plant:

Equipment maintenance records	[x] Yes	[ ] No*	[ ] N/A
Operational Log	[x] Yes	[ ] No*	[ ] N/A
Industrial contributor records	[x] Yes	[ ] No*	[ ] N/A
Instrumentation records	[x] Yes	[ ] No*	[ ] N/A
Sampling and testing records	[x] Yes	[ ] No*	[ ] N/A

6. Are records maintained at a different location? [ ] Yes [x] No
   Where are the records maintained? All are available on site.

7. Were the records reviewed during the inspection? [ ] Yes [x] No

8. Are the records adequate and the O & M Manual current? [x] Yes [ ] No* [ ] N/A
   O&M Manual date written: 5th Supplement - July 1997
   Date DEQ approved O&M: September 9, 1997 - VDH

9. Are the records maintained for required 3-year period? [x] Yes [ ] No*

Comments: #2 – In addition to operational logs where process control data is recorded, a log book is maintained at each manned station of the plant; the supervising operator signs in and makes staffing and operational notes. Lab records are maintained in the laboratory. #8 An extensive upgrade is ongoing which will require the current O&M Manual to be updated following the upgrade's completion.

(C) SAMPLING

1.	Are sampling locations capable of providing representative samples?	[x] Yes	[ ] No*	[ ] N/A
2.	Do sample types correspond to those required by the permit?	[x] Yes	[ ] No*	[ ] N/A
3.	Do sampling frequencies correspond to those required by the permit?	[x] Yes	[ ] No*	[ ] N/A
4.	Are composite samples collected in proportion to flow?	[x] Yes	[ ] No*	[ ] N/A
5.	Are composite samples refrigerated during collection?	[x] Yes	[ ] No*	[ ] N/A
6.	Does plant maintain required records of sampling?	[x] Yes	[ ] No*	[ ] N/A
7.	Does plant run operational control tests?	[x] Yes	[ ] No*	[ ] N/A

Comments:

(D) TESTING

1. Who performs the testing?
   [x] Plant/ Lab
   [ ] Central Lab
   [x] Commercial Lab: Microbac - Metals
   J.R. Reed & Assoc. – Bioassays

If plant performs any testing, complete 2-4.

2.	What method is used for chlorine analysis?	HACH Pocket Colorimeter		
3.	Is sufficient equipment available to perform required tests?	[x] Yes	[ ] No*	[ ] N/A
4.	Does testing equipment appear to be clean and/or operable?	[x] Yes	[ ] No*	[ ] N/A

Comments: Please see DEQ Laboratory Inspection Report, conducted August 15, 2007.

(E) FOR INDUSTRIAL FACILITIES W/ TECHNOLOGY BASED LIMITS N/A

1. Is the production process as described in the permit application? (If no, describe changes in comments)

   [ ] Yes [ ] No* [x] N/A

2. Do products and production rates correspond to the permit application? (If no, list differences in comments section)

   [ ] Yes [ ] No* [x] N/A

3. Has the State been notified of the changes and their impact on plant effluent?

   [ ] Yes [ ] No* [x] N/A

Comments: None

FOLLOW UP TO COMPLIANCE RECOMMENDATIONS FROM THE AUGUST 15, 2007 DEQ INSPECTION:

There were no Compliance Recommendations from the August 15, 2007 DEQ inspection.

FOLLOW UP TO GENERAL RECOMMENDATIONS FROM THE AUGUST 15, 2007 DEQ INSPECTION:

There were no General Recommendations from the August 15, 2007 DEQ inspection.

INSPECTION REPORT SUMMARY

Compliance Recommendations/Request for Corrective Action:

There are no Compliance Recommendations at this time.

General Recommendations/Observations:

There are no General Recommendations at this time.

Comments:

The City of Richmond is working, under Consent Special Order dated March 17, 2005, to implement an ongoing plan to minimize combined sewer overflows ("CSO") during storm events, as well as minimize their impacts on the WWTP. The Consent Order addresses solids and floatables control at 6 CSO outfalls; sewer separation in 3 areas; in-line flow equalization, conveyance system upgrade at Lower Gillies Creek and modifications at the Shockoe Retention Basin. The Consent Order also requires upgrades at the WWTP to better handle wet weather flows, including expanded solids handling to provide reliable treatment up to 140 MGD; improved disinfection up to 300 MGD; and modifications to the final clarifiers to improve settling for up to 85 MGD. Annual Average CBOD and TSS concentrations for flows above 75 MGD are also identified in the Special Order; the limits are tiered for flows > 75 MGD up to 80 MGD, > 80 MGD up to 85 MGD, > 85 MGD up to 90 MGD, and > 90 MGD.

There are numerous on-going construction projects at the plant site. Most, but not all, are related to the upgrades necessary to achieve compliance with new nutrient limitations. The following are projects currently underway:

1. Rehab/Replacement of 4 Gravity Thickener Tanks (motors, pumps, valves, VFD's, Drives etc)
2. Phase I Nutrient Reduction –Nitrogen – Phosphorus (Rehab Effluent Filter, New methanol storage, rehab ferric system)
3. Phase II – UV system installed (removal of Cl_2 and SO_2) New plant switch gear and power lines.
4. Phase III – Scum system for Primary and Final tanks – Scum concentrator Bld.
5. Phase IV – 2 Additional final tanks, bio-augmentation.
6. Upgrading MIS - computer system and also installing new monitoring equipment (DO, PH, nitrogen etc)

Items evaluated during this inspection include (check all that apply):

[x] Yes	[ ] No		Operational Units
[ ] Yes	[x] No		O & M Manual
[ ] Yes	[x] No		Maintenance Records
[ ] Yes	[x] No	[ ] N/A	Pathogen Reduction & Vector Attraction Reduction
[ ] Yes	[x] No	[ ] N/A	Sludge Disposal Plan
[ ] Yes	[ ] No	[x] N/A	Groundwater Monitoring Plan
[ ] Yes	[ ] No	[x] N/A	Storm Water Pollution Prevention Plan
[x] Yes	[ ] No	[ ] N/A	Permit Special Conditions
[ ] Yes	[ ] No	[ ] N/A	Permit Water Quality Chemical Monitoring
[x] Yes	[ ] No	[ ] N/A	Laboratory Records (see Lab Report – August 15, 2007)

UNIT PROCESS: Screening/Comminution

(Influent Pump Station)

1.	Number of units:	Manual: 0		Mechanical: 2
	Number of units in operation:	Manual: 0		Mechanical: 1
2.	Bypass channel provided?	[x] Yes	[ ] No	
	Bypass channel in use?	[ ] Yes	[x] No	[ ] N/A
3.	Area adequately ventilated?	[x] Yes	[ ] No*	
4.	Alarm system for equipment failure or overloads?	[x] Yes	[ ] No	[ ] N/A
	If present, is the alarm system operational?	[x] Yes	[ ] No *	[ ] N/A
5.	Proper flow-distribution between units?	[x] Yes	[ ] No *	[ ] N/A
6.	How often are units checked and cleaned?	checked hourly; timer activated rake		
7.	Cycle of operation:	Timer controls routine cleaning – runs continuously during high flows		
8.	Volume of screenings removed:	Varies. 3,000-5,000 lbs/day		
9.	General condition:	[x] Good	[x] Fair	[ ] Poor*

Comments: The screens may be bypassed by closing the preceding gate; all flow would back up to the supplemental pump station, which would pump the wastewater though the plant via the secondary screens and grit channels. Grab samples are manually collected hourly from the influent channel. The 2 units are alternated about every 2 – 3 weeks to clean the grit channels associated with each screen. #4. The differential head function that activates the operation of the screens no longer works (previous inspection). #6. Units are monitored via the MIS system by the staff at the influent lift station.

UNIT PROCESS: Grit Removal

1.	Number of units:	4		
	Number of units in operation:	2		
2.	Unit adequately ventilated?	[x] Yes	[ ] No *	
3.	Operation of grit collection equipment:	[x] Manual	[ ] Time clock	[ ] Continuous duty
4.	Proper flow-distribution between units?	[x] Yes	[ ] No *	[ ] N/A
5.	Daily volume of grit removed:	Varies. Avg. 3,000-5,000 lbs/day		
6.	All equipment operable?	[x] Yes	[ ] No *	
7.	General condition:	[x] Good	[x] Fair	[ ] Poor*

Comments: #1. The grit channels are alternated every 2 – 3 weeks. #3. Grit is manually removed by Gantry crane and bucket. The grit is taken to pad for draining and disposed of at the Waste Management facility in Charles City Co.

UNIT PROCESS: Sewage Pumping

1. Name of station: ***Influent Lift Station***
2. Location (if not at STP): ***N/A***
3. Following equipment operable:
   - a. All pumps? [x] Yes [ ] No*
   - b. Ventilation? [x] Yes [ ] No* [ ] N/A
   - c. Control system? [x] Yes [ ] No* [ ] N/A
   - d. Sump pump? [x] Yes [ ] No* [ ] N/A
   - e. Seal water system? [ ] Yes [ ] No* [x] N/A

4. Reliability considerations:
   - a. Class [x] I [ ] II [ ] III
   - b. Alarm system operable? [x] Yes [ ] No [ ] N/A
   - c. Alarm conditions monitored:
     1. high water level: [x] Yes [ ] No* [ ] N/A
     2. high liquid level in dry well: [x] Yes [ ] No* [ ] N/A
     3. main electric power: [x] Yes [ ] No* [ ] N/A
     4. auxiliary electric power: [ ] Yes [ ] No* [x] N/A
     5. failure of pump motors to start: [ ] Yes [ ] No* [x] N/A
     6. test function: [x] Yes [ ] No*
     7. other: variable frequency drive
   - d. Backup for alarm system operational? [ ] Yes [ ] No* [x] N/A
   - e. Alarm signal reported to (identify): local audible & visual (panel), control bldg., and SKADA
   - f. Continuous operability provisions:
     1. Generator hook up? [ ] Yes [x] No
     2. Two sources of electricity? [x] Yes [ ] No (two power feeds)
     3. Portable pump? [ ] Yes [x] No
     4. 1 day storage? [ ] Yes [x] No
     5. other: N/A

5. Does station have bypass? [ ] Yes* [x] No
   - a. Evidence of bypass use? [ ] Yes* [ ] No [x] N/A
   - b. Can bypass be disinfected? [ ] Yes [ ] No* [x] N/A
   - c. Can bypass be measured? [ ] Yes [ ] No* [x] N/A

6. How often is station checked? manned 24 hours

7. General condition: [x] Good [ ] Fair [ ] Poor*

Comments: #3a. There are 4 variable speed main pumps; all are operational. #4e. The lift station's high-level alarms report to operator enunciator panel, MIS system, and local audio visual. Richmond's three pump stations, Douglasdale Ave., Hampton Street and Upham Brook, each signal alarms to the operator's enunciator panel and MIS. #5. The main lift station has a supplemental pump station, for backup.

UNIT PROCESS: Flow Measurement

[x] Influent [ ] Intermediate [ ] Effluent

1. Type measuring device: 66" Venturi pressure differential

2. Present reading: Not checked

3. Bypass channel? [x] Yes [ ] No

   Metered? [x] Yes [ ] No* [ ] N/A

4. Return flows discharged upstream from meter? [ ] Yes [x] No

   If Yes, identify: N/A

5. Device operating properly? [x] Yes [ ] No*

6. Date of last calibration: Mag meter not calibrated, but readout's electronics are checked annually as a scheduled maintenance task

7. Evidence of following problems:

   a. Obstructions? [ ] Yes* [x] No

   b. Grease? [ ] Yes* [x] No

8. General condition: [x] Good [ ] Fair [ ] Poor*

Comments: This meter is located on the lower level of the main influent pump station. #6 Mag meters cannot be "calibrated." However, Richmond annually checks the meter's electronics as a scheduled maintenance task.

UNIT PROCESS: Sewage Pumping

1. Name of station: ***Supplemental Lift Station***
2. Location (if not at STP): ***N/A***
3. Following equipment operable:
   - a. All pumps? [x] Yes [ ] No*
   - b. Ventilation? [x] Yes [ ] No* [ ] N/A
   - c. Control system? [x] Yes [ ] No* [ ] N/A
   - d. Sump pump? [x] Yes [ ] No* [ ] N/A
   - e. Seal water system? [ ] Yes [ ] No* [x] N/A

4. Reliability considerations:
   - a. Class [x] I [ ] II [ ] III
   - b. Alarm system operable? [x] Yes [ ] No [ ] N/A
   - c. Alarm conditions monitored:
     1. high water level: [x] Yes [ ] No* [ ] N/A
     2. high liquid level in dry well: [x] Yes [ ] No* [ ] N/A
     3. main electric power: [x] Yes [ ] No* [ ] N/A
     4. auxiliary electric power: [ ] Yes [ ] No* [x] N/A
     5. failure of pump motors to start: [ ] Yes [ ] No* [x] N/A
     6. test function: [x] Yes [ ] No*
     7. other:
   - d. Backup for alarm system operational? [ ] Yes [ ] No* [x] N/A
   - e. Alarm signal reported to (identify): local audible & visual (panel), control bldg.
   - f. Continuous operability provisions:
     1. Generator hook up? [ ] Yes [x] No
     2. Two sources of electricity? [x] Yes [ ] No (two power feeds)
     3. Portable pump? [ ] Yes [x] No
     4. 1 day storage? [ ] Yes [x] No
     5. other: N/A

5. Does station have bypass? [x] Yes* [ ] No See comments below
   - a. Evidence of bypass use? [x] Yes* [ ] No [ ] N/A
   - b. Can bypass be disinfected? [x] Yes [ ] No* [ ] N/A
   - c. Can bypass be measured? [x] Yes [ ] No* [ ] N/A

6. How often is station checked? when in use

7. General condition: [X] Good [ ] Fair [ ] Poor*

Comments: Under normal operating conditions this station is bypassed. The main service line flows into this wet well and the wastewater passes through by gravity to the mechanical screen/grit channels and then on to the influent lift station.

UNIT PROCESS: Screening/Comminution

(Secondary)

1.	Number of units:	Manual: 0		Mechanical: 4
	Number of units in operation:	Manual: 0		Mechanical: 4
2.	Bypass channel provided?	[ ] Yes	[x] No	
	Bypass channel in use?	[ ] Yes	[ ] No	[x] N/A
3.	Area adequately ventilated?	[x] Yes	[ ] No*	
4.	Alarm system for equipment failure or overloads?	[x] Yes	[ ] No	[ ] N/A
	If present, is the alarm system operational?	[x] Yes	[ ] No *	[ ] N/A
5.	Proper flow-distribution between units?	[x] Yes	[ ] No *	[ ] N/A
6.	How often are units checked and cleaned?	once every 2 hours		
7.	Cycle of operation:	timer set based on flow		
8.	Volume of screenings removed:	Avg. 3-5 lbs/day		
9.	General condition:	[ ] Good	[x] Fair	[ ] Poor*

Comments: Located near supplemental pump station. Under normal operating conditions the Main influent Lift station pumps the wastewater to these screens; if the influent is being diverted to the supplemental pump station, that lift station pumps the wastewater directly to these screens. The four screens are operated in parallel.

UNIT PROCESS: Grit Removal

1.	Number of units:	4			
	Number of units in operation:	4			
2.	Unit adequately ventilated?	[x] Yes	[ ] No *		
3.	Operation of grit collection equipment:	[x] Manual	[ ] Time clock	[ ] Continuous duty	[ ] N/A
4.	Proper flow-distribution between units?	[x] Yes	[ ] No *	[ ] N/A	
5.	Daily volume of grit removed:	Not determined, manually cleaned occasionally			
6.	All equipment operable?	[ ] Yes	[x] No *		
7.	General condition:	[ ] Good	[x] Fair	[ ] Poor*	

Comments: #1. The 2° automatic grit removal equipment has been removed, however, grit is regularly removed from the grit settling channel by portable crane and bucket.

UNIT PROCESS: Sedimentation

[x] Primary [ ] Secondary [ ] Tertiary

1. Number of units: 4 clarifiers, each with forebays
   In operation: 4

2. Proper flow-distribution between units? [x] Yes [ ] No* [ ] N/A

3. Signs of short-circuiting and/or overloads? [ ] Yes* [x] No

4. Effluent weirs level? [x] Yes [ ] No* [ ] N/A
   Clean? [x] Yes [ ] No*

5. Scum-collection system working properly? [x] Yes [ ] No* [ ] N/A

6. Sludge-collection system working properly? [x] Yes [ ] No* [ ] N/A

7. Influent, effluent baffle systems working properly? [x] Yes [ ] No* [ ] N/A

8. Chemical addition? [ ] Yes [x] No
   Chemicals: None

9. Effluent characteristics: Turbid (normal)

10. General condition: [ ] Good [X] Fair [ ] Poor*

Comments: #6. The sludge is raked from the bottom of the tank, sent to the de-gritter, and then flows by gravity to the gravity thickeners.

UNIT PROCESS: Sludge Pumping

(Primary to Degritters)

1. Number of Pumps: 5

   Number of pumps in operation: 4 (1 per clarifier) and one in reserve

2. Type of sludge pumped: [x] Primary [ ] Secondary [ ] Return Activated [ ] Combination [ ] Other:

3. Type of pump: [ ] Plunger [ ] Diaphragm [ ] Screw lift [x] Centrifugal [ ] Progressing cavity [ ] Other:

4. Mode of operation: [x] Manual [ ] Automatic [ ] Other:

5. Sludge volume pumped: 2.7 MGD cumulative volume to date for August 09

6. Alarm system for equipment failures or overloads operational? [ ] Yes [ ] No* [X] N/A

7. General condition: [x] Good [ ] Fair [ ] Poor*

Comments: #4. Pumps run continuously.

UNIT PROCESS: Activated Sludge Aeration

1. Number of units: 4
   Number of units in operation: 4

2. Mode of operation: conventional

3. Proper flow distribution between units? [x] Yes [ ] No* [ ] N/A

4. Foam control operational? [x] Yes [ ] No* [ ] N/A

5. Scum control operational? [ ] Yes [ ] No* [x] N/A

6. Evidence of the following problems:
   a. Dead spots? [ ] Yes* [x] No
   b. Excessive foam? [ ] Yes* [x] No
   c. Poor aeration? [ ] Yes* [x] No
   d. Excessive aeration? [ ] Yes* [x] No
   e. Excessive scum? [ ] Yes* [x] No
   f. Aeration equipment malfunction? [ ] Yes* [x] No
   g. Other:

7. Mixed liquor characteristics (as available)

pH:	7.3 SU	MLSS:	2041, 1960, 3620, 3700 mg/L (daily average)
DO:	5.7, 4.8, 6.0, 5.0 mg/L	SDI:	
SVI:	____	Color:	Good
Odor:	Normal	Settleability:	___ ml/l
		Other:	MLVSS: ___ %

8. Return/waste sludge:
a. return rate: 10.6 MGD
b. waste rate: West = 0.3507 MGD
   East = 0.0821 MGD
c. frequency of wasting: continuous

9. Aeration system control: [ ] Time Clock [ ] Manual [x] Continuous
   [ ] Other

10. Effluent control devices working properly (oxidation ditches)? [ ] Yes [ ] No [x] N/A

11. General condition: [x] Good [ ] Fair [ ] Poor *

Comments: #2. Each basin is baffled to provide 4 “passes.” The influent wastewater is fed to the second pass, which is an anoxic zone and the return is fed to the first pass. #s 6 and 7, Visual observation of the mixed liquor indicated good color, consistency, odor and settling characteristics.

UNIT PROCESS: Sedimentation

[ ] Primary [x] Secondary [ ] Tertiary

1.	Number of units:	6		
	In operation:	5		
2.	Proper flow-distribution between units?	[x] Yes	[ ] No*	[ ] N/A
3.	Signs of short-circuiting and/or overloads?	[ ] Yes*	[x] No	
4.	Effluent weirs level?	[x] Yes	[ ] No*	[ ] N/A
	Clean?	[x] Yes	[ ] No*	
5.	Scum collection system working properly?	[x] Yes	[ ] No*	[ ] N/A
6.	Sludge-collection system working properly?	[x] Yes	[ ] No*	[ ] N/A
7.	Influent, effluent baffle systems working properly?	[x] Yes	[ ] No*	[ ] N/A
8.	Chemical addition?	[ ] Yes	[x] No	
	Chemicals:	none		
9.	Effluent characteristics:	clear		
10.	General condition:	[x] Good	[ ] Fair	[ ] Poor*

Comments: #5. Any scum that passes through from the 1° sedimentation tanks and the aeration basins is collected at the baffle in the 2° sedimentation tank and prevented from being discharged.

UNIT PROCESS: Sludge Pumping

(RAS to aeration tank)

1. Number of Pumps: 9
   Number of pumps in operation: 6 are alternately run at a time. 3 are held in reserve.

2. Type of sludge pumped: [ ] Primary [ ] Secondary [x] Return Activated
   [ ] Combination [ ] Other:

3. Type of pump: [ ] Plunger [ ] Diaphragm [ ] Screw lift
   [x] Centrifugal[ ] Progressing cavity [ ] Other:

4. Mode of operation: [x] Manual [ ] Automatic [ ] Other:

5. Sludge volume pumped: 10.6 MGD cumulative average to date for August

6. Alarm system for equipment failures or overloads operational? [x] Yes [ ] No* [ ] N/A

7. General condition: [x] Good [ ] Fair [ ] Poor*

Comments: The pumps are configured so that 3 pumps serve 2 clarifiers; one lead for each clarifier and one as back up for either. #4. The pumps operate continuously.

UNIT PROCESS: Sludge Pumping

(WAS to the Thickening Centrifuge)

1. Number of Pumps: 3
   Number of pumps in operation: 1

2. Type of sludge pumped: [ ] Primary [ ] Secondary [ ] Return Activated
   [ ] Combination [x] Other: WAS

3. Type of pump: [ ] Plunger [ ] Diaphragm [ ] Screw lift
   [x] Centrifugal[ ] Progressing cavity [ ] Other:

4. Mode of operation: [x] Manual [ ] Automatic [ ] Other:

5. Sludge volume pumped: 0.3961 MG cumulative average to date for August

6. Alarm system for equipment failures or overloads operational? [x] Yes [ ] No* [ ] N/A

7. General condition: [x] Good [ ] Fair [ ] Poor*

Comments: WAS is pulled off the RAS lines and pumped to the thickening centrifuges. #4. Pumps run continuously at variable speed.

UNIT PROCESS: Centrifugation

(WAS *Thickening Centrifuge*)

1. Number of units: 4
   Number in operation: 1

2. Purpose of centrifuge(s): [x] Thickening [ ] Dewatering [ ] Other:

3. Operation of equipment: [x] Manual [ ] Automatic [ ] Other:

4. Centrifuge run time: Based on flow and MLSS

5. Influent sludge flow rate: See comment, below

6. Amount cake produced: See comment, below

7. Percent solids in influent: See comment, below
   Percent solids in effluent: See comment, below

8. Conditioning chemical fed: none
   Dose: N/A

9 Centrate return location: Primary clarifiers
   Sign of problems? [ ] Yes* [x] No

10 General Condition: [x] Good [ ] Fair [ ] Poor*

Comments: These centrifuges are used to thicken WAS on its way to the digesters. The flow is manually controlled by the waste rate and/or changing the number of centrifuges on line. #'s 5,6,7 and 8 Sludge production/operational data was not recorded this inspection, however visual observation of the equipment indicated that the centrifuges are in good condition and operating as designed. One unit was out for major maintenance. #8. Polymer feed system available but not in use**.**

UNIT PROCESS: Sludge Pumping (WAS)

(Thickening Centrifuges to the Digesters)

1. Number of Pumps: 4
   Number of pumps in operation: 1

2. Type of sludge pumped: [ ] Primary [ ] Secondary [ ] Return Activated [ ] Combination [x] Other: Thickened WAS

3. Type of pump: [ ] Plunger [ ] Diaphragm [ ] Screw lift [ ] Centrifugal [x] Progressing cavity [ ] Other:

4. Mode of operation: [ ] Manual [x] Automatic [ ] Other:

5. Sludge volume pumped: Not ascertained

6. Alarm system for equipment failures or overloads operational? [x] Yes [ ] No* [ ] N/A

7. General condition: [x] Good [ ] Fair [ ] Poor*

Comments: Each of the 2 sludge pits is served by 2 pumps. #5 Sludge production/operational data was not recorded this inspection, however visual observation of the equipment indicated that the centrifuges are in good condition and operating as designed

UNIT PROCESS: Grit Removal (Primary Sludge via Cyclone Degritters)

1. Number of units: 3, each w/ 2 classifiers
   Number of units in operation: 2 in service at a time
2. Unit adequately ventilated? [x] Yes [ ] No *
3. Operation of grit collection equipment: [x] Manual or Continuous duty
4. Proper flow-distribution between units? [ ] Yes [ ] No * [x] N/A
5. Volume of grit removed: 265,980 lbs in July '09
6. All equipment operable? [x] Yes [ ] No *
7. General condition: [x] Good [ ] Fair [ ] Poor*

Comments: Under normal conditions all primary sludge is processed through the degritters. There is one classifier per primary clarifier with 2 backup classifiers. The degritted primary sludge flows by gravity to the gravity thickeners.

UNIT PROCESS: Gravity Thickening

(Primary Sludge)

1. Number of units: 4
   Number of units in operation: 3 (one being overhauled)
2. Types of sludge(s) fed to the thickener: [x] Primary [ ] WAS [ ] Combination
   [ ] Other:
3. Solids concentration in the influent sludge: 2602 mg/l as TSS
   Solids concentration in thickened sludge: 5.2% running average for August, to date
4. Sludge feeding: [x] Continuous [ ] Intermittent
5. Signs of short-circuiting and/or overloads? [ ] Yes* [x] No [ ] N/A
6. Effluent weirs level? [x] Yes [ ] No * [ ] N/A
7. Sludge collection system work properly? [x] Yes [ ] No * [ ] N/A
8. Influent, effluent baffle systems work properly? [x] Yes [ ] No * [ ] N/A
9. Chemical addition? [ ] Yes [x] No * [ ] N/A
   Identify chemical/dose: N/A
10. General condition: [x] Good [ ] Fair [ ] Poor*

Comments: None

UNIT PROCESS: Sludge Pumping

(Gravity Thickened Primary Sludge to the "Mixed Loop")

1. Number of Pumps: 8
   Number of pumps in operation: 3
2. Type of sludge pumped: Primary [ ] Secondary [ ] Return Activated [ ] Combination [X] Other: Thickened Primary
3. Type of pump: [ ] Plunger [ ] Diaphragm [ ] Screw lift [ ] Centrifugal [X] Progressing cavity [ ] Other:
4. Mode of operation: [X] Manual [ ] Automatic [ ] Other:
5. Sludge volume pumped: Not ascertained
6. Alarm system for equipment failures or overloads operational? [x] Yes [ ] No* [ ] N/A
7. General condition: [x] Good [ ] Fair [ ] Poor*

Comments: One pump and one back-up pump for each or 4 tanks. One tank is currently out for maintenance and two pumps are scheduled for replacement. These pumps pump the gravity thickened sludge to the mixed loop where it joins the WAS on its way to the digesters. #5. Sludge volume pumped was not checked this inspection, however the digesters were operating as designed and there were no obvious problems due to insufficiently thickened sludge.

UNIT PROCESS: Anaerobic Digestion

1. Number of units: 5 heated primary; 1 secondary (holding tank), 4 holding tanks
   Number of units in operation: 5 primary; 1 holding tank (2°); 2 holding tanks

2. Type of sludge digested: Primary and WAS

3. Type of digester: [x] Primary [x] High Rate
   [x] 2° Holding Tank [ ] Standard Rate

4. Frequency of sludge application to digesters: continuous (one at a time)

5. Number of recirculation pumps: 11 plus 2 for holding tank
   Number in operation: all operational

6. Sludge retention time: Average of 20 days in August, to date.

7. Provisions for pH adjustment? [x] Yes [ ] No
   pH adjustment utilized? [ ] Yes [x] No [ ] N/A

8. Location of supernatant return: [ ] Head [ ] Primary [ ] Other: N/A

9. Gas production rate: Not metered

10. Process control testing:
    a. reduction of volatile solids: [x]Yes [ ] No
    b. volatile acids: [x] Yes [ ] No
    c. pH [x] Yes [ ] No
    d. temperature: [x] Yes [ ] No
    e. alkalinity: [x] Yes [ ] No

11. Signs of overloading? [ ] Yes* [x] No

12. General condition: [x] Good [ ] Fair [ ] Poor*

Comments: Sludge is fed to the five primary digesters one at a time; the pumps automatically alternate the digester receiving the sludge. While a digester is being fed, the digested sludge is gravity fed to the Holding Tank (2° digester). #6. Sludge is recirculated in the Holding Tank (2° digester) and gas is produced, but no heat is provided. The sludge from the Holding Tank (2° digester) is gravity fed to one of the 2 sludge holding tanks, which are outside and open to the atmosphere. #8 The digesters are not decanted. All flow goes to centrifuges. #9. The methane gas is used to fuel the boilers and supply heat to the digesters. #12 The digesters were reported to be fully operational and there were no obvious indicators (odors, problems associated with supernatant return, etc) of operational problems.

UNIT PROCESS: Sludge Pumping (WAS)

(Sludge Holding Tanks to the Dewatering Centrifuges)

1. Number of Pumps: 6
   Number of pumps in operation: depends on number of centrifuges running, all are operational

2. Type of sludge pumped: [ ] Primary [ ] Secondary [ ] Return Activated
   [ ] Combination [x] Other: Digested Primary and WAS

3. Type of pump: [ ] Plunger [ ] Diaphragm [ ] Screw lift
   [ ] Centrifugal [x] Progressing cavity [ ] Other:_____

4. Mode of operation: [x] Manual [ ] Automatic [ ] Other:_____

5. Sludge volume pumped: Amount unknown. Recorded as Wet tons/day as finished cake
6. Alarm system for equipment failures or overloads operational? [x] Yes [ ] No* [ ] N/A

7. General condition: [x] Good [ ] Fair [ ] Poor*

Comments: These pumps are run manually as needed to manage the sludge, usually 12 hours/day, 7 days/week, but sometimes up to 16 hours/day. #5 No operational data was obtained this inspection.

UNIT PROCESS: Centrifugation
(Dewatering Digested Sludge)

1. Number of units: 5
   Number in operation: 4 operational; 1 undergoing maintenance

2. Purpose of centrifuge(s): [ ] Thickening [x] Dewatering [ ] Other:

3. Operation of equipment: [x] Manual [ ] Automatic [ ] Other:

4. Centrifuge run time: 12 hrs./day, 7 days/week

5. Influent sludge flow rate: 0.2473 MGD

6. Amount cake produced: 47.6 Wet tons per day in August, to date. 1801 wet tons were pumped in July for an average of 58.1 Wet tons per day.

7. Percent solids in influent: Not ascertained
   Percent solids in effluent: Not ascertained

8. Conditioning chemical fed: cationic polymer
   Dose: Not ascertained

9 Centrate return location: primary clarifiers
   Sign of problems? [ ] Yes* [x] No

10 General Condition: [x] Good [ ] Fair [ ] Poor*

Comments: Sludge is pumped from the holding tanks to each centrifuge. Dewatered sludge is placed on a holding pad until hauled away by contractor. The sludge holding pad is enclosed on three sides with concrete walls. The sludge is treated to meet Class B requirements, Pathogen Control Alternative 2, Vector Attraction Reduction Option 1. The minimum detention time required is temperature dependent: 15 days at 35°C – 60 days at 20°C. #'s 5, 6, 7 and 8. All centrifuges in operation appeared to be in good condition and the quality of the sludge being produced was excellent by visual standards The sludge on the pad at the time of the inspection was said to have a solids content of over 26%.

UNIT PROCESS: Filtration (Tertiary)

1. Type of filters: [x] Gravity [ ] Pressure [ ] Intermittent

2. Number of units: 18
   Number in operation: 18

3. Operation of system: [x] Automatic [ ] Semi-automatic
   [ ] Manual [ ] Other (specify):

4. Proper flow-distribution between units? [x] Yes [ ] No* [ ] N/A

5. Evidence of following problems:
   a. Uneven flow distribution? [ ] Yes* [x] No [ ] N/A
   b. Filter clogging (ponding)? [ ] Yes* [ ] No [x] N/A
   c. Nozzles clogging? [ ] Yes* [ ] No [x] N/A
   d. Icing? [ ] Yes* [x] No [ ] N/A
   e. Filter flies? [ ] Yes* [ ] No [x] N/A
   f. Vegetation on filter? [ ] Yes* [x] No [ ] N/A

6. Filter aid system provided? [x] Yes [ ] No
   Properly operating? (if needed) [ ] Yes [ ] No* [x] N/A Not Needed
   Chemical used: N/A

7. Automatic valves properly operating? [x] Yes [ ] No* [ ] N/A

8. Valves sequencing correctly? [x] Yes [ ] No* [ ] N/A

9. Backwash system operating properly? [x] Yes [ ] No* [ ] N/A

10. Filter building adequately ventilated? [ ] Yes [ ] No* [x] N/A

11. Effluent characteristics: very clear

12. General condition: [x] Good [ ] Fair [ ] Poor*

Comments: There are 4 backwash pumps (2 per side) – typically one pump is on-line for each side with the other one as a back-up. The filters backwash every 36-40 hours; backwash water returns to the primary effluent trough. The system is able to automatically backwash if the water reaches a preset high level.

NOTE: One half of these filters will be taken off line on or about August 12, 2009 as part of a major plant (nutrient) upgrade. They will remain off line until approximately January of 2010.

UNIT PROCESS: Chlorination

1. Number of chlorinators: *3*
   Number in operation: *1*

2. Number of evaporators: *3*
   Number in operation: *1*

3. Number of chlorine contact tanks: *1*
   Number in operation: *1*

4. Proper flow-distribution between units? [ ] Yes [ ] No * [X] N/A

5. How is chlorine introduced into the wastewater?
   [x] Perforated diffusers
   [ ] Injector with single entry point
   [ ] Other

6. Chlorine residual in basin effluent: 1.0 mg/L at 0900 - 8/11/09.

7. Applied chlorine dosage: ~ 1700 lbs per day (Average)

8. Contact basins adequately baffled? [x] Yes [ ] No * [ ] N/A

9. Adequate ventilation in:
   a. Chemical storage area? [ ] Yes [ ] No * [x] N/A (railcar)
   b. Equipment room? [x] Yes [ ] No * [ ] N/A

10. Proper safety precautions used? [x] Yes [ ] No *

11. General condition: [x] Good [ ] Fair [ ] Poor*

Comments: The facility has a good safety program in place.

UNIT PROCESS: Post Aeration

1. Number of units: 1

   Number of units in operation: 1

2. Proper flow distribution between units? [ ] Yes [ ] No* [x] N/A

3. Evidence of following problems:

a. Dead spots? [ ] Yes* [x] No

b. Excessive foam? [ ] Yes* [x] No

c. Poor aeration? [ ] Yes* [x] No

d. Mechanical equipment failure? [ ] Yes* [x] No [ ] N/A

4. How is the aerator controlled? [ ] Time clock [ ] Manual [x] Continuous

   [ ] Other _____ [ ] N/A

5. What is the current operating schedule? Continuous

6. Step weirs level? [ ] Yes [ ] No* [x] N/A

7. Effluent D.O. level: Not checked this inspection

8. General condition: [x] Good [ ] Fair [ ] Poor*

Comments: Post aeration shares 4 blowers with the aeration basins. Aeration occurs at the head of the chlorine contact tank, providing good mixing for the chlorine.

UNIT PROCESS: Dechlorination

1. Chemical used: [x] Sulfur Dioxide [ ] Bisulfite [ ] Other

2. Number of sulfonators: 2
   Number in operation: 1

3. Number of evaporators: 2
   Number in operation: 1

4. Number of chemical feeders: 0
   Number in operation: 0

5. Number of contact tanks: 1 mixer
   Number in operation: 1

6. Proper flow-distribution between units? [ ] Yes [ ] No * [x] N/A

7. How is chemical introduced? [X] Perforated diffusers
   [ ] Injector with single entry point
   [ ] Other

8. Control system operational? [x] Yes [ ] No *
   a. Residual analyzers? [x] Yes [ ] No * [ ] N/A
   b. System adjusted: [ ] Automatic [x] Manual [ ] Other:

9. Applied dechlorinating dose: 837 lbs/day (average for July, '09)

10. Chlorine residual in basin effluent: < QL (Actual reading 0.06 mg/l)

11. Contact basins adequately baffled? [ ] Yes [ ] No * [x] N/A

12. Adequate ventilation in:
    a. Chemical storage area? [ ] Yes [ ] No * [x] N/A (railcar)
    b. Equipment room? [x] Yes [ ] No *

13. Proper safety precautions used? [x] Yes [ ] No *

14. General condition: [x] Good [ ] Fair [ ] Poor*

Comments: None

UNIT PROCESS: Flow Measurement

(VPDES Outfall No. 001)

1.	Type measuring device:	66" In-Line Magnetic Meter (not used for low flows)
2.	Present reading:	Not recorded this inspection
3.	Bypass channel? Metered?	[x] Yes [ ] No [x] Yes [ ] No* [ ] N/A
4.	Return flows discharged upstream from meter? If Yes, identify:	[x] Yes [ ] No filter backwash
5.	Device operating properly?	[x] Yes [ ] No*
6.	Date of last calibration:	Mag meter not calibrated, but readout's electronics are checked annually as scheduled maintenance task
7.	Evidence of following problems: a. Obstructions? b. Grease?	[ ] Yes* [x] No [ ] Yes* [x] No
8.	General condition:	[x] Good [ ] Fair [ ] Poor*

Comments: An in-line mag meter monitors effluent flow, but if flow is not high enough to fill the pipe, accuracy of the meter can be affected. Therefore, the flow is also manually measured every two hours at the stilling well at the end of the contact tank. This manual reading is checked against the Mag meter to insure accuracy of the reported data. #6 Mag meters cannot be "calibrated." However, Richmond annually checks the meter's electronics. The current Mag meter is scheduled to be replaced as part of the ongoing plant upgrade.

UNIT PROCESS: Effluent/Plant Outfall

1. Type outfall: [x] Shore based [ ] Submerged

2. Type if shore based: [x] Wing wall [ ] Headwall [ ] Rip Rap [ ] N/A

3. Flapper valve? [ ] Yes [ ] No [x] N/A

4. Erosion of bank? [ ] Yes* [x] No [ ] N/A

5. Effluent plume visible? [x] Yes * [ ] No

Comments: Very clear effluent flows into the James River, creating a plume of clear water in the turbid river.

6. Condition of outfall and supporting structures: [x] Good [ ] Fair [ ] Poor *

7. Final effluent, evidence of following problems:

   a. Oil sheen? [ ] Yes* [x] No

   b. Grease? [ ] Yes* [x] No

   c. Sludge bar? [ ] Yes* [x] No

   d. Turbid effluent? [ ] Yes* [x] No

   e. Visible foam? [ ] Yes* [x] No

   f. Unusual odor? [ ] Yes* [x] No

Comments: The effluent was very clear.

cc:

[x] Owner: c/o Robert Steidel

[ ] Operator:

[ ] Local Health Department:

[x] DEQ - OWCP, attn: Steve Stell

[x] DEQ - Regional Office File

[x] EPA - Region III

Attachment E

Effluent Data

Application Data

Parameter	Maximum Daily Value		Average Daily Value		
	Value	Units	Value	Units	No. Samples
pH (minimum)	4.20	S.U.			
pH (maximum)	8.6	S.U.			
Flow Rate	85.00	MGD	54.90	MGD	1827
Temperature (Winter)	15.70	^{o}C	14.50	^{o}C	848
Temperature (Summer)	31.30	^{o}C	24.50	^{o}C	612

Pollutant	Maximum Daily Discharge		Average Daily Discharge		
	Conc.	Units	Conc.	Units	No. Samples
$cBOD_5$	64.70	mg/L	3.20	mg/L	1827
Fecal Coliform	2420	N/100 mL	10	N/100 mL	1006
TSS	129.00	mg/L	4.00	mg/L	1826

Water Quality Standards Testing

CASRN#	CHEMICAL	REQUIRED QUANTIFICATION LEVEL	REPORTING RESULTS (µg/L)
METALS			
7440-36-0	Antimony, dissolved	4.2E4	<80, <80, <80
7440-38-2	Arsenic, dissolved	480	<60, <60, <60
7440-43-9	Cadmium, dissolved	4.3	0.13, <0.1, <0.1
16065-83-1	Chromium III, dissolved (8)	280	<10, <10, <10
18540-29-9	Chromium VI, dissolved (8)	22	<10, <10, <10
7440-50-8	Copper, dissolved	17	5, <5, 8
7439-92-1	Lead, dissolved	47	<20, <20, <20
7439-97-6	Mercury, dissolved	0.50	<0.1, <0.1, <0.1
7440-02-0	Nickel, dissolved	76	<10, <10, <10
7782-49-2	Selenium, Total Recoverable	21	<5
7440-22-4	Silver, dissolved	4.2	<0.5, <0.5, <0.5
7440-28-0	Thallium, dissolved	n/a	<40, <40, <40
7440-66-6	Zinc, dissolved	150	50, 41, 42
PESTICIDES/PCB'S			
309-00-2	Aldrin	0.05	<0.05
57-74-9	Chlordane	0.2	ND
2921-88-2	Chlorpyrifos (synonym = Dursban)	n/a	<0.1
72-54-8	DDD	0.1	<0.05
72-55-9	DDE	0.1	<0.05
50-29-3	DDT	0.1	<0.05
8065-48-3	Demeton	n/a	<0.1
333-41-5	Diazinon	n/a	<1
60-57-1	Dieldrin	0.1	<0.05
959-98-8	Alpha-Endosulfan	0.1	<0.05
33213-65-9	Beta-Endosulfan	0.1	<0.05

CASRN#	CHEMICAL	REQUIRED QUANTIFICATION LEVEL	REPORTING RESULTS (µg/L)
1031-07-8	Endosulfan Sulfate	0.1	<0.05
72-20-8	Endrin	0.1	<0.05
7421-93-4	Endrin Aldehyde	n/a	<0.05
86-50-0	Guthion	n/a	<0.1
76-44-8	Heptachlor	0.05	<0.05
1024-57-3	Heptachlor Epoxide	n/a	<0.05
319-84-6	Hexachlorocyclohexane Alpha-BHC	n/a	<0.05
319-85-7	Hexachlorocyclohexane Beta-BHC	n/a	<0.05
58-89-9	Hexachlorocyclohexane Gamma-BHC or Lindane	n/a	<0.05
143-50-0	Kepone	n/a	<1.0
121-75-5	Malathion	n/a	<0.1
72-43-5	Methoxychlor	n/a	<0.05
2385-85-5	Mirex	n/a	<0.05
56-38-2	Parathion	n/a	<0.1
1336-36-3	PCB Total	7.0	ND
8001-35-2	Toxaphene	5.0	ND
BASE NEUTRAL EXTRACTABLES			
83-32-9	Acenaphthene	10.0	<10, <10, <10
120-12-7	Anthracene	10.0	<10, <10, <10
92-87-5	Benzidine	n/a	<10, <10, <10
56-55-3	Benzo (a) anthracene	10.0	<10, <10, <10
205-99-2	Benzo (b) fluoranthene (3,4-benzofluoranthene)	10.0	<10, <10, <10
207-08-9	Benzo (k) fluoranthene	10.0	<10, <10, <10
50-32-8	Benzo (a) pyrene	10.0	<10, <10, <10
111-44-4	Bis 2-Chloroethyl Ether	n/a	<10, <10, <10
108-60-1	Bis 2-Chloroisopropyl Ether	n/a	<10, <10, <10
85-68-7	Butyl benzyl phthalate	10.0	<10, <10, <10
91-58-7	2-Chloronaphthalene	n/a	<10, <10, <10
218-01-9	Chrysene	10.0	<10, <10, <10

CASRN#	CHEMICAL	REQUIRED QUANTIFICATION LEVEL	REPORTING RESULTS (µg/L)
53-70-3	Dibenz(a,h)anthracene	20.0	<10, <10, <10
84-74-2	Dibutyl phthalate (synonym = Di-n-Butyl Phthalate)	10.0	<10, <10, <10
95-50-1	1,2-Dichlorobenzene	10.0	<10, <10, <10
541-73-1	1,3-Dichlorobenzene	10.0	<10, <10, <10
106-46-7	1,4-Dichlorobenzene	10.0	<10, <10, <10
91-94-1	3,3-Dichlorobenzidine	n/a	<10, <10, <10
84-66-2	Diethyl phthalate	10.0	<10, <10, <10
117-81-7	Bis-2-ethylhexyl phthalate	10.0	<10, <10, <10
131-11-3	Dimethyl phthalate	n/a	<10, <10, <10
121-14-2	2,4-Dinitrotoluene	10.0	<10, <10, <10
122-66-7	1,2-Diphenylhydrazine	n/a	<10, <10, <10
206-44-0	Fluoranthene	10.0	<10, <10, <10
86-73-7	Fluorene	10.0	<10, <10, <10
118-74-1	Hexachlorobenzene	n/a	<10, <10, <10
87-68-3	Hexachlorobutadiene	n/a	<10, <10, <10
77-47-4	Hexachlorocyclopentadiene	n/a	<10, <10, <10
67-72-1	Hexachloroethane	n/a	<10, <10, <10
193-39-5	Indeno(1,2,3-cd)pyrene	20.0	<10, <10, <10
78-59-1	Isophorone	10.0	<10, <10, <10
98-95-3	Nitrobenzene	10.0	<10, <10, <10
62-75-9	N-Nitrosodimethylamine	n/a	<10, <10, <10
621-64-7	N-Nitrosodi-n-propylamine	n/a	<10, <10, <10
86-30-6	N-Nitrosodiphenylamine	n/a	<10, <10, <10
129-00-0	Pyrene	10.0	<10, <10, <10
120-82-1	1,2,4-Trichlorobenzene	10.0	<10, <10, <10
VOLATILES			
107-02-8	Acrolein	n/a	<10, <10, <10
107-13-1	Acrylonitrile	n/a	<10, <10, <10
71-43-2	Benzene	10.0	<10, <10, <10

CASRN#	CHEMICAL	REQUIRED QUANTIFICATION LEVEL	REPORTING RESULTS (µg/L)
75-25-2	Bromoform	10.0	<10, <10, <10
56-23-5	Carbon Tetrachloride	10.0	<10, <10, <10
108-90-7	Chlorobenzene (synonym = monochlorobenzene)	50.0	<10, <10, <10
124-48-1	Chlorodibromomethane	10.0	11.5, <10, <10
67-66-3	Chloroform	10.0	13.1, <10, 11.7
75-09-2	Dichloromethane (synonym = methylene chloride)	20.0	<10, <10, <10
75-27-4	Dichlorobromomethane	10.0	11.5, <10, <10
107-06-2	1,2-Dichloroethane	10.0	<10, <10, <10
75-35-4	1,1-Dichloroethylene	10.0	<10, <10, <10
156-60-5	1,2-trans-dichloroethylene	n/a	<10, <10, <10
78-87-5	1,2-Dichloropropane	n/a	<10, <10, <10
542-75-6	1,3-Dichloropropene	n/a	<20, <20, <20
100-41-4	Ethylbenzene	10.0	<10, <10, <10
74-83-9	Methyl Bromide	n/a	<10, <10, <10
79-34-5	1,1,2,2-Tetrachloroethane	n/a	<10, <10, <10
127-18-4	Tetrachloroethylene	10.0	<10, <10, <10
10-88-3	Toluene	10.0	<10, <10, <10
79-00-5	1,1,2-Trichloroethane	n/a	<10, <10, <10
79-01-6	Trichloroethylene	10.0	<10, <10, <10
75-01-4	Vinyl Chloride	10.0	<10, <10, <10
RADIONUCLIDES			
	Uranium	n/a	<0.7 pCi/L
	Radium 226	n/a	0.9 pCi/L
	Radium 228	n/a	<0.9 pCi/L
	Beta Particle & Photon Activity (mrem/yr)	n/a	8.94 pCi/L
	Gross Alpha Particle Activity (pCi/L)	n/a	1.95 pCi/L
	Strontium 90	n/a	<2 pCi/L
	Tritium	n/a	177 pCi/L

CASRN#	CHEMICAL	REQUIRED QUANTIFICATION LEVEL	REPORTING RESULTS (µg/L)
ACID EXTRACTABLES			
95-57-8	2-Chlorophenol	10.0	<10, <10, <10
120-83-2	2,4 Dichlorophenol	10.0	<10, <10, <10
105-67-9	2,4 Dimethylphenol	10.0	<10, <10, <10
51-28-5	2,4-Dinitrophenol	n/a	<10, <20, <10
534-52-1	2-Methyl-4,6-Dinitrophenol (4,6-dinitro-o-creosol)	n/a	<10, <10, <10
25154-52-3	Nonylphenol	n/a	<5
87-86-5	Pentachlorophenol	50.0	<10, <10, <10
108-95-2	Phenol	10.0	<10, <10, <10
88-06-2	2,4,6-Trichlorophenol	10.0	<10, <10, <10
MISCELLANEOUS			
776-41-7	Ammonia as NH3-N	200	See DMR data
16887-00-6	Chlorides	n/a	48 mg/L
7782-50-5	Chlorine, Total Residual	100	See DMR Data
57-12-5	Cyanide, Free	10.0	<10, <10, <10, <10
N/A	*E. coli* / *Enterococcus* (N/CML)	n/a	See DMR data
7783-06-4	Hydrogen Sulfide	n/a	<1.00 mg/L
60-10-5	Tributyltin	n/a	<30 ng/L
	Hardness (mg/L as $CaCO_3$)	n/a	128, 128, 84

Parameters sampled for EPA Form 2A, Part D not addressed above were reported as less than the quantification level.

2006 Effluent Temperature in ^{o}C

Jan	Feb	Mar	April	May	June	July	Aug	Sept	Oct	Nov	Dec
							31.3	22.3	19.9	20	17.8
							25.8	22.5	22.2	20.2	17
							31.3	22.5	23.3	19.4	16.6
							27.6	23.1	24.1	17.8	14.6
							27.9	22.3	23.5	18	13.9
							28.1	22	22.4	17.8	13.4
							26.2	23.8	23.5	17.5	15.6
							26.4	24.4	22.8	18.3	14.7
							26.1	23.5	23.1	19.5	13.9
							24.1	24.3	20.3	19.4	14.2
							23.8	24.9	19.3	22.4	15.6
							24.2	20.1	20.9	21.7	16.9
							25.5	22.9	19	16.7	16.2
							25.6	21.9	18.9	17.2	15.3
							25.9	21.6	18.6	17	15.5
							26.8	21.6	19.6	20.2	16.5
							26.4	22.3	20.5	18	15.8
							23.8	22.3	21.8	18.5	16.9
							24.5	24.2	22	17	16.3
							25.9	24.1	23.1	17.2	15.3
							22.7	23	20.2	16.5	15
							22.5	24.3	20.3	12.3	14.8
							26.5	24.1	20.3	12.2	15.7
							26.1	23.5	19.4	14.4	17.6
							26	23.3	19.6	15.2	15.1
							25.1	22.1	20	15.9	15.2
							26	23.6	19.3	17.4	16.3
							25.8	22.3	19	16.1	15.4
							26.3	20	20.7	16.5	16.2
							26.4	20.2	21.2	18	16.1
							25.2		24.4		16.3

2007 Effluent Temperature in ^{o}C

Jan	Feb	Mar	April	May	June	July	Aug	Sept	Oct	Nov	Dec
16.6	14.1	14.1	17.6	18	22.5	23.5	26.1	25.9	24.1	21.7	19
17	14.2	14.3	18.2	18.5	22	24	26.1	26.1	24.4	20	18.1
14.9	13.7	16.9	17.9	17.4	18.7	24.2	26	25.8	24.8	21.1	18.2
15.9	14.8	16.5	17.7	17.1	21.7	23.8	26.2	25.2	24.3	19.6	17.6
16.1	13.6	13	16.1	18	22.3	24	26.3	25.5	24.9	20.5	17.3
16.7	13.8	13	16	17.5	22.6	24.6	26.4	25.9	25.6	20.6	16.9
16.3	13.2	13.2	14.7	15.1	22.3	24.8	27.1	26.3	25.4	20.1	16.7
16	13.3	13.2	14.8	16.4	23.2	24.6	27.5	26.6	25.2	19	17.1
15.1	13.2	13.2	15	17.7	22.4	25.4	27.9	24.8	25.1	18.5	17.5
15.1	13.1	13.5	16	18.3	22.6	24.8	27.2	26.5	25.5	18.8	18.4
14.5	12.8	13.4	15.7	19.3	22.9	25.5	26.8	26.5	23.6	19	18.3
15.1	12.9	13.8	16.3	17.4	23.1	25.7	26.2	26.4	23.4	19.4	18.4
14.7	14.8	15.2	16.2	15.9	23	25.5	26.5	26	22.2	20	18
15	14.9	15.3	17.2	19.1	17.8	25.2	26.1	26.1	22.6	20.5	17.2
16.7	13.4	19.2	16.7	19.3	22.5	24.5	26.5	24.6	22.3	20.8	15.2
16.9	13.6	15.4	15.7	20.3	22.5	24.6	26.9	23.6	23.7	18	13.6
14.1	13	14.9	17.4	20.1	23	25.5	26	23.8	23	18.3	13.6
13.7	14	14.7	15.4	18	22.8	25.3	25.8	24.2	23.2	18.7	11.4
13.8	13.9	13.8	16	18	24	26.1	25.7	24.5	23.5	17.4	14.2
13.2	13.3	15.1	16	19	21.7	25.8	25.8	24.2	24	19	15.8
12.6	13.4	14.2	17.2	19.9	23.7	25.3	25.8	24	22.2	20.2	15.7
12.4	14	14.8	18.8	18	23.8	25.6	26	24.9	23.3	19.8	15.6
12.5	14.1	15.6	18.6	19.9	21.5	24.8	25.8	25.4	23.8	19.4	15.6
14.2	13.8	15.9	18.8	24.6	22.3	24.6	25.7	24.9	24.4	19.3	15.6
13.5	13.5	16.2	18.5	20.9	23.5	24.5	27.4	25.1	21.4	18.1	15.5
14	14.7	15.7	18.5	21.6	24	24.1	26.3	22.1	22.2	18.4	15.6
14.1	14.9	18	18.4	21.7	24.6	25.5	26.3	25.2	21.6	19.1	12.8
13.6	13.7	17.5	18.2	21.3	25	25	26.5	25.4	21.8	18.9	13.8
13.3		17.7	17.8	22	25	25.5	26.6	24.6	21.2	18.6	15.7
13.7		17.9	18.1	21.9	24.5	25.6	26.3	23.8	21.3	17.7	15.1
13.6		19.7		22.2		25.4	26.1		21.4		12.4

2008 Effluent Temperature in ^{o}C

Jan	Feb	Mar	April	May	June	July	Aug	Sept	Oct	Nov	Dec
14.4	14.5	14.2	16.6	17.9	22	25.1	27.2	26.4	24.4	21.2	14.7
13.8	14.7	14.5	17.6	18.3	21.8	24.8	27	25.4	24.4	21.4	16.5
13.5	12.3	14.6	17.1	18.6	21.9	24.9	26.7	26.1	24	21.3	15.5
13.1	15.2	15.8	14.1	18.8	23.5	25.6	26.5	27.1	24.1	21.4	17.8
14.7	15.6	16	15.9	18.9	23.8	25.1	26.9	26.4	24.3	21	17.6
15.8	15.6	16.2	15.8	20.2	23.7	24.8	26.8	26	24.3	21.5	17.7
15.6	15.9	15.4	15.5	20.6	25	24.6	27.5	26.4	24.4	21.8	17.1
16	15.5	15.6	15.9	19.9	26.1	25.3	26.7	25.5	24.1	22.1	16.6
16.5	15.3	15.2	16.3	19.5	24.1	25	25.4	25.8	24.3	21.5	16.8
15.7	15.3	13.8	17	19.1	24.5	25.4	25.1	26.2	24.7	20.9	17.9
15.6	14.5	13.5	17.7	18.7	24.7	26.4	26.1	25.8	25	20.6	17.8
15.3	13.1	15.4	18.2	17.2	24.5	27.1	25.9	26	24.1	20.7	15.1
15.6	14	15.5	18.1	17.7	24.4	27	26.1	26.3	24	20.9	15.9
15	14.2	15.9	17.2	18.4	24.4	25.7	26.3	26.5	24.2	19.9	16
15.1	13.8	16.3	17.5	18.7	24.4	25.4	26.6	26.5	24.5	20.6	16.6
15.1	15.1	15.6	19	20.3	24.4	25.9	26.4	26.4	24.5	19.6	17.2
14.3	15.6	14.9	18.2	19.1	24.9	26	26.3	25.8	24.5	19.2	15.9
13.2	15.9	15.7	18.2	19.3	24	26.2	27	25.4	21.3	19.4	16.7
13.6	15.4	16.1	18.3	19.1	25.6	26.4	26.5	25.7	21.7	19	17.7
15	14.1	16.9	18.6	19.3	25.7	26.8	26.5	24.9	21.7	19	17
13.6	13.1	16.5	17.8	19.6	24.4	28.1	26.6	24.9	22.4	18.8	16.6
13.6	14.4	16.6	16.7	19.5	24.3	26.7	26.3	25.7	22.4	18.3	15.3
14.2	14.4	16.1	17	19.8	24.2	27.8	26.6	25.3	22.3	18.1	15.9
14.5	14.1	15.7	17.6	20.1	24.4	26.7	26.5	25.2	22.2	18.8	16.4
13.7	14	15.7	17.9	19.9	24.5	26.5	27	24.7	22.7	17.5	16.9
13.4	14.6	16	18.4	20.1	24.7	26.3	26.5	22.6	22	17.5	16.5
13.9	14.8	16.8	18.5	20.9	24.8	26.5	26.4	25.3	22.1	17.9	16.7
13.3	14	18.6	18.2	21.5	24.7	27.8	25	25.2	20.7	18.3	17.3
14.5	14	16.9	17.8	21.7	25.5	27.1	26	24.7	20.7	17.7	17.3
14.7		16.7	17.4	21.7	25.3	27.1	25.1	25	20.8	17.8	16.9
14.5		16.4		21.7		27.1	25.2		20.9		16.8

2009 Effluent Temperature in ^{o}C

	Jan	Feb	Mar	April	May	June	July	Aug	Sept	Oct	Nov	Dec
	16	13.9	12.8	16.3	19.1	23	25.2	25.8				
	16	14.4	11.5	15.7	20.5	23.1	25.2	25.7				
	16.1	14.7	11.6	17.1	20.5	23.4	24.1	25.6				
	16	13.8	10.1	16.9	19.8	23.3	24.3	26.5				
	16.4	13.5	13.2	16.9	19.7	22.5	24.3	26.6				
	16.6	12.9	13.7	17.2	19	21	22.8	26.7				
	14.3	14.6	15.2	16.8	19.8	21.3	23.6	26.1				
	14.3	15.1	15.7	16.5	19.8	22.6	24.9	26.3				
	15	15	16	17	20	23.2	23.6	25.3				
	15.6	15.1	15.9	17.3	20.3	23.6	24.2	26.6				
	16	15.6	15.9	17.7	20.1	23.4	23.6	26.3				
	15.9	15.9	16.1	17	20	23.5	25.1	27.1				
	15.7	15.7	16	16.8	20.1	23.7	24	27				
	15.6	15.7	15.5	16.8	20.4	24.1	23.9	26.9				
	15.4	15.6	14.1	16.4	20.9	23.2	24.6	27				
	14.7	15	12.5	15.2	21.4	23.8	24.4	26.8				
	14.1	14.7	13.4	17.2	21.2	23.7	24.9	26.8				
	14.1	14.8	15.2	17.5	20.3	26.7	25.8	26.1				
	13.9	14.5	15.9	17.9	18.1	30.7	26.3	27.2				
	14.1	14.7	14.9	16.8	20.8	24.4	23.9	27.5				
	13.9	14.9	15.7	18.1	21.1	24.2	23.8	27.7				
	13.9	15	15.9	18.1	21.5	24.2	24.7	27.9				
	14.4	14.6	15.9	18.3	21.8	24.5	24.6	26.6				
	14	12.3	15.8	18.3	21.8	24.8	24.6	26.8				
	14.7	13.9	15.9	18.8	21.8	24.1	25.6	26.2				
	14.2	14.1	15.3	19.3	22	24	25.9	26.7				
	14.6	15.1	15.1	19.7	22.3	24.9	24.9	26.9				
	11.7		15.2	19.8	22.2	24.7	25.2	27				
	13.2		15.7	20	22.7	24.9	25.6	25.9				
	14.3		15.7	20	23.7	24.9	25.2	26.2				
	14		15.9		23.2		25.4	26.4				
90th%	**26.1**											
10th%	**14.2**											

Winter (November-May) Season Effluent Temperature (degrees Celsius)																				
Nov-06	Dec-06	Jan-07	Jan-07	Mar-07	Apr-07	May-07	Nov-07	Dec-07	Jan-08	Feb-08	Mar-08	Apr-08	May-08	Nov-08	Dec-08	Jan-09	Feb-09	Mar-09	Apr-09	May-09
20	17.8	16.6	14.1	14.1	17.6	18	21.7	19	14.4	14.5	14.2	16.6	17.9	21.2	14.7	16	13.9	12.8	16.3	19.1
20.2	17	17	14.2	14.3	18.2	18.5	20	18.1	13.8	14.7	14.5	17.6	18.3	21.4	16.5	16	14.4	11.5	15.7	20.5
19.4	16.6	14.9	13.7	16.9	17.9	17.4	21.1	18.2	13.5	12.3	14.6	17.1	18.6	21.3	15.5	16.1	14.7	11.6	17.1	20.5
17.8	14.6	15.9	14.8	16.5	17.7	17.1	19.6	17.6	13.1	15.2	15.8	14.1	18.8	21.4	17.8	16	13.8	10.1	16.9	19.8
18	13.9	16.1	13.6	13	16.1	18	20.5	17.3	14.7	15.6	16	15.9	18.9	21	17.6	16.4	13.5	13.2	16.9	19.7
17.8	13.4	16.7	13.8	13	16	17.5	20.6	16.9	15.8	15.6	16.2	15.8	20.2	21.5	17.7	16.6	12.9	13.7	17.2	19
17.5	15.6	16.3	13.2	13.2	14.7	15.1	20.1	16.7	15.6	15.9	15.4	15.5	20.6	21.8	17.1	14.3	14.6	15.2	16.8	19.8
18.3	14.7	16	13.3	13.2	14.8	16.4	19	17.1	16	15.5	15.6	15.9	19.9	22.1	16.6	14.3	15.1	15.7	16.5	19.8
19.5	13.9	15.1	13.2	13.2	15	17.7	18.5	17.5	16.5	15.3	15.2	16.3	19.5	21.5	16.8	15	15	16	17	20
19.4	14.2	15.1	13.1	13.5	16	18.3	18.8	18.4	15.7	15.3	13.8	17	19.1	20.9	17.9	15.6	15.1	15.9	17.3	20.3
22.4	15.6	14.5	12.8	13.4	15.7	19.3	19	18.3	15.6	14.5	13.5	17.7	18.7	20.6	17.8	16	15.6	15.9	17.7	20.1
21.7	16.9	15.1	12.9	13.8	16.3	17.4	19.4	18.4	15.3	13.1	15.4	18.2	17.2	20.7	15.1	15.9	15.9	16.1	17	20
16.7	16.2	14.7	14.8	15.2	16.2	15.9	20	18	15.6	14	15.5	18.1	17.7	20.9	15.9	15.7	15.7	16	16.8	20.1
17.2	15.3	15	14.9	15.3	17.2	19.1	20.5	17.2	15	14.2	15.9	17.2	18.4	19.9	16	15.6	15.7	15.5	16.8	20.4
17	15.5	16.7	13.4	19.2	16.7	19.3	20.8	15.2	15.1	13.8	16.3	17.5	18.7	20.6	16.6	15.4	15.6	14.1	16.4	20.9
20.2	16.5	16.9	13.6	15.4	15.7	20.3	18	13.6	15.1	15.1	15.6	19	20.3	19.6	17.2	14.7	15	12.5	15.2	21.4
18	15.8	14.1	13	14.9	17.4	20.1	18.3	13.6	14.3	15.6	14.9	18.2	19.1	19.2	15.9	14.1	14.7	13.4	17.2	21.2
18.5	16.9	13.7	14	14.7	15.4	18	18.7	11.4	13.2	15.9	15.7	18.2	19.3	19.4	16.7	14.1	14.8	15.2	17.5	20.3
17	16.3	13.8	13.9	13.8	16	18	17.4	14.2	13.6	15.4	16.1	18.3	19.1	19	17.7	13.9	14.5	15.9	17.9	18.1
17.2	15.3	13.2	13.3	15.1	16	19	19	15.8	15	14.1	16.9	18.6	19.3	19	17	14.1	14.7	14.9	16.8	20.8
16.5	15	12.6	13.4	14.2	17.2	19.9	20.2	15.7	13.6	13.1	16.5	17.8	19.6	18.8	16.6	13.9	14.9	15.7	18.1	21.1
12.3	14.8	12.4	14	14.8	18.8	18	19.8	15.6	13.6	14.4	16.6	16.7	19.5	18.3	15.3	13.9	15	15.9	18.1	21.5
12.2	15.7	12.5	14.1	15.6	18.6	19.9	19.4	15.6	14.2	14.4	16.1	17	19.8	18.1	15.9	14.4	14.6	15.9	18.3	21.8
14.4	17.6	14.2	13.8	15.9	18.8	24.6	19.3	15.6	14.5	14.1	15.7	17.6	20.1	18.8	16.4	14	12.3	15.8	18.3	21.8
15.2	15.1	13.5	13.5	16.2	18.5	20.9	18.1	15.5	13.7	14	15.7	17.9	19.9	17.5	16.9	14.7	13.9	15.9	18.8	21.8
15.9	15.2	14	14.7	15.7	18.5	21.6	18.4	15.6	13.4	14.6	16	18.4	20.1	17.5	16.5	14.2	14.1	15.3	19.3	22
17.4	16.3	14.1	14.9	18	18.4	21.7	19.1	12.8	13.9	14.8	16.8	18.5	20.9	17.9	16.7	14.6	15.1	15.1	19.7	22.3
16.1	15.4	13.6	13.7	17.5	18.2	21.3	18.9	13.8	13.3	14	18.6	18.2	21.5	18.3	17.3	11.7		15.2	19.8	22.2
16.5	16.2	13.3		17.7	17.8	22	18.6	15.7	14.5	14	16.9	17.8	21.7	17.7	17.3	13.2		15.7	20	22.7
18	16.1	13.7		17.9	18.1	21.9	17.7	15.1	14.7		16.7	17.4	21.7	17.8	16.9	14.3		15.7	20	23.7
	16.3	13.6		19.7		22.2		12.4	14.5		16.4		21.7		16.8	14		15.9		23.2

90th%tile	**20.1**

DMR and WET Data

Effluent Hardness Data*

Date	mg/L as CaCO3
9-May-05	83
11-May-05	90
13-May-05	86
1-Mar-06	86
3-Mar-06	89
6-Mar-06	92
30-Jan-07	82
1-Feb-07	81
3-Feb-07	80
29-Jan-08	120
31-Jan-08	107
2-Feb-08	106
17-Apr-08	84
31-Oct-08	128
3-Nov-08	128
20-Jan-09	88
22-Jan-09	88
24-Jan-09	90
Average	**95**

*obtained from 2005 permit cycle WET Tests and 2010 permit application

DMR Data October 2006 - October 2009

Date	pH Minimum (S.U.)	pH Maximum (S.U.)	DO Minimum (mg/L)	TP Average (mg/L)	TN Average (mg/L)	NH_3 Maximum (mg/L)	$cBOD_5$ Maximum (mg/L)	TSS Maximum (mg/L)	E.coli Maximum (N/100 mL)
10-Oct-06	6.5	7.4	5.6	0.9	16.8	3.3	4.1	5	32
10-Nov-06	6.3	7.4	6.1	1.4	16.1	1.2	3.1	4	1
10-Dec-06	6.4	8	6.5	1.2	17.1	2.9	2.9	3.6	17
10-Jan-07	6.5	8.3	7.4	1.3	18.9	6.2	2.4	3.2	4
10-Feb-07	6.5	7.3	8.3	0.9	9.4	2	5.2	10.3	23
10-Mar-07	6.5	7.2	7.1	0.9	12.2	1.7	7.6	15.6	1400
10-Apr-07	6	7.2	7.6	0.9	11.8	2.3	4.6	9.3	4
10-May-07	6	6.9	6.9	1.3	14	2.1	2.6	3.3	12
10-Jun-07	6.1	7.1	6.4	1.3	13.2	2.4	2.6	2	2
10-Jul-07	5.7	7.1	7.1	1.9	16	1.1	2.6	10	345
10-Aug-07	8.7	7	7.2	1.5	14.6	0.7	2.4	2	2420
10-Sep-07	6.1	6.8	7.1	1.5	12.7	0.3	2.1	1	55
10-Oct-07	5.2	7.6	7.2	1.9	16.2	1.7	3.5	3	45
10-Nov-07	6.4	7.2	7.2	1.9	16.5	0.6	2	1	21
10-Dec-07	6.2	7.2	8	1.2	15.5	0.4	2.5	1.1	20
10-Jan-08	6.4	7.3	8.5	0.8	13	1.1	2.1	1.4	32
10-Feb-08	6.1	7	6.9	1	17.7	2.2	2.2	2.4	42
10-Mar-08	6.1	7	7.3	0.7	18.1	3	3	1.7	23
10-Apr-08	4.2	6.8	8.9	0.8	19	3.1	3.3	1.6	24
10-May-08	5.7	6.7	8	0.6	13.1	1.4	2	1.4	28
10-Jun-08	6.1	6.7	7.9	0.7	14.5	3.3	2.3	1.3	37
10-Jul-08	5.8	7	7.3	1	13.5	1.3	2.1	2	365
10-Aug-08	6.1	7.1	7.4	0.8	15	0.3	2	1	68
10-Sep-08	6.4	6.9	7.2	0.8	16.6	0.5	2	1	38
10-Oct-08	5.9	6.9	7.5	0.8	15.1	0.3	2	1	579
10-Nov-08	6.3	7	7.4	0.8	13.9	0.3	2.4	1	41
10-Dec-08	6	7.5	8.2	0.6	15.1	7	2.6	1.4	70
10-Jan-09	6.3	7.4	8.7	0.6	14	1.7	3.2	1.3	40
10-Feb-09	6.1	6.8	9	0.6	16.2	2.3	2.9	1.1	21
10-Mar-09	6.1	6.8	8.6	0.6	15	4.6	3.4	7	7
10-Apr-09	6.1	6.6	8.3	0.4	13.8	1.7	2.8	4.7	60
10-May-09	3.9	6.5	8.1	0.6	14.4	0.6	2.7	3.1	71
10-Jun-09	4.3	6.8	7.8	0.6	2	1	2.4	2.4	411
10-Jul-09	5	7.2	7.3	0.6	15.5	0.7	2.5	1	2420
10-Aug-09	6.1	7.2	7.4	0.9	14.9	0.4	3.6	2	20
10-Sep-09	6.5	7.2	6.8	1	15.9	0.2	2.6	4	130
10-Oct-09	6.3	7.4	7.6	0.8	14.7	0.3	2.5	2	142
Average	**6.0**	**7.1**	**7.5**	**1.0**	**14.6**	**1.8**	**2.9**	**3.2**	**245**
90th%	**6.5**	**7.4**	**8.5**	**1.5**	**17.3**	**3.3**	**3.8**	**7.9**	**478**
10th%	**5.1**	**6.8**	**6.7**	**0.6**	**12.5**	**0.3**	**2.0**	**1.0**	**6**

Attachment F

CORMIX Model Approval Memorandum

COMMONWEALTH OF VIRGINIA
DEPARTMENT OF ENVIRONMENTAL QUALITY

Water Division - Office of Water Permit Support
629 East Main Street Richmond, Virginia 23219

M E M O R A N D U M

Subject: Richmond Mixing

To: A. Brockenbrough, PRO

From: M. Dale Phillips, OWPS

Date: August 29, 1996

Copies:

SEP 1996
PRO

I have applied the CORMIX model to the Richmond discharge with the following results:

1. CORMIX would not run with parameters that properly specify the discharge velocity (some sort of domain error or bug in the code). The maximum I could get it to run with is about 2.4 ft/sec. This will not invalidate the model but the results will be somewhat conservative e.g. mixing will be faster than predicted.

2. CORMIX III will not accept a discharge temperature that is less than the ambient. This will not invalidate the model but the results will be somewhat inflated (e.g. mixing will be slower that predicted because there is a potential for stratification that is not captured by the model).

3. Due to the location being very near the fall line and the lack of actual flow reversal due to the tide, I did not include any tidal mixing in the model runs.

3. The 3 items above will offset each other to some extent and I believe the attached prediction file is adequate to assess potential mixing at the Richmond outfall.

4. Due to these difficulties, I did not make any attempt to analyze any minor differences in stream flow. In my opinion, relatively small changes in the river flow is not going to make a significant difference in the mixing prediction.

5. According to the model prediction, about 2 hours travel time is required for the effluent to become fully mixed with the receiving stream. A mix with about 1/2 of the stream flow will provide an exposure time of about 1 hour.

6. According to the model prediction, the effluent is completely mixed with the stream at a distance of about 650 meters downstream from the discharge point.

Comments:

There are three conditions that make this situation difficult to analyze with a theoretical model without field data:

1. The effluent is negatively buoyant.
2. The location very near the fall line and is influenced by the tide but no flow reversal takes place.
3. The design of the foam reducing outfall structure makes estimation of the actual velocity somewhat difficult.

If stringent effluent limits result, I would suggest that you Make the city aware that a dye study may result in different results, I cannot estimate if they would be less or more stringent than the recommendations I will make. The installation of a relatively simple diffuser would result in rapid mixing at this location and should be much less expensive than installing additional treatment. I would estimate the acute WLA would approximately double with the installation of a diffuser.

Recommendations:

Based on the concepts expressed in Amendment No.1 - Mixing Zones to guidance memorandum #93-015, I would recommend:

1. Assume a complete mix of the effluent with the 7Q10 stream flow for the estimation of wasteload allocations based on chronic toxicity. The assumed condition should be reached in about 2 hours, well within the allowed 2 day exposure time.

2. Assume a complete mix of the effluent with 1/2 of the 1Q10 stream flow for the estimation of wasteload allocations based on acute toxicity. This should limit exposures to concentrations higher than the acute standards to one hour or less.

Attachment G

Effluent Limitation Analysis

Source of MIX.exe and MSTRANTI Input Data

Stream Information: 2-JMS110.30	
Stream Flows	Flow Frequency Memorandum (Attachment C). The annual 1Q10 and 30Q10 are also input as the wet season 1Q10 and 30Q10 because the seasonal tiering is based on temperature rather than flow.
Mean Hardness	Ambient Monitoring Station data (Attachment C)
90% Temperature (Annual)	
90% Temperature (Wet Season)	
90% Maximum pH	
10% Maximum pH	
Tier Designation	Flow Frequency Memorandum (Attachment C)
Mixing Information for MSTRANTI	
All Data	CORMIX model (Attachment F)
Effluent Information	
Mean Hardness	Application Effluent Data (Attachment E)
90% Temperature (Annual)	
90% Temperature (Wet Season)	
90% Maximum pH	DMR Data (See Attachment E)
10% Maximum pH	
Discharge Flow	Design Dry-weather Flow

FRESHWATER
WATER QUALITY CRITERIA / WASTELOAD ALLOCATION ANALYSIS

Facility Name: Richmond WWTP Permit No.: VA0063177

Receiving Stream: James River Version: OWP Guidance Memo 00-2011 (8/24/00)

Stream Information		
Mean Hardness (as CaCO3) =	79	mg/L
90% Temperature (Annual) =	28.6	deg C
90% Temperature (Wet season) =	20.1	deg C
90% Maximum pH =	8.7	SU
10% Maximum pH =	7.1	SU
Tier Designation (1 or 2) =	1	
Public Water Supply (PWS) Y/N? =	n	
Trout Present Y/N? =	n	
Early Life Stages Present Y/N? =	y	

Stream Flows		
1Q10 (Annual) =	300	MGD
7Q10 (Annual) =	355	MGD
30Q10 (Annual) =	496	MGD
1Q10 (Wet season) =	300	MGD
30Q10 (Wet season)	496	MGD
30Q5 =	567	MGD
Harmonic Mean =	1962	MGD

Mixing Information		
Annual - 1Q10 Mix =	50	%
- 7Q10 Mix =	100	%
- 30Q10 Mix =	100	%
Wet Season - 1Q10 Mix =	50	%
- 30Q10 Mix =	100	%

Effluent Information		
Mean Hardness (as CaCO3) =	95	mg/L
90% Temp (Annual) =	26.1	deg C
90% Temp (Wet season) =		deg C
90% Maximum pH =	7.4	SU
10% Maximum pH =	6.8	SU
Discharge Flow =	45	MGD

Parameter	Background	Water Quality Criteria				Wasteload Allocations				Antidegradation Baseline				Antidegradation Allocations				**Most Limiting Allocations**			
(ug/l unless noted)	Conc.	Acute	Chronic	HH (PWS)	HH	Acute	Chronic	HH (PWS)	HH	Acute	Chronic	HH (PWS)	HH	Acute	Chronic	HH (PWS)	HH	**Acute**	**Chronic**	**HH (PWS)**	**HH**
Acenapthene	0	--	--	na	9.9E+02	--	--	na	1.3E+04	--	--	--	--	--	--	--	--	**--**	**--**	**na**	**1.3E+04**
Acrolein	0	--	--	na	9.3E+00	--	--	na	1.3E+02	--	--	--	--	--	--	--	--	**--**	**--**	**na**	**1.3E+02**
Acrylonitrile[C]	0	--	--	na	2.5E+00	--	--	na	1.1E+02	--	--	--	--	--	--	--	--	**--**	**--**	**na**	**1.1E+02**
Aldrin [C]	0	3.0E+00	--	na	5.0E-04	1.3E+01	--	na	2.2E-02	--	--	--	--	--	--	--	--	**1.3E+01**	**--**	**na**	**2.2E-02**
Ammonia-N (mg/l) (Yearly)	0	8.90E+00	6.34E-01	na	--	3.9E+01	7.6E+00	na	--	--	--	--	--	--	--	--	--	**3.9E+01**	**7.6E+00**	**na**	**--**
Ammonia-N (mg/l) (High Flow)	0	8.90E+00	1.21E+00	na	--	3.9E+01	1.5E+01	na	--	--	--	--	--	--	--	--	--	**3.9E+01**	**1.5E+01**	**na**	**--**
Anthracene	0	--	--	na	4.0E+04	--	--	na	5.4E+05	--	--	--	--	--	--	--	--	**--**	**--**	**na**	**5.4E+05**
Antimony	0	--	--	na	6.4E+02	--	--	na	8.7E+03	--	--	--	--	--	--	--	--	**--**	**--**	**na**	**8.7E+03**
Arsenic	o	3.4E+02	1.5E+02	na	--	1.5E+03	1.3E+03	na	--	--	--	--	--	--	--	--	--	**1.5E+03**	**1.3E+03**	**na**	**--**
Barium	0	--	--	na	--	--	--	na	--	--	--	--	--	--	--	--	--	**--**	**--**	**na**	**--**
Benzene [C]	0	--	--	na	5.1E+02	--	--	na	2.3E+04	--	--	--	--	--	--	--	--	**--**	**--**	**na**	**2.3E+04**
Benzidine[C]	0	--	--	na	2.0E-03	--	--	na	8.9E-02	--	--	--	--	--	--	--	--	**--**	**--**	**na**	**8.9E-02**
Benzo (a) anthracene [C]	0	--	--	na	1.8E-01	--	--	na	8.0E+00	--	--	--	--	--	--	--	--	**--**	**--**	**na**	**8.0E+00**
Benzo (b) fluoranthene [C]	0	--	--	na	1.8E-01	--	--	na	8.0E+00	--	--	--	--	--	--	--	--	**--**	**--**	**na**	**8.0E+00**
Benzo (k) fluoranthene [C]	0	--	--	na	1.8E-01	--	--	na	8.0E+00	--	--	--	--	--	--	--	--	**--**	**--**	**na**	**8.0E+00**
Benzo (a) pyrene [C]	0	--	--	na	1.8E-01	--	--	na	8.0E+00	--	--	--	--	--	--	--	--	**--**	**--**	**na**	**8.0E+00**
Bis2-Chloroethyl Ether [C]	0	--	--	na	5.3E+00	--	--	na	2.4E+02	--	--	--	--	--	--	--	--	**--**	**--**	**na**	**2.4E+02**
Bis2-Chloroisopropyl Ether	0	--	--	na	6.5E+04	--	--	na	8.8E+05	--	--	--	--	--	--	--	--	**--**	**--**	**na**	**8.8E+05**
Bis 2-Ethylhexyl Phthalate [C]	0	--	--	na	2.2E+01	--	--	na	9.8E+02	--	--	--	--	--	--	--	--	**--**	**--**	**na**	**9.8E+02**
Bromoform [C]	0	--	--	na	1.4E+03	--	--	na	6.2E+04	--	--	--	--	--	--	--	--	**--**	**--**	**na**	**6.2E+04**
Butylbenzylphthalate	0	--	--	na	1.9E+03	--	--	na	2.6E+04	--	--	--	--	--	--	--	--	**--**	**--**	**na**	**2.6E+04**
Cadmium	0	3.2E+00	9.6E-01	na	--	1.4E+01	8.5E+00	na	--	--	--	--	--	--	--	--	--	**1.4E+01**	**8.5E+00**	**na**	**--**
Carbon Tetrachloride [C]	0	--	--	na	1.6E+01	--	--	na	7.1E+02	--	--	--	--	--	--	--	--	**--**	**--**	**na**	**7.1E+02**
Chlordane [C]	0	2.4E+00	4.3E-03	na	8.1E-03	1.0E+01	3.8E-02	na	3.6E-01	--	--	--	--	--	--	--	--	**1.0E+01**	**3.8E-02**	**na**	**3.6E-01**
Chloride	0	8.6E+05	2.3E+05	na	--	3.7E+06	2.0E+06	na	--	--	--	--	--	--	--	--	--	**3.7E+06**	**2.0E+06**	**na**	**--**
TRC	0	1.9E+01	1.1E+01	na	--	8.2E+01	9.8E+01	na	--	--	--	--	--	--	--	--	--	**8.2E+01**	**9.8E+01**	**na**	**--**
Chlorobenzene	0	--	--	na	1.6E+03	--	--	na	2.2E+04	--	--	--	--	--	--	--	--	**--**	**--**	**na**	**2.2E+04**

Parameter	Background	Water Quality Criteria				Wasteload Allocations				Antidegradation Baseline				Antidegradation Allocations				**Most Limiting Allocations**			
(ug/l unless noted)	Conc.	Acute	Chronic	HH (PWS)	HH	Acute	Chronic	HH (PWS)	HH	Acute	Chronic	HH (PWS)	HH	Acute	Chronic	HH (PWS)	HH	**Acute**	**Chronic**	**HH (PWS)**	**HH**
Chlorodibromomethane[C]	0	--	--	na	1.3E+02	--	--	na	5.8E+03	--	--	--	--	--	--	--	--	**--**	**--**	**na**	**5.8E+03**
Chloroform	0	--	--	na	1.1E+04	--	--	na	1.5E+05	--	--	--	--	--	--	--	--	**--**	**--**	**na**	**1.5E+05**
2-Chloronaphthalene	0	--	--	na	1.6E+03	--	--	na	2.2E+04	--	--	--	--	--	--	--	--	**--**	**--**	**na**	**2.2E+04**
2-Chlorophenol	0	--	--	na	1.5E+02	--	--	na	2.0E+03	--	--	--	--	--	--	--	--	**--**	**--**	**na**	**2.0E+03**
Chlorpyrifos	0	8.3E-02	4.1E-02	na	--	3.6E-01	3.6E-01	na	--	--	--	--	--	--	--	--	--	**3.6E-01**	**3.6E-01**	**na**	**--**
Chromium III	0	4.9E+02	6.2E+01	na	--	2.1E+03	5.5E+02	na	--	--	--	--	--	--	--	--	--	**2.1E+03**	**5.5E+02**	**na**	**--**
Chromium VI	0	1.6E+01	1.1E+01	na	--	6.9E+01	9.8E+01	na	--	--	--	--	--	--	--	--	--	**6.9E+01**	**9.8E+01**	**na**	**--**
Chromium, Total	0	--	--	1.0E+02	--	--	--	na	--	--	--	--	--	--	--	--	--	**--**	**--**	**na**	**--**
Chrysene [C]	0	--	--	na	1.8E-02	--	--	na	8.0E-01	--	--	--	--	--	--	--	--	**--**	**--**	**na**	**8.0E-01**
Copper	0	1.1E+01	7.5E+00	na	--	4.9E+01	6.6E+01	na	--	--	--	--	--	--	--	--	--	**4.9E+01**	**6.6E+01**	**na**	**--**
Cyanide, Free	0	2.2E+01	5.2E+00	na	1.6E+04	9.5E+01	4.6E+01	na	2.2E+05	--	--	--	--	--	--	--	--	**9.5E+01**	**4.6E+01**	**na**	**2.2E+05**
DDD [C]	0	--	--	na	3.1E-03	--	--	na	1.4E-01	--	--	--	--	--	--	--	--	**--**	**--**	**na**	**1.4E-01**
DDE [C]	0	--	--	na	2.2E-03	--	--	na	9.8E-02	--	--	--	--	--	--	--	--	**--**	**--**	**na**	**9.8E-02**
DDT [C]	0	1.1E+00	1.0E-03	na	2.2E-03	4.8E+00	8.9E-03	na	9.8E-02	--	--	--	--	--	--	--	--	**4.8E+00**	**8.9E-03**	**na**	**9.8E-02**
Demeton	0	--	1.0E-01	na	--	--	8.9E-01	na	--	--	--	--	--	--	--	--	--	**--**	**8.9E-01**	**na**	**--**
Diazinon	0	1.7E-01	1.7E-01	na	--	7.4E-01	1.5E+00	na	--	--	--	--	--	--	--	--	--	**7.4E-01**	**1.5E+00**	**na**	**--**
Dibenz(a,h)anthracene [C]	0	--	--	na	1.8E-01	--	--	na	8.0E+00	--	--	--	--	--	--	--	--	**--**	**--**	**na**	**8.0E+00**
1,2-Dichlorobenzene	0	--	--	na	1.3E+03	--	--	na	1.8E+04	--	--	--	--	--	--	--	--	**--**	**--**	**na**	**1.8E+04**
1,3-Dichlorobenzene	0	--	--	na	9.6E+02	--	--	na	1.3E+04	--	--	--	--	--	--	--	--	**--**	**--**	**na**	**1.3E+04**
1,4-Dichlorobenzene	0	--	--	na	1.9E+02	--	--	na	2.6E+03	--	--	--	--	--	--	--	--	**--**	**--**	**na**	**2.6E+03**
3,3-Dichlorobenzidine[C]	0	--	--	na	2.8E-01	--	--	na	1.2E+01	--	--	--	--	--	--	--	--	**--**	**--**	**na**	**1.2E+01**
Dichlorobromomethane [C]	0	--	--	na	1.7E+02	--	--	na	7.6E+03	--	--	--	--	--	--	--	--	**--**	**--**	**na**	**7.6E+03**
1,2-Dichloroethane [C]	0	--	--	na	3.7E+02	--	--	na	1.7E+04	--	--	--	--	--	--	--	--	**--**	**--**	**na**	**1.7E+04**
1,1-Dichloroethylene	0	--	--	na	7.1E+03	--	--	na	9.7E+04	--	--	--	--	--	--	--	--	**--**	**--**	**na**	**9.7E+04**
1,2-trans-dichloroethylene	0	--	--	na	1.0E+04	--	--	na	1.4E+05	--	--	--	--	--	--	--	--	**--**	**--**	**na**	**1.4E+05**
2,4-Dichlorophenol	0	--	--	na	2.9E+02	--	--	na	3.9E+03	--	--	--	--	--	--	--	--	**--**	**--**	**na**	**3.9E+03**
2,4-Dichlorophenoxy acetic acid (2,4-D)	0	--	--	na	--	--	--	na	--	--	--	--	--	--	--	--	--	**--**	**--**	**na**	**--**
1,2-Dichloropropane[C]	0	--	--	na	1.5E+02	--	--	na	6.7E+03	--	--	--	--	--	--	--	--	**--**	**--**	**na**	**6.7E+03**
1,3-Dichloropropene [C]	0	--	--	na	2.1E+02	--	--	na	9.4E+03	--	--	--	--	--	--	--	--	**--**	**--**	**na**	**9.4E+03**
Dieldrin [C]	0	2.4E-01	5.6E-02	na	5.4E-04	1.0E+00	5.0E-01	na	2.4E-02	--	--	--	--	--	--	--	--	**1.0E+00**	**5.0E-01**	**na**	**2.4E-02**
Diethyl Phthalate	0	--	--	na	4.4E+04	--	--	na	6.0E+05	--	--	--	--	--	--	--	--	**--**	**--**	**na**	**6.0E+05**
2,4-Dimethylphenol	0	--	--	na	8.5E+02	--	--	na	1.2E+04	--	--	--	--	--	--	--	--	**--**	**--**	**na**	**1.2E+04**
Dimethyl Phthalate	0	--	--	na	1.1E+06	--	--	na	1.5E+07	--	--	--	--	--	--	--	--	**--**	**--**	**na**	**1.5E+07**
Di-n-Butyl Phthalate	0	--	--	na	4.5E+03	--	--	na	6.1E+04	--	--	--	--	--	--	--	--	**--**	**--**	**na**	**6.1E+04**
2,4 Dinitrophenol	0	--	--	na	5.3E+03	--	--	na	7.2E+04	--	--	--	--	--	--	--	--	**--**	**--**	**na**	**7.2E+04**
2-Methyl-4,6-Dinitrophenol	0	--	--	na	2.8E+02	--	--	na	3.8E+03	--	--	--	--	--	--	--	--	**--**	**--**	**na**	**3.8E+03**
2,4-Dinitrotoluene [C]	0	--	--	na	3.4E+01	--	--	na	1.5E+03	--	--	--	--	--	--	--	--	**--**	**--**	**na**	**1.5E+03**
Dioxin 2,3,7,8-tetrachlorodibenzo-p-dioxin	0	--	--	na	5.1E-08	--	--	na	6.9E-07	--	--	--	--	--	--	--	--	**--**	**--**	**na**	**6.9E-07**
1,2-Diphenylhydrazine[C]	0	--	--	na	2.0E+00	--	--	na	8.9E+01	--	--	--	--	--	--	--	--	**--**	**--**	**na**	**8.9E+01**
Alpha-Endosulfan	0	2.2E-01	5.6E-02	na	8.9E+01	9.5E-01	5.0E-01	na	1.2E+03	--	--	--	--	--	--	--	--	**9.5E-01**	**5.0E-01**	**na**	**1.2E+03**
Beta-Endosulfan	0	2.2E-01	5.6E-02	na	8.9E+01	9.5E-01	5.0E-01	na	1.2E+03	--	--	--	--	--	--	--	--	**9.5E-01**	**5.0E-01**	**na**	**1.2E+03**
Alpha + Beta Endosulfan	0	2.2E-01	5.6E-02	--	--	9.5E-01	5.0E-01	--	--	--	--	--	--	--	--	--	--	**9.5E-01**	**5.0E-01**	**--**	**--**
Endosulfan Sulfate	0	--	--	na	8.9E+01	--	--	na	1.2E+03	--	--	--	--	--	--	--	--	**--**	**--**	**na**	**1.2E+03**
Endrin	0	8.6E-02	3.6E-02	na	6.0E-02	3.7E-01	3.2E-01	na	8.2E-01	--	--	--	--	--	--	--	--	**3.7E-01**	**3.2E-01**	**na**	**8.2E-01**
Endrin Aldehyde	0	--	--	na	3.0E-01	--	--	na	4.1E+00	--	--	--	--	--	--	--	--	**--**	**--**	**na**	**4.1E+00**

Parameter	Background	Water Quality Criteria				Wasteload Allocations				Antidegradation Baseline				Antidegradation Allocations				**Most Limiting Allocations**			
(ug/l unless noted)	Conc.	Acute	Chronic	HH (PWS)	HH	Acute	Chronic	HH (PWS)	HH	Acute	Chronic	HH (PWS)	HH	Acute	Chronic	HH (PWS)	HH	**Acute**	**Chronic**	**HH (PWS)**	**HH**
Ethylbenzene	0	--	--	na	2.1E+03	--	--	na	2.9E+04	--	--	--	--	--	--	--	--	**--**	**--**	**na**	**2.9E+04**
Fluoranthene	0	--	--	na	1.4E+02	--	--	na	1.9E+03	--	--	--	--	--	--	--	--	**--**	**--**	**na**	**1.9E+03**
Fluorene	0	--	--	na	5.3E+03	--	--	na	7.2E+04	--	--	--	--	--	--	--	--	**--**	**--**	**na**	**7.2E+04**
Foaming Agents	0	--	--	na	--	--	--	na	--	--	--	--	--	--	--	--	--	**--**	**--**	**na**	**--**
Guthion	0	--	1.0E-02	na	--	--	8.9E-02	na	--	--	--	--	--	--	--	--	--	**--**	**8.9E-02**	**na**	**--**
Heptachlor [C]	0	5.2E-01	3.8E-03	na	7.9E-04	2.3E+00	3.4E-02	na	3.5E-02	--	--	--	--	--	--	--	--	**2.3E+00**	**3.4E-02**	**na**	**3.5E-02**
Heptachlor Epoxide[C]	0	5.2E-01	3.8E-03	na	3.9E-04	2.3E+00	3.4E-02	na	1.7E-02	--	--	--	--	--	--	--	--	**2.3E+00**	**3.4E-02**	**na**	**1.7E-02**
Hexachlorobenzene[C]	0	--	--	na	2.9E-03	--	--	na	1.3E-01	--	--	--	--	--	--	--	--	**--**	**--**	**na**	**1.3E-01**
Hexachlorobutadiene[C]	0	--	--	na	1.8E+02	--	--	na	8.0E+03	--	--	--	--	--	--	--	--	**--**	**--**	**na**	**8.0E+03**
Hexachlorocyclohexane Alpha-BHC[C]	0	--	--	na	4.9E-02	--	--	na	2.2E+00	--	--	--	--	--	--	--	--	**--**	**--**	**na**	**2.2E+00**
Hexachlorocyclohexane Beta-BHC[C]	0	--	--	na	1.7E-01	--	--	na	7.6E+00	--	--	--	--	--	--	--	--	**--**	**--**	**na**	**7.6E+00**
Hexachlorocyclohexane Gamma-BHC[C] (Lindane)	0	9.5E-01	na	na	1.8E+00	4.1E+00	--	na	8.0E+01	--	--	--	--	--	--	--	--	**4.1E+00**	**--**	**na**	**8.0E+01**
Hexachlorocyclopentadiene	0	--	--	na	1.1E+03	--	--	na	1.5E+04	--	--	--	--	--	--	--	--	**--**	**--**	**na**	**1.5E+04**
Hexachloroethane[C]	0	--	--	na	3.3E+01	--	--	na	1.5E+03	--	--	--	--	--	--	--	--	**--**	**--**	**na**	**1.5E+03**
Hydrogen Sulfide	0	--	2.0E+00	na	--	--	1.8E+01	na	--	--	--	--	--	--	--	--	--	**--**	**1.8E+01**	**na**	**--**
Indeno (1,2,3-cd) pyrene [C]	0	--	--	na	1.8E-01	--	--	na	8.0E+00	--	--	--	--	--	--	--	--	**--**	**--**	**na**	**8.0E+00**
Iron	0	--	--	na	--	--	--	na	--	--	--	--	--	--	--	--	--	**--**	**--**	**na**	**--**
Isophorone[C]	0	--	--	na	9.6E+03	--	--	na	4.3E+05	--	--	--	--	--	--	--	--	**--**	**--**	**na**	**4.3E+05**
Kepone	0	--	0.0E+00	na	--	--	0.0E+00	na	--	--	--	--	--	--	--	--	--	**--**	**0.0E+00**	**na**	**--**
Lead	0	9.3E+01	1.0E+01	na	--	4.0E+02	9.2E+01	na	--	--	--	--	--	--	--	--	--	**4.0E+02**	**9.2E+01**	**na**	**--**
Malathion	0	--	1.0E-01	na	--	--	8.9E-01	na	--	--	--	--	--	--	--	--	--	**--**	**8.9E-01**	**na**	**--**
Manganese	0	--	--	na	--	--	--	na	--	--	--	--	--	--	--	--	--	**--**	**--**	**na**	**--**
Mercury	0	1.4E+00	7.7E-01	- -	- -	6.1E+00	6.8E+00	- -	- -	--	--	--	--	--	--	--	--	**6.1E+00**	**6.8E+00**	**- -**	**- -**
Methyl Bromide	0	--	--	na	1.5E+03	--	--	na	2.0E+04	--	--	--	--	--	--	--	--	**--**	**--**	**na**	**2.0E+04**
Methylene Chloride [C]	0	--	--	na	5.9E+03	--	--	na	2.6E+05	--	--	--	--	--	--	--	--	**--**	**--**	**na**	**2.6E+05**
Methoxychlor	0	--	3.0E-02	na	--	--	2.7E-01	na	--	--	--	--	--	--	--	--	--	**--**	**2.7E-01**	**na**	**--**
Mirex	0	--	0.0E+00	na	--	--	0.0E+00	na	--	--	--	--	--	--	--	--	--	**--**	**0.0E+00**	**na**	**--**
Nickel	0	1.6E+02	1.7E+01	na	4.6E+03	6.7E+02	1.5E+02	na	6.3E+04	--	--	--	--	--	--	--	--	**6.7E+02**	**1.5E+02**	**na**	**6.3E+04**
Nitrate (as N)	0	--	--	na	--	--	--	na	--	--	--	--	--	--	--	--	--	**--**	**--**	**na**	**--**
Nitrobenzene	0	--	--	na	6.9E+02	--	--	na	9.4E+03	--	--	--	--	--	--	--	--	**--**	**--**	**na**	**9.4E+03**
N-Nitrosodimethylamine[C]	0	--	--	na	3.0E+01	--	--	na	1.3E+03	--	--	--	--	--	--	--	--	**--**	**--**	**na**	**1.3E+03**
N-Nitrosodiphenylamine[C]	0	--	--	na	6.0E+01	--	--	na	2.7E+03	--	--	--	--	--	--	--	--	**--**	**--**	**na**	**2.7E+03**
N-Nitrosodi-n-propylamine[C]	0	--	--	na	5.1E+00	--	--	na	2.3E+02	--	--	--	--	--	--	--	--	**--**	**--**	**na**	**2.3E+02**
Nonylphenol	0	2.8E+01	6.6E+00	--	--	1.2E+02	5.9E+01	na	--	--	--	--	--	--	--	--	--	**1.2E+02**	**5.9E+01**	**na**	**--**
Parathion	0	6.5E-02	1.3E-02	na	--	2.8E-01	1.2E-01	na	--	--	--	--	--	--	--	--	--	**2.8E-01**	**1.2E-01**	**na**	**--**
PCB Total[C]	0	--	1.4E-02	na	6.4E-04	--	1.2E-01	na	2.9E-02	--	--	--	--	--	--	--	--	**--**	**1.2E-01**	**na**	**2.9E-02**
Pentachlorophenol [C]	0	8.8E+00	7.1E+00	na	3.0E+01	3.8E+01	6.3E+01	na	1.3E+03	--	--	--	--	--	--	--	--	**3.8E+01**	**6.3E+01**	**na**	**1.3E+03**
Phenol	0	--	--	na	8.6E+05	--	--	na	1.2E+07	--	--	--	--	--	--	--	--	**--**	**--**	**na**	**1.2E+07**
Pyrene	0	--	--	na	4.0E+03	--	--	na	5.4E+04	--	--	--	--	--	--	--	--	**--**	**--**	**na**	**5.4E+04**
Radionuclides	0	--	--	na	--	--	--	na	--	--	--	--	--	--	--	--	--	**--**	**--**	**na**	**--**
Gross Alpha Activity (pCi/L)	0	--	--	na	--	--	--	na	--	--	--	--	--	--	--	--	--	**--**	**--**	**na**	**--**
Beta and Photon Activity (mrem/yr)	0	--	--	na	4.0E+00	--	--	na	5.4E+01	--	--	--	--	--	--	--	--	**--**	**--**	**na**	**5.4E+01**
Radium 226 + 228 (pCi/L)	0	--	--	na	--	--	--	na	--	--	--	--	--	--	--	--	--	**--**	**--**	**na**	**--**
Uranium (ug/l)	0	--	--	na	--	--	--	na	--	--	--	--	--	--	--	--	--	**--**	**--**	**na**	**--**

Parameter	Background	Water Quality Criteria				Wasteload Allocations				Antidegradation Baseline				Antidegradation Allocations				**Most Limiting Allocations**			
(ug/l unless noted)	Conc.	Acute	Chronic	HH (PWS)	HH	Acute	Chronic	HH (PWS)	HH	Acute	Chronic	HH (PWS)	HH	Acute	Chronic	HH (PWS)	HH	**Acute**	**Chronic**	**HH (PWS)**	**HH**
Selenium, Total Recoverable	0	2.0E+01	5.0E+00	na	4.2E+03	8.7E+01	4.4E+01	na	5.7E+04	--	--	--	--	--	--	--	--	**8.7E+01**	**4.4E+01**	**na**	**5.7E+04**
Silver	0	2.5E+00	--	na	--	1.1E+01	--	na	--	--	--	--	--	--	--	--	--	**1.1E+01**	**--**	**na**	**--**
Sulfate	0	--	--	na	--	--	--	na	--	--	--	--	--	--	--	--	--	**--**	**--**	**na**	**--**
1,1,2,2-Tetrachloroethane[C]	0	--	--	na	4.0E+01	--	--	na	1.8E+03	--	--	--	--	--	--	--	--	**--**	**--**	**na**	**1.8E+03**
Tetrachloroethylene[C]	0	--	--	na	3.3E+01	--	--	na	1.5E+03	--	--	--	--	--	--	--	--	**--**	**--**	**na**	**1.5E+03**
Thallium	0	--	--	na	4.7E-01	--	--	na	6.4E+00	--	--	--	--	--	--	--	--	**--**	**--**	**na**	**6.4E+00**
Toluene	0	--	--	na	6.0E+03	--	--	na	8.2E+04	--	--	--	--	--	--	--	--	**--**	**--**	**na**	**8.2E+04**
Total dissolved solids	0	--	--	na	--	--	--	na	--	--	--	--	--	--	--	--	--	**--**	**--**	**na**	**--**
Toxaphene [C]	0	7.3E-01	2.0E-04	na	2.8E-03	3.2E+00	1.8E-03	na	1.2E-01	--	--	--	--	--	--	--	--	**3.2E+00**	**1.8E-03**	**na**	**1.2E-01**
Tributyltin	0	4.6E-01	7.2E-02	na	--	2.0E+00	6.4E-01	na	--	--	--	--	--	--	--	--	--	**2.0E+00**	**6.4E-01**	**na**	**--**
1,2,4-Trichlorobenzene	0	--	--	na	7.0E+01	--	--	na	9.5E+02	--	--	--	--	--	--	--	--	**--**	**--**	**na**	**9.5E+02**
1,1,2-Trichloroethane[C]	0	--	--	na	1.6E+02	--	--	na	7.1E+03	--	--	--	--	--	--	--	--	**--**	**--**	**na**	**7.1E+03**
Trichloroethylene [C]	0	--	--	na	3.0E+02	--	--	na	1.3E+04	--	--	--	--	--	--	--	--	**--**	**--**	**na**	**1.3E+04**
2,4,6-Trichlorophenol [C]	0	--	--	na	2.4E+01	--	--	na	1.1E+03	--	--	--	--	--	--	--	--	**--**	**--**	**na**	**1.1E+03**
2-(2,4,5-Trichlorophenoxy) propionic acid (Silvex)	0	--	--	na	--	--	--	na	--	--	--	--	--	--	--	--	--	**--**	**--**	**na**	**--**
Vinyl Chloride[C]	0	--	--	na	2.4E+01	--	--	na	1.1E+03	--	--	--	--	--	--	--	--	**--**	**--**	**na**	**1.1E+03**
Zinc	0	1.0E+02	9.9E+01	na	2.6E+04	4.3E+02	8.8E+02	na	3.5E+05	--	--	--	--	--	--	--	--	**4.3E+02**	**8.8E+02**	**na**	**3.5E+05**

Notes:

1. All concentrations expressed as micrograms/liter (ug/l), unless noted otherwise
2. Discharge flow is highest monthly average or Form 2C maximum for Industries and design flow for Municipals
3. Metals measured as Dissolved, unless specified otherwise
4. "C" indicates a carcinogenic parameter
5. Regular WLAs are mass balances (minus background concentration) using the % of stream flow entered above under Mixing Information.
   Antidegradation WLAs are based upon a complete mix.
6. Antideg. Baseline = (0.25(WQC - background conc.) + background conc.) for acute and chronic
   = (0.1(WQC - background conc.) + background conc.) for human health
7. WLAs established at the following stream flows: 1Q10 for Acute, 30Q10 for Chronic Ammonia, 7Q10 for Other Chronic, 30Q5 for Non-carcinogens and Harmonic Mean for Carcinogens. To apply mixing ratios from a model set the stream flow equal to (mixing ratio - 1), effluent flow equal to 1 and 100% mix.

Metal	Target Value (SSTV)
Antimony	8.7E+03
Arsenic	5.9E+02
Barium	na
Cadmium	5.1E+00
Chromium III	3.3E+02
Chromium VI	2.8E+01
Copper	1.9E+01
Iron	na
Lead	5.5E+01
Manganese	na
Mercury	2.4E+00
Nickel	9.0E+01
Selenium	2.7E+01
Silver	4.3E+00
Zinc	1.7E+02

Note: do not use QL's lower than the minimum QL's provided in agency guidance

Chloride

Facility = CoR
Chemical = Chloride
Chronic averaging period = 4
WLAa = 3700
WLAc = 2000
Q.L. = 1
# samples/mo. = 1
# samples/wk. = 1

Summary of Statistics:
observations = 1
Expected Value = 48
Variance = 829.44
C.V. = 0.6
97th percentile daily values = 116.804
97th percentile 4 day average = 79.8619
97th percentile 30 day average= 57.8905
< Q.L. = 0
Model used = BPJ Assumptions, type 2 data

No Limit is required for this material

The data are:
48

Zinc

Facility = CoR
Chemical = Zinc
Chronic averaging period = 4
WLAa = 430
WLAc = 880
Q.L. = 5
# samples/mo. = 1
# samples/wk. = 1

Summary of Statistics:
observations = 3
Expected Value = 44.3333
Variance = 707.56
C.V. = 0.6
97th percentile daily values = 107.881
97th percentile 4 day average = 73.7613
97th percentile 30 day average= 53.4683
< Q.L. = 0
Model used = BPJ Assumptions, type 2 data

No Limit is required for this material

The data are:
50
41
42

Note: All effluent data above was submitted in the permit application. Chloride is expressed in mg/L and zinc is expressed in µg/L. As indicated, no limitations are needed for chloride or zinc at this time.

TRC

Facility = CoR
Chemical = TRC
Chronic averaging period = 4
WLAa = 82
WLAc = 98
Q.L. = 1
# samples/mo. = 360
# samples/wk. = 90

Summary of Statistics:
observations = 1
Expected Value = 20000
Variance = 1440000
C.V. = 0.6
97th percentile daily values = 48668.3
97th percentile 4 day average = 33275.8
97th percentile 30 day average= 24121.0
< Q.L. = 0
Model used = BPJ Assumptions, type 2 data

A limit is needed based on Acute Toxicity
Maximum Daily Limit = 82
Average Weekly limit = 37.8742990225253
Average Monthly LImit = 35.7018717094059

The data are:
20000

Note: 20000 µg/L was used to force a limitation per Guidance Memorandum 00-2011. As indicated, the TRC weekly average limit is 38 µg/L; the TRC monthly average limit is 36 µg/L.

Ammonia (June – October)

Facility = CoR
Chemical = NH3
Chronic averaging period = 30
WLAa = 39
WLAc = 7.6
Q.L. = 0.2
# samples/mo. = 30
# samples/wk. = 7

Summary of Statistics:
observations = 1
Expected Value = 9
Variance = 29.16
C.V. = 0.6
97th percentile daily values = 21.9007
97th percentile 4 day average = 14.9741
97th percentile 30 day average= 10.8544
< Q.L. = 0
Model used = BPJ Assumptions, type 2 data

A limit is needed based on Chronic Toxicity
Maximum Daily Limit = 15.334292709964
Average Weekly limit = 9.36476306842008
Average Monthly LImit = 7.60

The data are:
9.00

Note: 9.00 mg/L was used to force a limitation per Guidance Memorandum 00-2011. As indicated, water quality-base effluent limitations are necessary. However, antibacksliding also prohibits the relaxation of limitations. Discussion of the permit limits is found in Item 18 of the fact sheet.

Ammonia (November - May)

Facility = CoR
Chemical = NH3
Chronic averaging period = 30
WLAa = 39
WLAc = 15
Q.L. = 0.2
# samples/mo. = 30
# samples/wk. = 7

Summary of Statistics:
observations = 1
Expected Value = 9
Variance = 29.16
C.V. = 0.6
97th percentile daily values = 21.9007
97th percentile 4 day average = 14.9741
97th percentile 30 day average= 10.8544
< Q.L. = 0
Model used = BPJ Assumptions, type 2 data

No Limit is required for this material

The data are:
9.00

Note: 9.00 mg/L was used to force a limitation per Guidance Memorandum 00-2011. As indicated, water quality-base effluent limitations are not necessary. Discussion of the permit limits is found in Item 18 of the fact sheet.

Cadmium

Facility = CoR
Chemical = Cd
Chronic averaging period = 4
WLAa = 14
WLAc = 8.5
Q.L. = .1
# samples/mo. = 1
# samples/wk. = 1

Summary of Statistics:
observations = 3
Expected Value = .092774
Variance = .003098
C.V. = 0.6
97th percentile daily values = .225760
97th percentile 4 day average = .154357
97th percentile 30 day average= .111891
< Q.L. = 2
Model used = BPJ Assumptions, Type 1 data

No Limit is required for this material

The data are:
0.13
0
0

Copper

Facility = CoR
Chemical = Cu
Chronic averaging period = 4
WLAa = 49
WLAc = 66
Q.L. = 5
# samples/mo. = 1
# samples/wk. = 1

Summary of Statistics:
observations = 3
Expected Value = 7.44178
Variance = 19.9368
C.V. = 0.6
97th percentile daily values = 18.1089
97th percentile 4 day average = 12.3815
97th percentile 30 day average= 8.97518
< Q.L. = 1
Model used = BPJ Assumptions, Type 1 data

No Limit is required for this material

The data are:
5
0
8

Note: All effluent data above was submitted in the permit application and are expressed in µg/L. Data entered as "<QL" are represented as "0." As indicated, no limitations are needed for either metal at this time.

Attachment H

Richmond Crater Water Quality Management Plan

Allied (Hopewell)	165.00	2750		10326		6.1		2750		10326		6.1
Hopewell Regional WTF	34.07	12502	44.0	12091	36.2	4.8		12502	44.0	10291	36.2	4.8
Petersburg STP	15.00	2802	22.4	801	6.4	5.0		2802	22.4	2028	16.2	5.0
TOTAL	380.81	31084		28978				36679	35958			

1 NH3-N values represent ammonia as nitrogen.

2 Dissolved oxygen limits represent average minimum allowable levels.

3 Allied (Hopewell) allocation may be redistributed to the Hopewell Regional WTF by VPDES permit.

TABLE B7- WASTE LOAD ALLOCATION FOR THE YEAR 2000

	SUMMER (June-October)							WINTER (November-May)				
	FLOW (mgd)	CBOD5		NH3-N1,3		DO2 (mg/l)		CBOD5		NH3-N1		DO2 (mg/l)
		(lbs/d)	(mg/l)	(lbs/d)	(mg/l)			(lbs/d)	(mg/l)	(lbs/d)	(mg/l)	
City of Richmond STP	45.08	3002	8.0	2403	6.4	5.6		5367	14.3	5707	15.2	5.6
E.I. DuPont-Spruance	196.99	948		590		4.4		948		756		2.9
Falling Creek STP	10.10	1348	16.0	539	6.4	5.9		2023	24.0	1281	15.2	5.9
Proctor's Creek STP	16.80	1602	11.4	961	6.9	5.9		2403	17.1	1402	10.0	5.9
Reynolds Metals Co.	0.78	172		13		6.5		172		13		6.5
Henrico STP	32.80	3002	11.0	2403	8.8	5.6		4756	17.4	3504	12.8	5.6
American Tobacco Co.	3.00	715		113		5.8		715		113		5.8
ICI Americas, Inc.	0.20	167		8		5.8		167		8		3.1
Phillip Morris- Park 500	2.90	819		92		4.6		819		92		4.6
Allied (Chesterfield)	56.00	1255		442		5.7		1255		442		5.7
Allied (Hopewell)	170.00	2750		10326		6.1		2750		10326		6.1
Hopewell Regional WTF	36.78	12502	40.7	12091	33.5	4.8		12502	40.7	10291	33.5	4.8
Petersburg STP	15.00	2802	22.4	801	6.4	5.0		2802	22.4	2028	16.2	5.0
TOTAL	406.43	31084		28982				36679		35963		

1 NH3-N values represent ammonia as nitrogen.

2 Dissolved oxygen limits represent average minimum allowable levels.

3 Allied (Hopewell) allocation may be redistributed to the Hopewell Regional WTF by VPDES permit.

TABLE B7- WASTE LOAD ALLOCATIONS FOR THE YEAR 2010

	SUMMER (June-October)							WINTER (November-May)				
	FLOW (mgd)	CBOD5		NH3-N1,3		DO2 (mg/l)		CBOD5		NH3-N1		DO2 (mg/l)
		(lbs/d)	(mg/l)	(lbs/d)	(mg/l)			(lbs/d)	(mg/l)	(lbs/d)	(mg/l)	
City of Richmond STP	45.86	3002	7.8	2403	6.3	5.6		5367	14.0	5707	14.9	5.6
E.I. DuPont-Spruance	16.99	948		590		4.4		948		756		2.9
Falling Creek STP	10.10	1348	16.0	539	6.4	5.9		2023	24.0	1281	15.2	5.9
Proctor's Creek STP	24.00	1602	8.0	961	4.8	5.9		2403	12.0	1402	7.0	5.9
Reynolds Metals Co.	0.78	172		13		6.5		172		13		6.5
Henrico STP	38.07	3002	9.5	2403	7.6	5.6		4756	15.0	3504	11.0	5.6
American Tobacco Co.	3.00	715		113		5.8		715		113		5.8
ICI Americas, Inc.	0.20	167		8		5.8		167		8		3.1
Phillip Morris- Park 500	2.90	819		92		4.6		819		92		4.6
Allied (Chesterfield)	56.00	1255		442		5.7		1255		442		5.7
Allied (Hopewell)	180.00	2750		10326		6.1		2750		10326		6.1
Hopewell Regional WTF	39.61	12502	37.8	10291	31.1	4.8		12502	37.8	10291	31.1	4.8
Petersburg STP	15.00	2802	22.4	801	6.4	5.0		2802	22.4	2028	16.2	5.0
TOTAL	432.1	31084		28982				36679		35963		

1 NH3-N values represent ammonia as nitrogen.

2 Dissolved oxygen limits represent average minimum allowable levels.

3 Allied (Hopewell) allocation may be redistributed to the Hopewell Regional WTF by VPDES permit.

Attachment I

WET Testing Evaluation and Memorandum

MEMORANDUM

DEPARTMENT OF ENVIRONMENTAL QUALITY
Piedmont Regional Office

4949-A Cox Road Glen Allen, VA 23060 804/527-5020

SUBJECT: Whole Effluent Toxicity (WET) Test Data Review:
Richmond WWTP, VPDES Permit No. VA0063177

TO: Curtis J. Linderman, Water Permit Manager, PRO

FROM: Gina Kelly, PRO

DATE: November 5, 2009; revised January 21, 2010

COPIES: Deborah DeBiasi, CO - WET

Facility Name: Richmond WWTP
Permit Number: VA0063177
Receiving Stream James River (Lower) - Freshwater tidal
Facility SIC: 4952
In-stream Waste Concentration (IWC): Outfall 001: IWC $_{acute}$ 23.07%, IWC $_{chronic}$ 11.25%
Effluent Design Flow 45 MGD (dry weather flow); 75 MGD (wet weather flow)

Stream Flows	**Low Flows***	**High Flows***
1-Day, 10-Year	300 MGD	923 MGD
7-Day, 10-Year	355 MGD	1118 MGD

* These flows represent the adjusted stream flow, reflecting the water withdrawals by the Henrico and Richmond Water Treatment Plants

FACILITY DESCRIPTION

The permit for this municipal discharger is in the process of reissuance. Richmond WWTP is owned and operated by the City of Richmond; the actual facility is located at 1400 Brander St., Richmond, VA. The facility discharges treated wastewater (mostly municipal with some industrial contributors) through outfall 001 to the James River.

FACILITY REQUIREMENTS

The expiring VPDES permit contains a WET Testing Program for outfall 001; requirements of the WET tests are based on Guidance Memorandum Number 00-2012.

The expiring permit was reissued effective March 19, 2005 and included a Whole Effluent Toxicity Program special condition requiring annual monitoring for outfall 001. Required testing included acute and chronic tests using *Ceriodaphnia dubia and Pimephales promelas*; both testing scenarios required 24-hour flow-proportioned effluent samples. All toxicity tests were performed by James Reed and Associates. No quality control problems were found in any of the tests performed for the VPDES permit.

The acute tests were required to be 48-hour static tests using the two test species noted above; the acute test had an endpoint of an $LC_{50} \geq 63\%$. Static renewal chronic tests were also to be performed with these two test species; the chronic test endpoint was an NOEC $\geq$ 7%.

Results of the whole effluent toxicity tests performed on samples since the permit reissuance in 2005 indicate compliance with the WET Program in the current permit. During the permit term, all of the acute tests resulted in LC_{50}s >100% and all the chronic tests results in NOECs = 100%.

The proposed special condition language is attached. Also attached is the WETLim10 spreadsheet, which was used to compute the endpoints for acute and chronic toxicity contained in the special condition. At the bottom of page three is a recommended dilution series for the chronic tests which, if used will simplify the determination of compliance with the chronic toxicity endpoint contained in the permit.

DATA SUMMARY

Table 1: Results of **Acute Toxicity Tests** *C. dubia*

TEST DATE	TEST RESULT	% SURVIVAL IN 100% EFFLUENT	TEST LAB	COMMENTS
May 2005	LC50 > 100%	100%	James R. Reed & Associates	1, 3
March 2006	LC50 > 100%	100%	James R. Reed & Associates	1, 3
January 2007	LC50 > 100%	100%	James R. Reed & Associates	1, 3
January 2008	LC50 > 100%	100%	James R. Reed & Associates	1, 2, 3
January 2009	LC50 > 100%	100%	James R. Reed & Associates	1, 2, 3

Table 2: Results of **Acute Toxicity Tests** *P.promelas*

TEST DATE	TEST RESULT	% SURVIVAL IN 100% EFFLUENT	TEST LAB	COMMENTS
May 2005	LC50 > 100%	100%	James R. Reed & Associates	1, 3
March 2006	LC50 > 100%	100%	James R. Reed & Associates	1, 3
January 2007	LC50 > 100%	95%	James R. Reed & Associates	1, 3
January 2008	LC50 > 100%	100%	James R. Reed & Associates	1, 2, 3
January 2009	LC50 > 100%	100%	James R. Reed & Associates	1, 2, 3

Comments:

1. No notation regarding whether sample had to be filtered or not (assume "not" unless noted).
2. DO was not measured daily in one replicate at each concentration (only at 0 and 48 hours).
3. pH was not measured daily in one replicate at each concentration (only at 0 and 48 hours).

Table 3: Results of **Chronic Toxicity Tests** *C. dubia*

TEST DATE	TEST RESULT	% SURVIVAL IN 100% EFFLUENT	TEST LAB	COMMENTS
May 2005	NOEC= 100%	100%	James R. Reed & Associates	1, 2, 3
March 2006	NOEC= 100%	90%	James R. Reed & Associates	1, 2, 4
January 2007	NOEC= 100%	100%	James R. Reed & Associates	1, 2, 4
January 2008	NOEC= 100%	100%	James R. Reed & Associates	1, 5
January 2009	NOEC= 100%	100%	James R. Reed & Associates	1, 2, 4

Table 4: Results of **Chronic Toxicity Tests** *P.promelas*

TEST DATE	TEST RESULT	% SURVIVAL IN 100% EFFLUENT	TEST LAB	COMMENTS
May 2005	NOEC= 100%	100%	James R. Reed & Associates	1, 2, 3
March 2006	NOEC= 100%	100%	James R. Reed & Associates	1, 2, 4
January 2007	NOEC= 100%	100%	James R. Reed & Associates	1, 2, 4
January 2008	NOEC= 100%	100%	James R. Reed & Associates	1, 5
January 2009	NOEC= 100%	100%	James R. Reed & Associates	1, 2, 4

Comments:

1. No notation regarding whether sample had to be filtered or not (assume "not" unless noted).
2. Feeding information (what, when) during the testing was not provided.
3. Organisms were not within the specified time period for age.
4. Renewal did not occur within 24 ± 2 hrs.
5. The pH of the dilution water was outside of the suggested range of 7.4 –7.8, or 7.9- 8.3 for mineral water.

CONCLUSIONS & RECOMMENDATIONS

The results of these toxicity tests for outfall 001are summarized in the tables above. As indicated, all tests met the appropriate toxicity criterion. Thus, these annual compliance toxicity tests indicate that effluent from outfall 001 has not demonstrated acute or chronic toxicity in undiluted effluent or at instream exposures.

Given the results of the acute tests, the acute testing requirements were removed. Chronic toxicity testing with two species meets the needs of the VPDES reissuance application and other legal requirements. Accordingly, the permitting staff recommend the following Draft WET Special Condition language.

Whole Effluent Toxicity (WET) Monitoring Program

1. Biological Monitoring
   a. In accordance with the schedule in Part I.E.2 below, the permittee shall perform annual chronic toxicity testing on Outfall 001 using 24-hour flow-proportioned composite samples for the duration of the permit. The chronic tests to use are:

      Chronic 3-Brood Survival and Reproduction Static Renewal Test with *Ceriodaphnia dubia*
      Chronic 7-Day Survival and Growth Static Renewal Test with *Pimephales promelas*

      These chronic tests shall be conducted in such a manner and at sufficient dilutions (minimum of five dilutions, derived geometrically) to determine the "No Observed Effect Concentration" (NOEC) for survival and reproduction or growth. Results which cannot be quantified (i.e., a "less than" NOEC value) are not acceptable, and a retest will have to be performed. A retest of a non-acceptable test must be performed during the same compliance period as the .test it is replacing. Express the test NOEC as TUc (Chronic Toxic Units), by dividing 100/NOEC for DMR reporting. Report the LC_{50} at 48 hours and the IC_{25} with the NOEC's in the test report.

   b. The test dilutions should be able to determine compliance with the following endpoint(s):
      Outfall 001
      Chronic NOEC $\geq$ 8.0 %, equivalent to a TUc $\leq$ 12.5%

   c. The permittee may provide additional samples to address data variability. These data shall be reported and may be included in the evaluation of effluent toxicity. Test procedures and reporting shall be in accordance with the WET testing methods cited in 40 CFR 136.3.

   d. The test data will be evaluated for reasonable potential at the conclusion of the test period. The data may be evaluated sooner if requested by the permittee, or if toxicity has been noted. Should evaluation of the data indicate that a limit is needed, a WET limit and compliance schedule will be required and the toxicity tests of Part I.E.1.a. may be discontinued.

   e. The permit may be modified or revoked and reissued to include pollutant specific limits in lieu of a WET limit should it be demonstrated that toxicity is due to specific parameters. The pollutant specific limits must control the toxicity of the effluent.

2. Reporting Schedule
   The permittee shall submit the toxicity test reports with the DMR for the tests specified in accordance with the following schedule:

Period	Compliance Date	Submittal Date
Annual 1	By 12/31/2010	By 01/10/2011
Annual 2	By 12/31/2011	By 01/10/2012
Annual 3	By 12/31/2012	By 01/10/2013
Annual 4	By 12/31/2013	By 01/10/2014
Annual 5	By 12/31/2014	By 01/10/2015

Spreadsheet for determination of WET test endpoints or WET limits

Excel 97
Revision Date: 01/10/05
File: WETLIM10.xls
(MIX.EXE required also)

Acute Endpoint/Permit Limit — **Use as LC_{50} in Special Condition, as TUa on DMR**

ACUTE	1.300000032	TUa	LC_{50} =	77	%	Use as	1.29	TUa

ACUTE WLAa 1.3

Note: Inform the permittee that if the mean of the data exceeds this TUa: 1.0 a limit may result using WLA.EXE

Chronic Endpoint/Permit Limit — **Use as NOEC in Special Condition, as TUc on DMR**

CHRONIC	13.00000032	TU_c	NOEC =	8	%	Use as	12.50	TU_c
BOTH*	13.00000032	TU_c	NOEC =	8	%	Use as	12.50	TU_c
AML	13.00000032	TU_c	NOEC =	8	%	Use as	12.50	TU_c

ACUTE WLAa,c 13
CHRONIC WLAc 8.88888889
* Both means acute expressed as chronic

Note: Inform the permittee that if the mean of the data exceeds this TUc: 5.34228085 a limit may result using WLA.EXE

Enter data in the cells with blue type:

Entry Date:	11/16/09	
Facility Name:	Richmond WWTP	
VPDES Number:	VA0063177	
Outfall Number:	001	

			% Flow to be used from MIX.EXE	
Plant Flow:	45	MGD		
Acute 1Q10:	300	MGD	50	%
Chronic 7Q10:	355	MGD	100	%

Difuser /modeling study?

Enter Y/N	N	
Acute	1	:1
Chronic	1	:1

Are data available to calculate CV? (Y/N)	N	(Minimum of 10 data points, same species, needed)	Go to Page 2
Are data available to calculate ACR? (Y/N)	N	(NOEC<LC50, do not use greater/less than data)	Go to Page 3

IWC_a	23.07692308	%	Plant flow/plant flow + 1Q10
IWC_c	11.25	%	Plant flow/plant flow + 7Q10

NOTE: If the IWCa is >33%, specify the NOAEC = 100% test/endpoint for use

Dilution, acute	4.333333333	100/IWCa
Dilution, chronic	8.888888889	100/IWCc

WLA_a	1.3	Instream criterion (0.3 TUa) X's Dilution, acute
WLA_c	8.888888889	Instream criterion (1.0 TUc) X's Dilution, chronic
$WLA_{a,c}$	13	ACR X's WLA_a - converts acute WLA to chronic units

ACR -acute/chronic ratio		10	LC50/NOEC (Default is 10 - if data are available, use tables Page 3)
CV-Coefficient of variation		0.6	Default of 0.6 - if data are available, use tables Page 2)
Constants	eA	0.4109447	Default = 0.41
	eB	0.6010373	Default = 0.60
	eC	2.4334175	Default = 2.43
	eD	2.4334175	Default = 2.43 (1 samp)

No. of samples: 1

****The Maximum Daily Limit is calculated from the lowest LTA, X's eC. The LTAa,c and MDL using it are driven by the ACR.**

$LTA_{a,c}$	5.3422811	WLAa,c X's eA						
LTA_c	5.342553778	WLAc X's eB					Rounded NOEC's	%
MDL** with $LTA_{a,c}$	13.00000032	TU_c	NOEC =	7.692308	(Protects from acute/chronic toxicity)		NOEC = 8	%
MDL** with LTA_c	13.00066386	TU_c	NOEC =	7.691915	(Protects from chronic toxicity)		NOEC = 8	%
AML with lowest LTA	13.00000032	TU_c	NOEC =	7.692308	Lowest LTA X's eD		NOEC = 8	

IF ONLY ACUTE ENDPOINT/LIMIT IS NEEDED, CONVERT MDL FROM TU_c to TU_a

						Rounded LC50's	%
MDL with $LTA_{a,c}$	1.300000032	TU_a	LC50 =	76.923075	%	LC50 = 77	%
MDL with LTA_c	1.300066386	TU_a	LC50 =	76.919149	%	LC50 = 77	

Page 2 - Follow the directions to develop a site specific CV (coefficient of variation)

IF YOU HAVE AT LEAST 10 DATA POINTS THAT ARE QUANTIFIABLE (NOT "<" OR ">") FOR A SPECIES, ENTER THE DATA IN EITHER COLUMN "G" (VERTEBRATE) OR COLUMN "J" (INVERTEBRATE). THE 'CV' WILL BE PICKED UP FOR THE CALCULATIONS BELOW. THE DEFAULT VALUES FOR eA, eB, AND eC WILL CHANGE IF THE 'CV' IS ANYTHING OTHER THAN 0.6.

Coefficient of Variation for effluent tests

CV = 0.6 (Default 0.6)

δ^2 = 0.3074847

δ = 0.554513029

Using the log variance to develop eA

(P. 100, step 2a of TSD)

Z = 1.881 (97% probability stat from table

A = -0.88929666

eA = 0.410944686

Using the log variance to develop eB

(P. 100, step 2b of TSD)

δ_4^2 = 0.086177696

δ_4 = 0.293560379

B = -0.50909823

eB = 0.601037335

Using the log variance to develop eC

(P. 100, step 4a of TSD)

δ^2 = 0.3074847

δ = 0.554513029

C = 0.889296658

eC = 2.433417525

Using the log variance to develop eD

(P. 100, step 4b of TSD)

n = **1** This number will most likely stay as "1", for 1 sample/month.

δ_n^2 = 0.3074847

δ_n = 0.554513029

D = 0.889296658

eD = 2.433417525

	Vertebrate IC_{25} Data or LC_{50} Data	LN of data		Invertebrate IC_{25} Data or LC_{50} Data	LN of data
	**********			**********	
1	0		1	0	
2			2		
3			3		
4			4		
5			5		
6			6		
7			7		
8			8		
9			9		
10			10		
11			11		
12			12		
13			13		
14			14		
15			15		
16			16		
17			17		
18			18		
19			19		
20			20		
St Dev	NEED DATA	NEED DATA	St Dev	NEED DATA	NEED DATA
Mean	0	0	Mean	0	0
Variance	0	0.000000	Variance	0	0.000000
CV	0		CV	0	

Page 3 - Follow directions to develop a site specific ACR (Acute to Chronic Ratio)

To determine Acute/Chronic Ratio (ACR), insert usable data below. Usable data is defined as valid paired test results, acute and chronic, tested at the same temperature, same species. The chronic NOEC must be less than the acute LC_{50}, since the ACR divides the LC_{50} by the NOEC. LC_{50}'s >100% should not be used.

Table 1. ACR using Vertebrate data

Set #	LC_{50}	NOEC	Test ACR	Logarithm	Geomean	Antilog	ACR to Use
1	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	NO DATA
2	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	NO DATA
3	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	NO DATA
4	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	NO DATA
5	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	NO DATA
6	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	NO DATA
7	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	NO DATA
8	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	NO DATA
9	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	NO DATA
10	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	NO DATA
				ACR for vertebrate data:			0

Table 1. Result:	Vertebrate ACR	0
Table 2. Result:	Invertebrate ACR	0
	Lowest ACR	Default to 10

Table 2. ACR using Invertebrate data

Set #	LC_{50}	NOEC	Test ACR	Logarithm	Geomean	Antilog	ACR to Use
1	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	NO DATA
2	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	NO DATA
3	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	NO DATA
4	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	NO DATA
5	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	NO DATA
6	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	NO DATA
7	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	NO DATA
8	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	NO DATA
9	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	NO DATA
10	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	NO DATA
				ACR for vertebrate data:			0

Convert LC_{50}'s and NOEC's to Chronic TU's

for use in WLA.EXE

Table 3. **ACR used: 10**

	Enter LC_{50}	TUc	Enter NOEC	TUc
1		NO DATA		NO DATA
2		NO DATA		NO DATA
3		NO DATA		NO DATA
4		NO DATA		NO DATA
5		NO DATA		NO DATA
6		NO DATA		NO DATA
7		NO DATA		NO DATA
8		NO DATA		NO DATA
9		NO DATA		NO DATA
10		NO DATA		NO DATA
11		NO DATA		NO DATA
12		NO DATA		NO DATA
13		NO DATA		NO DATA
14		NO DATA		NO DATA
15		NO DATA		NO DATA
16		NO DATA		NO DATA
17		NO DATA		NO DATA
18		NO DATA		NO DATA
19		NO DATA		NO DATA
20		NO DATA		NO DATA

If WLA.EXE determines that an acute limit is needed, you need to convert the TUc answer you get to TUa and then an LC50,

enter it here: NO DATA %LC_{50}

NO DATA TUa

DILUTION SERIES TO RECOMMEND

Table 4.	Monitoring		Limit	
	% Effluent	TUc	% Effluent	TUc
Dilution series based on data mean	18.7	5.3422808		
Dilution series to use for limit			8	12.5
Dilution factor to recommend:	0.4326499		0.2828427	
Dilution series to recommend:	100.0	1.00	100.0	1.00
	43.3	2.31	28.3	3.54
	18.7	5.34	8.0	12.50
	8.1	12.35	2.3	44.19
	3.50	28.54	0.6	156.25
Extra dilutions if needed	1.52	65.97	0.2	552.43
	0.66	152.47	0.1	1953.13

Cell: I9
Comment:
This is assuming that the data are Type 2 data (none of the data in the data set are censored - "<" or ">").

Cell: K18
Comment: This is assuming that the data are Type 2 data (none of the data in the data set are censored - "<" or ">").

Cell: J22
Comment: Remember to change the "N" to "Y" if you have ratios entered, otherwise, they won't be used in the calculations.

Cell: C40
Comment:
If you have entered data to calculate an ACR on page 3, and this is still defaulted to "10", make sure you have selected "Y" in cell E21

Cell: C41
Comment: If you have entered data to calculate an effluent specific CV on page 2, and this is still defaulted to "0.6", make sure you have selected "Y" in cell E20

Cell: L48
Comment:
See Row 151 for the appropriate dilution series to use for these NOEC's

Cell: G62
Comment:
Vertebrates are:
Pimephales promelas
Oncorhynchus mykiss
Cyprinodon variegatus

Cell: J62
Comment:
Invertebrates are:
Ceriodaphnia dubia
Mysidopsis bahia

Cell: C117
Comment: Vertebrates are:

Pimephales promelas
Cyprinodon variegatus

Cell: M119
Comment: The ACR has been picked up from cell C34 on Page 1. If you have paired data to calculate an ACR, enter it in the tables to the left, and make sure you have a "Y" in cell E21 on Page 1. Otherwise, the default of 10 will be used to convert your acute data.

Cell: M121
Comment: If you are only concerned with acute data, you can enter it in the NOEC column for conversion and the number calculated will be equivalent to the TUa. The calculation is the same: 100/NOEC = TUc or 100/LC50 = TUa.

Cell: C138
Comment: Invertebrates are:

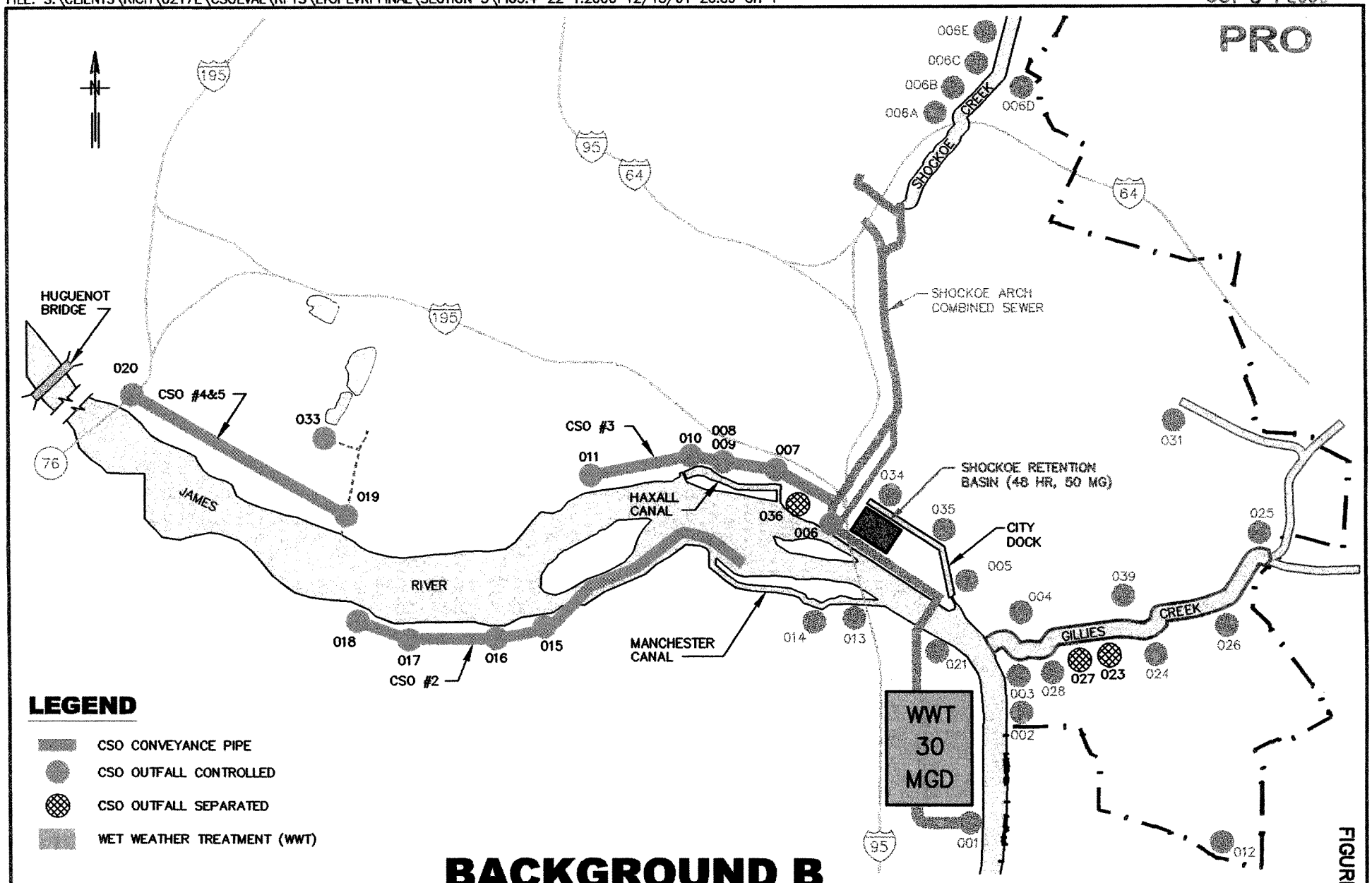
Ceriodaphnia dubia
Mysidopsis bahia

Attachment J

CSS Maps

RECEIVED
OCT 0 1 2009
PRO

FILE: S:\CLIENTS\RICH\0217E\CSOEVAL\RPTS\LTCPEVRPFINAL\SECTION 5\FIG5.4-22 1:2000 12/18/01 20:39 GH-F



BACKGROUND B

AFTER PHASE II IMPROVEMENTS

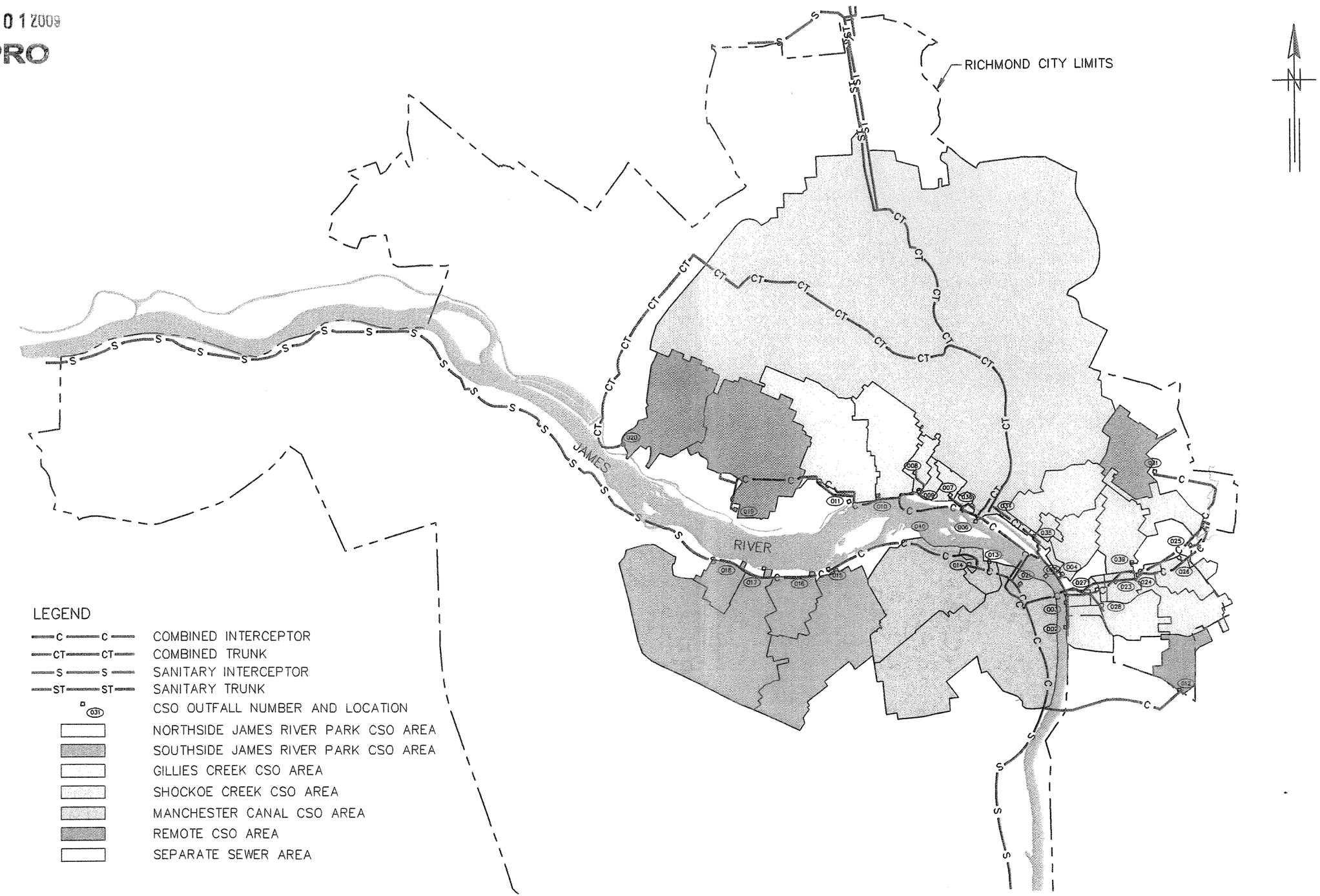
GREELEY AND HANSEN LLC

CITY OF RICHMOND, VIRGINIA
DEPARTMENT OF PUBLIC UTILITIES
CSO RE-EVALUATION FINAL REPORT
JANUARY 2002

FIGURE 5.4-22

RECEIVED
OCT 01 2009
PRO

FIGURE 2.2–4



INTERCEPTING AND TRUNK SEWER SYSTEM
SERVING SEPARATE AND COMBINED SEWER AREAS

CITY OF RICHMOND, VIRGINIA
DEPARTMENT OF PUBLIC UTILITIES
CSO RE–EVALUATION FINAL REPORT
JANUARY 2002

GREELEY AND HANSEN LLC

FILE: S:\CLIENTS\RICH\0217E\CSOEVAL\RPTS\LTCPEVRPFINAL\SECTION 2\FIG2.2-4 1:2000 12/18/01 17:48 GH-F

Attachment K

Application Waivers

CITY OF RICHMOND
DEPARTMENT OF PUBLIC UTILITIES
DIVISION OF WASTEWATER TREATMENT

RECEIVED
NOV 26 2007
PRO

November 15, 2007

Virginia R. Kelly
Department of Environmental Quality
4949-A Cox Road
Glen Allen Va. 23060-6269

RE: Permit application waiver for: Richmond Wastewater Treatment Plant (VA0063177)

Dear Ms. Kelly:

Richmond WWTP is in the process of preparing it permit application for submittal to the DEQ. Richmond is taking this opportunity to request a wavier for its treatment facility that will be applying for permit reissue in 2009.

Per 9 VAC25-31-100J. , Richmond is requesting a wavier to submit dissolved metals data in lieu of total recoverable metals data to complete Form 2A. Part D (expanded effluent testing). The Virginia Water Quality Standards,9VAC25-260-5et.seq., list requirements which apply to dissolved metals. Therefore, it is more representative to provide dissolved metal data to DEQ for your evaluation of reasonable potential by the plant effluent to exceed the water quality standards of the receiving waters. Richmond believes that total recoverable metals data is not of material concern for this VPDES permit.

Please contact me at 804-646-8903 if you have any questions. Thank you for your consideration of this waiver request.

Sincerely,

Clair L Watson
Supt. of Plant Operations

1400 BRANDER STREET • RICHMOND VA 23224-2399 • 804 646 8720 • FAX 804 646 0081 • WWW.RICHMONDGOV.COM

COMMONWEALTH of VIRGINIA

DEPARTMENT OF ENVIRONMENTAL QUALITY

PIEDMONT REGIONAL OFFICE
4949-A Cox Road, Glen Allen, Virginia 23060
(804) 527-5020 Fax (804) 527-5106
www.deq.virginia.gov

L. Preston Bryant, Jr.
Secretary of Natural Resources

David K. Paylor
Director

Gerard Seeley, Jr.
Regional Director

DEC 0 4 2007

Mr. Mark Smith (3WP12)
U.S. Environmental Protection Agency, Region III
1650 Arch Street
Philadelphia, PA 19103-2029

RE: VPDES Permit No. VA0063177, Richmond WWTP, City of Richmond, Application Form 2A Testing Waiver Request

Dear Mr. Smith:

The Virginia Department of Environmental Quality is in receipt of a request for waiver of certain testing requirements of NPDES Application Form 2A. On behalf of the Director and in accordance with sections 9 VAC 25-31-100.E.4 and J of the Virginia Pollutant Discharge Elimination System Permit Regulation, the applicant's waiver request is being submitted to you for EPA approval. Attached is a copy of the DEQ waiver request memorandum approval and correspondence from the applicant detailing their request.

Please send any comments and/or objections regarding this waiver request to the Virginia Department of Environmental Quality, at the following address:

Virginia DEQ
Office of Water Permit Programs
P.O. Box 10009
Richmond, Virginia 23240

Also, please copy Gina Kelly, of the Piedmont Regional Office permitting staff, at vekelly@deq.virginia.gov on any correspondence.

If EPA does not comment or object within 29 days of receipt of this notification; the waiver request will be deemed acceptable to the Regional Administrator.

Sincerely,

Curtis J. Linderman, P.E.
Water Permit Manager

Enclosures
cc: OWPP

MEMORANDUM

DEPARTMENT OF ENVIRONMENTAL QUALITY
Piedmont Regional Office

4949-A Cox Road, Glen Allen, Virginia 23060-6295 804/527-5020

TO: Curt Linderman
FROM: Gina Kelly GK
DATE: December 4, 2007
SUBJECT: Waiver Request for VA0063177 – Richmond WWTP
COPIES: File (R/W)

The attached waiver request is from Richmond WWTP, VA0063177. Please note the following:

- The facility has a design flow rate of 75 MGD.
- The facility requested a sampling waiver for total recoverable metals (substituting dissolved metals data).
- Justifications cited for the waiver are:
  (1) the cost of testing;
  (2) Virginia WQS are in terms of dissolved metals and it is more representative to provide dissolved metals data to DEQ for evaluations of the facility's reasonable potential to violate applicable water quality standards.

Testing to total recoverable metals is a requirement of the reissuance application via the EPA For 2A. While DEQ permitting staff can demonstrate metals limits are not necessary using total recoverable metals data, staff can o0nly establish water quality based effluent limitations based on dissolved metals data. Dissolved sampling enables DEQ to compare the sampling results directly with the applicable water quality standard and associated wasteload location whereas total recoverable metals sampling does not. Accordingly, I recommend accepting dissolved metals sampling in lieu of the required total recoverable metals sampling (e.g. waiving the total recoverable metals sampling requirement).

☒ Approved ☐ Denied

Comments: _____

Signature

12/4/07
Date

Attachment L

Consent Order

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COMMONWEALTH of VIRGINIA

DEPARTMENT OF ENVIRONMENTAL QUALITY

W. Tayloe Murphy, Jr.
Secretary of Natural Resources

PIEDMONT REGIONAL OFFICE
4949-A Cox Road
Glen Allen, Virginia 23060
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www.deq.state.va.us

Robert G. Burnley
Director

Gerard Seeley, Jr.
Piedmont Regional Director

STATE WATER CONTROL BOARD ENFORCEMENT ACTION
SPECIAL ORDER BY CONSENT
ISSUED TO
THE CITY OF RICHMOND
Permit No. VA0063177

SECTION A: Purpose

This is a Consent Special Order issued under the authority of Va. Code §§ 10.1-1185 and 62.1-44.15(8a), between the State Water Control Board and the City of Richmond. This Order supercedes and replaces the Consent Special Order issued to the City on October 8, 1999, regarding implementation of a plan to control combined sewer overflow discharges to the James River.

SECTION B: Definitions

Unless the context clearly indicates otherwise, the following words and terms have the meaning assigned to them below:

1. "Va. Code" means the Code of Virginia (1950), as amended.

2. "Board" means the State Water Control Board, a permanent citizens' board of the Commonwealth of Virginia as described in Va. Code §§ 10.1-1184 and 62.1-44.7.

3. "Department" or "DEQ" means the Department of Environmental Quality, an agency of the Commonwealth of Virginia as described in Va. Code § 10.1-1183.

4. "Director" means the Director of the Department of Environmental Quality.

5. "Order" means this document, also known as a Consent Special Order.

6. "City" means the City of Richmond, Virginia.

7. "Facility" means a component of the City of Richmond's wastewater treatment works located in Richmond, Virginia.

8. "Functioning Element" means a component of a project that if constructed and placed in operation will provide some part of the overall beneficial function of the project.

9. "Place in Operation" or "Placing a Facility in Operation" means to achieve consistent operations following completion of a startup and test period in such a way as to accomplish the intended function, even though all construction activities (such as completion of a punch-list, resolution of contract disputes and other close-out items) may not be completed.

10. "PRO" means the Piedmont Regional Office of DEQ, located in Glen Allen, Virginia.

11. "Permit" means VPDES permit No. VA0063177, issued to the City and any future, extended, modified or reissued permit.

12. "O&M" means operations and maintenance.

13. "WWTP" means wastewater treatment plant.

14. "CSO" means combined sewer overflow, a term which is used to describe overflows from a combined sanitary and stormwater sewer system.

15. "CSS" means combined sewer system consisting of the pipelines, pumping stations, and treatment facilities in the City which are designed to convey wastewater and storm water through a single pipe system to a combined sewer overflow outfall and/or the WWTP.

16. "CSO Policy" means EPA's April 19, 1994 CSO Control Policy, published at 59 Fed Reg 18688, and incorporated into the Clean Water Act pursuant to the Wet Weather Water Quality Act, Section 402(q) of the Clean Water Act, 33 U.S.C. § 1342.

17. "City Charter" means the Richmond Charter of 1948, as amended from time to time.

18. "Indenture" means the Master Indenture of Trust of April 1, 1998 between the City of Richmond and Crestar, now Suntrust, Bank, as amended from time to time.

19. LTCP" means Long Term Control Plan, which is the plan for controlling CSOs from the City's CSS that has been prepared by the City pursuant to the CSO Policy and submitted to DEQ as a final report in January 2002 and all supplements thereto.

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20. "CCF" means hundred cubic feet.

21. "Treatment Works" means those devices and systems described at 9VAC 25-31-10.

SECTION C: Findings of Fact and Conclusions of Law

1. The City of Richmond owns and operates a combined sanitary and stormwater sewer system which, during periods of rainfall, discharges pollutants from some or all of twenty-nine (29) CSO outfalls to the James River and its local tributaries. The City's CSO discharges are authorized by VPDES Permit No. VA0063177.

2. The City has been cooperating with the State Water Control Board since the mid-1970s to address combined sewer overflow impacts on the James River. The City's compliance with Consent Orders and Permits issued since that time have resulted in the implementation of best management practices and the completion of major construction projects that have significantly reduced the volume, frequency and impacts of combined sewer overflows during storm events.

3. The CSO Policy calls for localities with combined sewer systems to prepare LTCPs that meet certain minimum technical criteria and ultimately result in compliance with state water quality standards.

4. The most recent Consent Order; issued to the City on October 8, 1999; required the City to evaluate its progress with respect to the CSO Policy, and recommend a course of future actions to comply with that policy. The City prepared the evaluation, obtained public comment and submitted to DEQ an LTCP on January 2, 2002, which was presented to the Board on May 6, 2002. In its LTCP, the City identified several alternatives for future actions and recommended one that is referred to as CSO Control Plan E. This control plan is reflected in Appendix B of this Order and has been submitted by the City to satisfy the "Demonstration" approach criteria of Section II.C.4.b. of the CSO Policy. However, the Board has not completed the water quality standards coordination process provided in Section III of the CSO Policy, and, therefore, is unable to determine at this time that the recommended plan makes the water quality standards compliance demonstration called for in Section II.C.4.b.i and ii. of the CSO Policy. Accordingly, the water quality standards coordination process will continue until the Board makes such a determination.

SECTION D: Agreement and Order

Accordingly, the Board, by virtue of the authority granted it in Va. Code § 62.1- 4.15(8a), orders the City, and the City agrees, that:

1. The previous Order issued on October 8, 1999 is terminated.

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2. The Board accepts the City's January 2002 LTCP and approves CSO Control Plan E, as described in the LTCP subject to the Board completing its ongoing water quality standards coordination process pursuant to Section III of the CSO Policy and the Board's determination that the recommended plan makes the water quality standards compliance demonstration called for in Section II.C.4.b.i and ii of the CSO Policy.

3. The City shall implement CSO Control Plan E in accordance with the schedule in Appendix A of this Order.

4. If at any time prior to the termination of this order, the Clean Water Act, 33 U.S.C. § 1251 et seq., is modified, or EPA duly promulgates new regulations to establish requirements for the control of CSO's in conflict with one or more provisions of this Order, the City and the Board agree to modify or terminate this order to comply with such federal requirements.

5. New, more cost effective technologies or improvements in the performance of the LTCP, are expected during implementation. At any time the City or Department becomes aware of such new technology or performance improvements, a joint evaluation of the new technology or proposed modification will be undertaken to determine if the LTCP and this Order should be modified.

SECTION E: Administrative Provisions

1. The Board may modify or amend this Order with the consent of the City, or for good cause shown by the City, or on its own motion after notice and opportunity to be heard.

2. This Order only addresses the matters specified herein. This Order shall not preclude the Board or the Director from taking any action authorized by law, including but not limited to: (1) taking any action authorized by law regarding any violations not specifically addressed herein; or (2) taking subsequent action to enforce this Order. This Order shall not preclude appropriate enforcement actions by other federal, state, or local regulatory authorities for matters not addressed herein.

3. Nothing herein shall be construed as altering, modifying or amending any term or condition contained in VPDES Permit No. VA0063177.

4. For purposes of this Order and subsequent actions with respect to this Order, the City admits the jurisdictional allegations, factual findings, and conclusions of law contained herein. In agreeing to this Order however, the City shall not be deemed to have admitted that it is violating any federal or state law, rule, regulation, standard or criterion.

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5. The City consents to venue in the Circuit Court of the City of Richmond for any civil action taken to enforce the terms of this Order.

6. The City acknowledges it has received fair and due process under the Administrative Process Act, Va. Code §§ 2.2-4000 et seq., and the State Water Control Law and it waives the right to any hearing or other administrative proceeding authorized or required by law or regulation, and to any judicial review of any issue of fact or law contained herein. Nothing herein shall be construed as a waiver of the right to any administrative proceeding for, or to judicial review of, any action taken by the Board to enforce this Order.

7. Failure by the City to comply with any of the terms of this Order shall constitute a violation of an order of the Board. Nothing herein shall waive the initiation of appropriate enforcement actions or the issuance of additional orders as appropriate by the Board or the Director as a result of such violations. Nothing herein shall affect appropriate enforcement actions by any other federal, state, or local regulatory authority.

8. If any provision of this Order is found to be unenforceable for any reason, the remainder of the Order shall remain in full force and effect.

9. The City shall be responsible for failure to comply with any of the terms and conditions of this Order unless compliance is made impossible by earthquake, flood, other acts of God, war, strike, or other event beyond the control of the City, or its contractors or agents that will delay or prevent the performance on any obligation under this Order. The City shall show that such circumstances were beyond its control and not due to a lack of good faith or diligence on its part. The City shall notify the PRO Regional Director in writing when circumstances are anticipated to occur, are occurring, or have occurred that may delay compliance or cause noncompliance with any requirement of the Order. Such notice shall set forth the reasons for the delay or noncompliance, the projected duration of any such delay or noncompliance, the measures taken and to be taken to prevent or minimize such delay or noncompliance and the timetable by which such measures will be implemented and the date full compliance will be achieved. Failure to so notify the Regional Director within 30 days of learning of any condition, which the City intends to assert will result in the impossibility of compliance, shall constitute a waiver of any claim of inability to comply with a requirement of this Order. The City may assert and it shall be a defense to any enforcement action for alleged violation of this Order that the alleged violation was beyond the control of the City.

10. This Order is binding on the parties hereto, their successors in interest, designees and assigns, jointly and severally.

11. This Order shall become effective upon execution by both the Director or his designee and the City. Notwithstanding the foregoing, the City agrees to be bound by any compliance date, which precedes the effective date of this O

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12. This Order shall continue in effect until the Director or Board terminates the Order upon 30 days written notice to the City. Such termination shall be a case decision within the meaning of Virginia Code § 2.2 – 4019 and Rule 2A:2 of the rules of the Supreme Court of Virginia. Termination of this Order, or any obligation imposed in this Order, shall not operate to relieve the City from its obligation to comply with any statute, regulation, permit condition, other order, certificate, certification, standard, or requirement otherwise applicable.

13. Communications regarding this Order, and its requirements shall be addressed as follows:

Department of Environmental Quality
Piedmont Regional Office
4949-A Cox Road
Glen Allen, Virginia 23060
Attn. Water Enforcement Specialist

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And it is so ORDERED this day of March 17, 2005.

Gerard Gulley Jr. (for)
Robert G. Burnley, Director
Department of Environmental Quality

The City voluntarily agrees to the issuance of this Order.

By: _____
William E. Harrell,
Interim Chief Administrative Officer
City of Richmond, Virginia

Date: 2/8/05

Approved As To Form

By: _____
David W. Seitz, Assistant City Attorney

Date: 2/2/05

Commonwealth of Virginia
City/County of Richmond

The foregoing document was signed and acknowledged before me this 8th day of February, 2005, by William E. Harrell, who is Interim Chief Administrative Officer of the City, on behalf of the City.

Mildred D. Kennedy
Notary Public

My commission expires: October 31, 2005

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APPENDIX A

Implementation Schedule for Richmond's CSO Long Term Control Plan (LTCP)

SECTION A.1.

The City shall implement the CSO Control Plan E projects set forth in Appendix B to this Order on the following schedule.

The City shall raise revenue for implementation of CSO Control Plan E to the limit of its financial capability. The City shall be deemed to be raising CSO control project funds to the limit of its financial capability if the following criteria are met:

1. At least bi-annually the City adjusts its sewer rates so that within five years of the effective date of this Order:

   a The annual sewer bill for typical residential customers (i.e. 7 ccf of average monthly use) will be at least 1.25% of median household income[1]; and

   b The sewer volume rate for customers identified as industrial users in the City's utility billing records will equal the rate charged to the City's residential customers.

2. The City periodically borrows funds for Treatment Works related projects, including CSO control projects, according to City Charter and Indenture and maintains a Wastewater Utility debt coverage ratio, as defined in the indenture, below 1.75.

3. The City annually seeks grant funding for CSO control projects in the LTCP from all applicable federal and state sources.

SECTION A.2.

Each fiscal year following the effective date of this order the City shall allocate and spend available funds on appropriated CSO control projects in Appendix B in accordance with the schedule in this Appendix A. The City shall, however, not be required to spend funds to construct part of a project unless that part will provide a Functioning Element. Available funds for CSO control projects shall include annual sewer revenues remaining after deducting from those revenues the monies required for the following:

- Operating expenses,
- Non-operating expenses,

[1] As reflected in the 2000 and any subsequent census. In the years between each census, the median household income (MHI) shall be adjusted based on the percent increase in the consumer price index– all urban consumers U.S. city average (CPI-U) for that year.

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- Any other expenditures required to comply with any federal, state or local water quality related requirements associated with the City's combined sewer system and Treatment Works.

Available funds for CSO control projects also include any loan and grant funds obtained for the purpose of implementing CSO projects identified in the LTCP.

SECTION A.3.

The City shall plan, design, construct, startup, test and place in operation the CSO Control Plan E projects in Appendix B, in accordance with the following schedule:

REQUIREMENTS	MILESTONES
1. CSO Disinfection Study: Submit to the Department a final report on a disinfection pilot study to determine the most effective method of disinfecting CSO discharges at the Shockoe retention basin and the City's WWTP	Not Later Than (NLT) June 30, 2005
2. Phase III Program Project Plan: Submit to the Department, for it's review and approval, a program project plan(s) for implementing the elements of the CSO Control Plan E.	NLT December 31, 2006
3. Solids and Floatable Control Regulator for CSO Outfall No. 024:	
a. Submit to the Department for its approval the Preliminary Design Report for the Solids and Floatable Control Regulator for CSO Outfall No. 024	NLT 3 months after issuance of this Order.
b. Submit to the Department for its approval the final drawings and specifications for Solids and Floatable Control Regulator for CSO Outfall No. 024	NLT 6 months after approval of activities under Requirement 3.a.
c. Construct, startup, and test the Solids and Floatable Control Regulator for CSO Outfall No. 024	NLT 20 months after approval of the final drawings and specifications under Requirement 3.b.
d. Place in Operation the Solids and Floatable Control Regulator for CSO Outfall No. 024	NLT 1 month after completion of activities under Requirement 3.c.

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REQUIREMENTS	MILESTONES
4. Solids and Floatable Control Regulator for CSO Outfall No. 026:	
a. Submit to the Department for its approval the Preliminary Design Report for the Solids and Floatable Control Regulator for CSO Outfall No. 026	NLT 3 months after issuance of this Order.
b. Submit to the Department for its approval the final drawings and specifications for Solids and Floatable Control Regulator for CSO Outfall No. 026	NLT 6 months after approval of activities under Requirement 4.a.
c. Construct, startup, and test the Solids and Floatable Control Regulator for CSO Outfall No. 026	NLT 20 months after approval of the final drawings and specifications under Requirement 4.b.
d. Place in Operation the Solids and Floatable Control Regulator for CSO Outfall No. 026	NLT 1 month after completion of activities under Requirement 4.c.
5. Solids and Floatable Control Regulator for CSO Outfall No. 025:	
a. Submit to the Department for its approval the Preliminary Design Report for the Solids and Floatable Control Regulator for CSO Outfall No. 025	NLT 3 months after issuance of this Order.
b. Submit to the Department for its approval the final drawings and specifications for Solids and Floatable Control Regulator for CSO Outfall No. 025	NLT 6 months after approval of activities under Requirement 5.a.
c. Construct, startup, and test the Solids and Floatable Control Regulator for CSO Outfall No. 025	NLT 20 months after approval of the final drawings and specifications under Requirement 5.b.
d. Place in Operation the Solids and Floatable Control Regulator for CSO Outfall No. 025	NLT 1 month after completion of activities under Requirement 5.c.

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REQUIREMENTS	MILESTONES
6. Fulton Bottom Urban Renewal Separation Project:	
a. Submit to the Department for its approval the Preliminary Design Report for the Fulton Bottom Urban Renewal Separation Project	NLT 3 months after the Phase III Program Project Plan under Requirement 2.
b. Submit to the Department for its approval the final drawings and specifications for the Fulton Bottom Urban Renewal Separation Project	NLT 6 months after approval of activities under Requirement 6.a.
c. Construct, startup, and test the Fulton Bottom Urban Renewal Separation Project	NLT 36 months after approval of the final drawings and specifications under Requirement 6.b.
d. Place in Operation the Fulton Bottom Urban Renewal Separation Project	NLT 1 month after completion of activities under Requirement 6.c.
7. Maury Street Separation Project:	
a. Submit to the Department for its approval the Preliminary Design Report for the Maury Street Separation Project	NLT 3 months after the Phase III Program Project Plan under Requirement 2.
b. Submit to the Department for its approval the final drawings and specifications for the Maury Street Separation Project	NLT 6 months after approval of activities under Requirement 7.a.
c. Construct, startup, and test the Maury Street Separation Project	NLT 48 months after approval of the final drawings and specifications under Requirement 7.b.
d. Place in Operation the Maury Street Separation Project	NLT 1 month after completion of activities under Requirement 7.c.

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REQUIREMENTS	MILESTONES
8. Orleans and Nicholson Streets Separation Project:	
a. Submit to the Department for its approval the Preliminary Design Report for the Orleans and Nicholson Streets Separation Project	NLT 3 months after the Phase III Program Project Plan under Requirement 2.
b. Submit to the Department for its approval the final drawings and specifications for the Orleans and Nicholson Streets Separation Project	NLT 6 months after approval of activities under Requirement 8.a.
c. Construct, startup, and test the Orleans and Nicholson Streets Separation Project	NLT 60 months after approval of the final drawings and specifications under Requirement 7.b.
d. Place in Operation the Orleans and Nicholson Streets Separation Project	NLT 1 month after completion of activities under Requirement 8.c.
9. Oakwood Peripheral In-Line Flow Equalization:	
a. Submit to the Department for its approval the Preliminary Design Report for the Oakwood Peripheral In-Line Flow Equalization	NLT 3 months after the Phase III Program Project Plan under Requirement 2.
b. Submit to the Department for its approval the final drawings and specifications for the Oakwood Peripheral In-Line Flow Equalization	NLT 6 months after approval activities under Requirement 9.a.
c. Construct, startup, and test the Oakwood Peripheral In-Line Flow Equalization	NLT 72 months after approval of the final drawings and specifications under Requirement 9.b.
d. Place in Operation the Oakwood Peripheral In-Line Flow Equalization	NLT 1 month after completion of activities under Requirement 9.c.

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REQUIREMENTS	MILESTONES
10. Solids and Floatable Control Regulator for CSO Outfall No. 012:	
a. Submit to the Department for its approval the Preliminary Design Report for the Solids and Floatable Control Regulator for CSO Outfall No. 012	NLT 3 months after the Phase III Program Project Plan under Requirement 2.
b. Submit to the Department for its approval the final drawings and specifications for Solids and Floatable Control Regulator for CSO Outfall No. 012	NLT 6 months after approval of activities under Requirement 10.a.
c. Construct, startup, and test the Solids and Floatable Control Regulator for CSO Outfall No. 012	NLT 84 months after approval of the final drawings and specifications under Requirement 10.b.
d. Place in Operation the Solids and Floatable Control Regulator for CSO Outfall No. 012	NLT 1 month after completion of activities under Requirement 10.c.
11. Solids and Floatable Control Regulator for CSO Outfall No. 014:	
a. Submit to the Department for its approval the Preliminary Design Report for the Solids and Floatable Control Regulator for CSO Outfall No. 014	NLT 3 months after the Phase III Program Project Plan under Requirement 2.
b. Submit to the Department for its approval the final drawings and specifications for Solids and Floatable Control Regulator for CSO Outfall No. 014	NLT 6 months after approval of activities under Requirement 11.a.
c. Construct, startup, and test the Solids and Floatable Control Regulator for CSO Outfall No. 014	NLT 96 months after approval of the final drawings and specifications under Requirement 11.b.
d. Place in Operation the Solids and Floatable Control Regulator for CSO Outfall No. 014	NLT 1 month after completion of activities under Requirement 11.c.

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REQUIREMENTS	MILESTONES
12. Solids and Floatable Control Regulator for CSO Outfall No. 039:	
a. Submit to the Department for its approval the Preliminary Design Report for the Solids and Floatable Control Regulator for CSO Outfall No. 039	NLT 3 months after of the Phase III Program Project Plan under Requirement 2.
b. Submit to the Department for its approval the final drawings and specifications for Solids and Floatable Control Regulator for CSO Outfall No. 039	NLT 6 months after approval of activities under Requirement 12.a.
c. Construct, startup, and test the Solids and Floatable Control Regulator for CSO Outfall No. 039	NLT 108 months after approval of the final drawings and specifications under Requirement 12.b.
d. Place in Operation the Solids and Floatable Control Regulator for CSO Outfall No. 039	NLT 1 month after completion of activities under Requirement 12.c.
13. Lower Gillies Creek Conveyance System Project:	
a. Submit to the Department for its approval the Preliminary Design Report for the Lower Gillies Creek Conveyance System Project	NLT 3 months after the Board or the Department determines that (1) Plan E satisfies all the criteria under Section II.C.4.b.i and ii of the CSO Policy, and (2) approval of the Phase III Program Project Plan under Requirement 2.
b. Submit to the Department for its approval the final drawings and specifications for the Lower Gillies Creek Conveyance System Project	NLT 9 months after completion or approval of activities under Requirement 13.a.
c. Construct, startup, and test the Lower Gillies Creek Conveyance System Project	At such time as the combined affordability and spending measures under Sections A.1. and A.2. produce revenue to proceed with construction of a Functioning Element or; if sufficient funds are available at the time of completion of final drawings and specifications, NLT 26 months after approval of the final drawings and specifications under Requirement 13.b.
d. Place in Operation the Lower Gillies Creek Conveyance System Project	NLT 1 month after completion of activities under Requirement 13.c.

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REQUIREMENTS	MILESTONES
14. Wet Weather Flow Improvements at the WWTP: Solids Removal Improvements Project	
a. Submit to the Department for its approval the Preliminary Design Report for the Solids Removal Improvements Project	NLT 3 months after starting construction of the project under Requirement 13.c.
b. Submit to the Department for its approval the final drawings and specifications for the Solids Removal Improvements Project	NLT 9 months after completion or approval of activities under Requirement 14.a. (1)
c. Construct, startup, and test the Solids Removal Improvements Project	At such time as the combined affordability and spending measures under Sections A.1. and A.2. produce revenue to proceed with construction of a Functioning Element or; if sufficient funds are available at the time of completion of final drawings and specifications, NLT 26 months after approval of the final drawings and specifications under Requirement 14.a.(2)
d. Place in Operation for the Solids Removal Improvements Project	NLT 1 month after completion of activities under Requirement 14.a.(3)
15. Wet Weather Flow Improvements at the WWTP: Wet Weather Disinfection Facilities Project	
a. Submit to the Department for its approval the Preliminary Design Report for the Wet Weather Disinfection Facilities Project	NLT 3 months after starting construction of the project under Requirement 14.a.(3)
b. Submit to the Department for its approval the final drawings and specifications for the Wet Weather Disinfection Facilities Project	NLT 9 months after completion or approval of activities under Requirement 14.b.(1)
c. Construct, startup, and test the Wet Weather Disinfection Facilities Project	At such time as the combined affordability and spending measures under Sections A.1. and A.2. produce revenue to proceed with construction of a Functioning Element or; if sufficient funds are available at the time of completion of final drawings and specifications, NLT 26 months after approval of the final drawings and specifications under Requirement 14.b.(2)
d. Place in Operation for Wet Weather Disinfection Facilities Project	NLT 1 month after completion of activities under Requirement 14.b.(3)

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REQUIREMENTS	MILESTONES
16. Wet Weather Flow Improvements at the WWTP: Expand Secondary Wet Weather Flow Treatment Project	
a. Submit to the Department for its approval the Preliminary Design Report for the Expand Secondary Wet Weather Flow Treatment Project	NLT 3 months after starting construction of the project under Requirement 14.b.(3)
b. Submit to the Department for its approval the final drawings and specifications for the Expand Secondary Wet Weather Flow Treatment Project	NLT 9 months after completion or approval of activities under Requirement 14.c.(1)
c. Construct, startup, and test the Expand Secondary Wet Weather Flow Treatment Project	At such time as the combined affordability and spending measures under Sections A.1. and A.2. produce revenue to proceed with construction of a Functioning Element or; if sufficient funds are available at the time of completion of final drawings and specifications, NLT 26 months after approval of the final drawings and specifications under Requirement 14.c.(2)
d. Place in Operation for Wet Weather Disinfection Facilities Project	NLT 1 month after completion of activities under Requirement 14.c.(3)
17. Shockoe Retention Basin: Adapt Existing Basin for Pass Through Wet Weather Flow Project	
a. Submit to the Department for its approval the Preliminary Design Report for the Adapt Existing Basin for Pass Through Wet Weather Flow Project	NLT 3 months after starting construction of the project under Requirement 14.c.(3)
b. Submit to the Department for its approval the final drawings and specifications for the Adapt Existing Basin for Pass Through Wet Weather Flow Project	NLT 9 months after completion or approval of activities under Requirement 15.a.(1)

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REQUIREMENTS	MILESTONES
c. Construct, startup, and test the Adapt Existing Basin for Pass Through Wet Weather Flow Project	At such time as the combined affordability and spending measures under Sections A.1. and A.2. produce revenue to proceed with construction of a Functioning Element or; if sufficient funds are available at the time of completion of final drawings and specifications, NLT 26 months after approval of the final drawings and specifications under Requirement 15.a.(2)
d. Place in Operation for Adapt Existing Basin for Pass Through Wet Weather Flow Project	NLT 1 month after completion of activities under Requirement 15.a.(3)
18. Shockoe Retention Basin: Shockoe Retention Basin 15 MG Expansion Project	
a. Submit to the Department for its approval the Preliminary Design Report for the Shockoe Retention Basin 15 MG Expansion Project	NLT 3 months after starting construction of the project under Requirement 15.a.(3)
b. Submit to the Department for its approval the final drawings and specifications for the Shockoe Retention Basin 15 MG Expansion Project	NLT 9 months after completion or approval of activities under Requirement 15.b.(1)
c. Construct, startup, and test the Shockoe Retention Basin 15 MG Expansion Project	At such time as the combined affordability and spending measures under Sections A.1. and A.2. produce revenue to proceed with construction of a Functioning Element or; if sufficient funds are available at the time of completion of final drawings and specifications, NLT 38 months after approval of the final drawings and specifications under Requirement 15.b.(2)
d. Place in Operation for Shockoe Retention Basin 15 MG Expansion Project	NLT 1 month after completion of activities under Requirement 15.b.(3)

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REQUIREMENTS	MILESTONES
19. Shockoe Retention Basin: Shockoe Wet Weather Disinfection Facility Project	
a. Submit to the Department for its approval the Preliminary Design Report for the Shockoe Wet Weather Disinfection Facility Project	NLT 3 months after starting construction of the project under Requirement 15.b.(3)
b. Submit to the Department for its approval the final drawings and specifications for the Shockoe Wet Weather Disinfection Facility Project	NLT 9 months after completion or approval of activities under Requirement 15.c.(1)
c. Construct, startup, and test the Shockoe Wet Weather Disinfection Facility Project	At such time as the combined affordability and spending measures under Sections A.1. and A.2. produce revenue to proceed with construction of a Functioning Element or; if sufficient funds are available at the time of completion of final drawings and specifications, NLT 26 months after approval of the final drawings and specifications under Requirement 15.c.(2)
d. Place in Operation for Shockoe Wet Weather Disinfection Facility Project	NLT 1 month after completion of activities under Requirement 15.c.(3)

SECTION A.4.

Beginning December 1, 2005, and no later than December 1st of each year thereafter, the City shall submit a compliance and progress report to the Department. The report shall describe progress made in the previous fiscal year in controlling CSO's and plans for further implementation of the LTCP in the near and long term future. The report shall include, at a minimum, the following elements:

1. An independent rate consultant report that includes schedules and other material designed to demonstrate compliance with the above funding and spending criteria. At a minimum, the independent rate consultant's report will include:

   a A schedule of sewer rates and charges in effect during the year and an explanation of any changes in the sewer rates and charges during the year;

   b A schedule that calculates the current year annual sewer bill for a residential customer with a 7 ccf average monthly sewer use and the percentage of such bill to median household income in the City;

   c A schedule detailing sewer related revenues, operation and maintenance expenses, net revenues, debt service, reserve funds and the sewer debt service coverage ratio for the previous year;

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d A schedule detailing amounts borrowed, grants, and other sources of capital funds, and the amount of capital funds obligated for water quality projects during the previous year; and,

e A schedule displaying the industrial rate structure and progress toward the goal of parity between industrial and residential rates.

2. An accounting of all sums expended on implementation of specific CSO projects contained in the LTCP in the previous fiscal year and in each fiscal year since the effective date of this Order.

3. An accounting of all sums obligated in the current fiscal year, and funds projected to be obligated within the next five years for implementation of specific CSO projects contained in the LTCP.

4. A narrative report of the status of each CSO project identified in the LTCP including projected completion dates contingent upon funding availability.

5. A status report of progress being made in procuring state and federal grants and low interest loans for the purpose of implementing specific elements of the LTCP.

The City agrees to accommodate requests by the Department for changes in annual report format and additional information. The City also agrees to meet with the Department in December, 2005, and every December thereafter, to discuss the status of the CSO projects required under this Order.

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APPENDIX B

Description of the Elements in Richmond's CSO Control Plan E

The City's Long-Term Control Plan (LTCP) components of the CSO Control Plan E are described in the following table:

PROJECTS	DESCRIPTION
1. CSO Disinfection Study	Determines the most cost effective method of disinfecting CSO discharges at the Shockoe retention basin and the City's WWTP
2. Phase III Program Project Plan	Develops program project plan(s) for implementing the elements of the CSO Control Plan E.
3. Solids and Floatable Control Regulator for CSO Outfall No. 024	Provides solids and floatables treatment for CSO Outfall 024 prior to discharge to Gillies Creek and the James River. Part of the project for Solids and Floatable Control Regulators (#III-7) in the City's Long Term Control Plan.
4. Solids and Floatable Control Regulator for CSO Outfall No. 026	Provides solids and floatables treatment for CSO Outfall 026 prior to discharge to Gillies Creek and the James River. Part of the project for Solids and Floatable Control Regulators (#III-7) in the City's Long Term Control Plan.
5. Solids and Floatable Control Regulator for CSO Outfall No. 025	Provides solids and floatables treatment for CSO Outfall 025 prior to discharge to Gillies Creek and the James River. Part of the project for Solids and Floatable Control Regulators (#III-7) in the City's Long Term Control Plan.
6. Fulton Bottom Urban Renewal Separation Project	Separates combined sewers into separate sewers for the conveyance of sanitary sewage and storm water to eliminate discharges of combined sewer overflows from this CSO area into Gillies Creek and the James River. Part of the project for Separation of Select CSO Basins (#III-5) in the City's Long Term Control Plan.
7. Maury Street Separation Project	Separates combined sewers into separate sewers for the conveyance of sanitary sewage and storm water to eliminate discharges of combined sewer overflows from this CSO area into the James River. Part of the project for Separation of Select CSO Basins (#III-5) in the City's Long Term Control Plan.
8. Orleans and Nicholson Street Separation Project	Separates combined sewers into separate sewers for the conveyance of sanitary sewage and storm water to eliminate discharges of combined sewer overflows from this CSO area into the James River. Part of the project for Separation of Select CSO Basins (#III-5) in the City's Long Term Control Plan.

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PROJECTS	DESCRIPTION
9. Peripheral In-Line Flow Equalization at Oakwood	Captures and stores combined sewage in excess of the capacity of existing conveyance system, and conveys it to the WWTP once the conveyance and treatment capacities are restored. It attenuates peak combined sewer flows, provides a relatively constant flow into the WWTP and thus reduces the size and cost of treatment facilities.
10. Solids and Floatable Control Regulator for CSO Outfall No. 012	Provides solids and floatables treatment for CSO Outfall 012 prior to discharge to Almond Creek and the James River. Part of the project for Solids and Floatable Control Regulators (#III-7) in the City's Long Term Control Plan.
11. Solids and Floatable Control Regulator for CSO Outfall No. 014	Provides solids and floatables treatment for CSO Outfall 014 prior to discharge to Manchester Canal and the James River. Part of the project for Solids and Floatable Control Regulators (#III-7) in the City's Long Term Control Plan.
12. Solids and Floatable Control Regulator for CSO Outfall No. 039	Provides solids and floatables treatment for CSO Outfall 039 prior to discharge to Gillies Creek and the James River. Part of the project for Solids and Floatable Control Regulators (#III-7) in the City's Long Term Control Plan.
13. Lower Gillies Creek Conveyance System Project	Conveys combined sewer flows from the lower portion of the Gillies Creek CSO district to WWTP, and control these CSOs to 4 overflows per year. Conveys combined sewer flows from CSO Outfall 034 to Shockoe Retention Basin to reduce discharges of combined sewer overflows from this CSO area into the James River.
14. Wet Weather Flow Improvements at the WWTP: Solids Removal Improvements Project	Upgrades the primary treatment facilities to provide reliable treatment of up to 140 MGD wet weather flow; upgrades solids handling facilities to handle an increased solids loading associated with the increased CSO wet weather flow treatment.
15. Wet Weather Flow Improvements at the WWTP: Wet Weather Disinfection Facilities Project	Maximizes the wet weather treatment capacity to 300 MGD at WWTP; controls Gordon Avenue (CSO 021) outfall to 4 overflows per year. Upgrades the coarse screens, primary grit removal facilities, Main Pumping Station, and fine screens to provide reliable treatment of up to 300 MGD wet weather flow; Constructs a new wet weather disinfection facility at WWTP to treat flows up to 215 MGD (55 MGD primary effluent plus 160 MGD wet weather flow)
16. Wet Weather Flow Improvements at the WWTP: Expand Secondary Wet Weather Flow Treatment Project	Installs sedimentation enhancing technologies such as inclined plate settlers in the Final Sedimentation Tanks to increase the solids capture efficiency for up to 85 MGD wet weather flow; upgrades the return sludge and sludge withdrawals to increase the capacity of this facility.

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PROJECTS	DESCRIPTION
17. Shockoe Retention Basin: Adapt Existing Basin for Pass Through Wet Weather Flow Project	Modifies Shockoe Diversion Structures, including trash rack improvement, solids removal and cleaning of Shockoe retention basin and diversion structure; Reconfigures aeration piping; Modifies retention basin bottom to slope to drain gates; Provides potential flushing system to clean the retention basin and diversion structures after every storm event.
18. Shockoe Retention Basin: Shockoe Retention Basin 15 MG Expansion Project	Expands the Shockoe Retention Basin by 15 MG; Provides flushing system; Relocates outfall to east end of retention basin; Provides access for servicing and mechanically cleaning the retention basin.
19. Shockoe Retention Basin: Shockoe Wet Weather Disinfection Facility Project	Provides disinfection for the new Shockoe outfall CSOs to decrease bacterial loading to the James River by an 80% event mean reduction

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APPENDIX C

Wastewater Treatment During Wet Weather: The City shall operate and maintain its treatment works to treat as much flow as possible during combined sewer overflow treatment conditions. The City shall prepare an operating and reporting plan for maximizing treatment during combined sewer overflow treatment conditions and submit that plan to DEQ within 90 days of the effective date of this Order. The following annual average concentration limits shall apply for flow rates above 75 mgd during any calendar year:

Flow Rates	Effluent Limit mg/L (1)	
	CBOD5	TSS
Greater than 75 mgd less than or equal to 80 mgd	15	26
Greater than 80 mgd less than or equal to 85 mgd	18	35
Greater than 85 mgd less than or equal to 90 mgd	20	42
Greater than 90 mgd	21	51

(1) Annual average (i.e. average over the number of days in any flow tier)

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