

EFFECT OF POINT SOURCE CONTROL  
ON  
PHOSPHORUS LOADS TO THE CHESAPEAKE BAY

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## 1. Introduction

Eutrophication is considered the major concern of the Chesapeake Bay due to nutrient enrichment from both point and nonpoint sources in the basin. Several point source control alternatives are being contemplated for the Bay. In order to evaluate the water quality impact (i.e., reduction of eutrophication), we need to determine, as a first step, the reduction of phosphorus loads to the Bay associated with each control alternative. That is, we need to quantify the reduced phosphorus loads discharged from the publicly owned treatment works (POTWs) as well as the reduced loads to the Bay. Further, we put this issue into a better perspective by comparing the reduced point source loads under various control alternatives with the nonpoint source loads from the Bay drainage area.

The results of such an analysis can then be used to assess the water quality improvement, if any, resulting from these control measures. Such water quality impact analysis will, in most cases, require a water quality model to predict the impact. A separate study is being conducted to assess the water quality impact in the James River Estuary in Virginia under various control alternatives. Thus, the results from this study of reduced loads will provide input to the ongoing James River Estuary modeling study.

## 2. Phosphorus Load Reduction Alternatives

The phosphorus load reduction alternatives evaluated in this study are:

- Alt. 1 - basinwide phosphate detergent bans,
- Alt. 2 - broadly applied effluent phosphorus limit (2 mg/l) to the POTWs with flows 1 mgd or greater,
- Alt. 3 - broadly applied effluent phosphorus limit (2 mg/l) to the POTWs with flows 0.5 mgd or greater,

Alt. 4 - broadly applied effluent phosphorus limit (1 mg/l) to the POTWs with flows 1 mgd or greater, and

Alt. 5 - broadly applied effluent phosphorus limit (1 mg/l) to the POTWs with flows 0.5 mgd or greater.

The basis used for comparison with the control scenarios in terms of load reduction is the 1983 POTW phosphorus loads (Lung, 1984a). In calculating the reduced POTW loads, the 1983 wastewater flows are used. In addition, the default effluent phosphorus concentration of 5 mg/l (Lung, 1984a) is used for the POTWs which do not remove phosphorus and do not measure the effluent phosphorus concentrations.

When considering the phosphate detergent ban alternative, average values of 15% and 25% are used to represent the range of the phosphorus contribution from laundry detergent. Thus, under the phosphate detergent ban alternative, two different load reductions (15% and 25%) are assumed for the POTWs which do not have phosphorus removal. On the other hand, such bans will not have any impact on the POTWs currently practicing phosphorus removal and meeting their current NPDES permit limits.

In calculating the loads associated with the broadly applied effluent limits of 1 mg/l and 2 mg/l, if a POTW already achieves a lower limit, this lower limit applies to the load calculation. For example, the Upper Occoquan AWT in the Potomac River basin had an annual average effluent phosphorus level of 0.028 mg/l. The 1 mg/l or 2 mg/l limit will not have any impact on the phosphorus load calculation for the Upper Occoquan AWT.

### 3. POTW Phosphorus Load Reduction

The phosphorus loads from the POTWs with wastewater flows greater than 1 mgd under the control alternatives of phosphate detergent bans, 2 mg/l and 1 mg/l effluent phosphorus concentrations are summarized in a number of tables in the Appendix. Also shown in the appendisized tables are the 1983 average loads from Lung (1984a) for comparison purpose. In addition, the 1983 wastewater flows are given along with the 1983 phosphorus concentrations. The phosphorus concentrations resulting from basin-wide

phosphate detergent bans are also presented. Note that a 15% reduction and a 25% reduction in phosphorus concentrations and in phosphorus loads are shown for the POTWs not having phosphorus removal. At the end of each table, an overall phosphorus load reduction is calculated for each of the control alternatives when compared with the 1983 loads. Table 1 summarizes the load reduction estimates for the POTWs in the major river basins tributary to the Bay.

Table 1. Percent (%) Reduction\* of POTW Phosphorus Loads in Major River Basins of the Chesapeake Bay

River Basin	P-Bans		2 mg/l	1 mg/l
	(15%)	(25%)		
Susquehanna:				
upper	15	25	65	83
lower	10	16	42	66
Potomac	7	12	51	65
James	15	25	63	81
Western Chesapeake and Upper Bay	14	23	47	70
Eastern Shore	15	25	60	80
Patuxent	6	10	26	62
Rappahannock	12	20	50	75
York	15	25	60	80

\*compared with 1983 POTW loads (Lung, 1984a)

*loads from the plants, not to the Bay*

Table 1 shows that several river basins, which do not have phosphorus removal, can achieve the maximum load reductions of 15% and 25% under the phosphate detergent ban scenario. They include the upper Susquehanna, Eastern Shore, York, and James River basins. On the other hand, the Potomac River basin which has many POTWs practicing phosphorus removal would have load reductions ranging from 7% to 12% resulting from the bans.

A 2 mg/l phosphorus limit would result in significant load reductions for the major river basins ranging from 26% in the Patuxent basin to 65% in the upper Susquehanna basin. Similarly, a 1 mg/l phosphorus limit would further reduce the loads. The load reductions for this scenario range from 62% in the Patuxent basin to 83% in the upper Susquehanna basin.

#### 4. Reduction of Phosphorus Loads to the Chesapeake Bay

Following the procedure used by Lung (1984b), the reduced point source phosphorus loads are then incorporated with nonpoint source loads from the Bay watershed to form the total loads entering the Bay. Subsequently, the reductions of the total loads to the Bay attributable to each of the major river basins are summarized in Table 2. The percent reductions associated with three (3) different hydrologic conditions in the Bay drainage basin are shown in Table 2. The different hydrologic conditions are dry year, average year, and wet year conditions (Lung, 1984b). As expected, the percent contributions from point sources in each basin decrease progressively from a dry year to a wet year, so do the percent reductions of loads (see Table 2).

The results in Table 2 indicate that basin-wide phosphate detergent bans would result in small reductions in phosphorus loads to the Bay, ranging from 4.34% in a wet year to 7.36% in a dry year, assuming 15% of the phosphorus in wastewaters from laundry detergent. Similarly, the load reductions range from 7.25% in wet year to 12.3% in a dry year, assuming 25% of the phosphorus from laundry detergent. Such small reductions would be easily compensated by the increase of nonpoint source loads in a wet year. That is, the total phosphorus loads (under phosphate detergent bans) entering the Bay (in lbs/day) in a wet year would still be far greater than those in a dry year (even without bans). The load reductions associated with the broadly applied effluent phosphorus limits of 2 mg/l and 1 mg/l are substantially greater than the reductions due to the phosphate detergent bans. The maximum benefit from phosphorus removal is to be expected in a dry year when the reduction of loads to the Bay would reach over 40%, resulting from the 1 mg/l effluent limit.

Table 2. Percent (%) Reductions of Phosphorus Loads to Chesapeake Bay Resulting from Point Source Control

River Basin	Dry Year				Average Year				Wet Year			
	[15%] <sup>P Bans</sup>	[25%]	[2mg/l]	[1mg/l]	[15%] <sup>P Bans</sup>	[25%]	[2mg/l]	[1mg/l]	[15%] <sup>P Bans</sup>	[25%]	[2mg/l]	[1mg/l]
Susquehanna	0.41	0.68	1.80	2.48	0.30	0.52	1.33	1.83	0.18	0.30	0.80	1.10
Potomac	0.35	0.60	2.55	3.25	0.29	0.49	2.09	2.67	0.18	0.30	1.28	1.63
James	4.35	7.25	18.3	23.5	3.80	6.33	15.9	20.5	2.00	3.33	8.38	10.8
W. Chspk/U. Bay	2.00	3.36	6.86	10.2	1.86	3.13	6.39	9.52	1.82	3.06	6.25	9.31
Eastern Shore	0.16	0.28	0.66	0.88	0.14	0.23	0.54	0.72	0.08	0.13	0.30	0.40
Patuxent	0.05	0.09	0.23	1.18	0.09	0.18	0.42	0.99	0.05	0.09	0.23	0.56
Rappahannock	0.02	0.04	0.10	0.15	0.03	0.04	0.10	0.15	0.01	0.02	0.05	0.08
York	0.02	0.04	0.06	0.08	0.02	0.04	0.06	0.08	0.02	0.04	0.06	0.08
Total	7.36	12.3	30.6	41.7	6.53	10.9	26.9	36.5	4.34	7.25	17.4	23.9

Among all the basins evaluated, the James would benefit the most from these control measures in terms of load reduction simply because the James River basin does not have any phosphorus removal facilities and the POTWs in the James River basin contribute a sizable amount of phosphorus (29% in a dry year) to the Bay (Lung, 1984b).

#### 5. Load Reductions from POTWs with Flows Less Than 1 mgd

The phosphorus loads from the POTWs which have flows under 1 mgd represent only a small portion (6%) of the total POTW phosphorus loads in the basin (Lung, 1984a). These facilities, because of their small size, usually do not have phosphorus removal. Based on the above discussions, the phosphate detergent bans and other phosphorus limits (2 mg/l and 1 mg/l), if applied to these small plants, are not expected to generate significant additional reductions in loads to the Bay.

#### 6. Summary and Conclusions

This study evaluated a number of point source control alternatives which could be used to reduce the phosphorus loads to the Chesapeake Bay. Among the control measures evaluated, phosphate detergent bans were found to have a very small impact on the loads when comparing the reduced loads with existing loads. In fact, the percent reduction resulting from phosphate detergent bans is so small that it can easily be offset by the increase of nonpoint source loads in a wet year. This result implies that nonpoint source control should be considered concurrently with point source control if any appreciable reduction of phosphorus loads to the Bay is to be expected.

7. References

Lung, W.S., 1984a. Phosphorus Loads Discharged from the POTWs in the Chesapeake Bay Drainage. Report prepared for The Soap and Detergent Association, March, 1984.

Lung, W.S., 1984b. Phosphorus Loads to the Chesapeake Bay Systems. Report prepared for The Soap and Detergent Association, August, 1984.



APPENDIX

Phosphorus Loads from POTWs > 1 mgd

(Upper Susquehanna River)

Facility	Treatment Level	NPDES Flow(mgd)	NPDES P (mg/l)	1983 Flow(mgd)	Avg P (mg/l)		Avg Load (lb/day)			
					1983	P Bans	1983	P Bans	2 mg/l	1 mg/l
Dallas Area	Secondary		None	1.92	5.00	4.24/3.75	80.1	68.1/60.0	32.3	16.1
Hazleton	Secondary		None	5.70	5.00	4.25/3.75	237.7	202.0/178.3	95.8	47.9
Jermym-Archbold	Secondary		None	2.81	5.00	4.25/3.75	117.2	99.6/87.9	46.9	23.4
Lower Lkwana	Secondary		None	2.58	5.00	4.25/3.75	107.6	91.4/80.7	41.4	20.7
Scranton	Secondary		None	14.2	5.00	4.25/3.75	593.4	504.4/445.0	237.4	118.7
Throop	Secondary		None	4.18	5.00	4.25/3.75	174.3	148.2/130.7	69.7	34.9
Wyoming Valley	Primary		None	23.4		5.27/4.65	1310.8	1114./983.1	389.4	194.7
Total				56.7			2621.0	2228/1966	912.8	456.4
						Load Reduction		15%/25%	65%	83%

Phosphorus Loads from POTWs > 1 mgd  
Lower Susquehanna River

Facility	Treatment Level	NPDES Flow(mgd)	NPDES P(mg/l)	1983 Flow(mgd)	Avg P (mg/l)		Avg Load (lb/day)			
					1983	P Bans	1983	P Bans	2 mg/l	1 mg/l
Altoona East	Secondary		None	5.18	5.00	4.25/3.75	216.0	183.6/162.0	86.4	43.2
Altoona West	Secondary		None	5.84	5.00	4.25/3.75	243.5	207.0/182.7	97.4	48.7
Carlise Boro	Sec+P Rmvl		1.0	2.86	0.83	0.83	19.8	19.8	19.8	19.8
Derry Twp	Sec+P Rmvl		2.0	2.41	1.17	1.17	23.5	23.5	23.5	20.1
Dover Twp	Sec+P Rmvl		2.0	1.40	5.00	4.25/3.75	58.4	49.6/43.8	23.4	11.7
Dover Boro	Secondary		None	0.22	8.75	7.44/6/56	16.0	13.7/12.0	3.7	1.8
E. Pennsboro	Sec+P Rmvl		2.0	2.09	1.24	1.24	21.6	21.6	21.6	17.4
Elizabeth Town	Sec+P Rmvl		2.0	2.05	1.60	1.60	27.4	27.4	27.4	17.1
Ephrata STP	Secondary		2.0	2.80	5.00	4.25/3.75	116.8	99.3/87.6	46.7	23.4
Hampton STP	Sec+P Rmvl		2.0	1.31	2.88	2.88	31.5	31.5	21.9	10.9
Hanover	Secondary		None	2.60	6.01	5.11/4.51	130.3	110.8/97.80	43.4	21.7
Harrisburg	Sec+P Rmvl		2.0	24.7	1.05	1.05	216.1	216.1	216.1	205.8
Huntington	Primary		None	1.58	6.20	5.27/4.65	81.7	69.4/61.3	26.4	13.2
Lancaster	Secondary		None	4.37	5.00	4.25/3.75	182.2	154.9/136.7	72.9	36.4
Lancaster North	Secondary		None	9.80	1.69	1.69	138.1	138.1	138.1	81.7
Lancaster South	Secondary		None	9.54	5.04	4.28/3.78	401.0	340.5/300.8	159.1	79.6
Lebanon STP	Sec+P Rmvl		2.0	3.95	1.67	1.67	55.0	55.0	55.0	32.9
Lemoyne	Sec+P Rmvl		2.0	1.54	2.16	2.16	27.7	27.7	25.7	12.8
Hampden Twp	Sec+P Rmvl		2.0	1.36	1.80	1.80	20.4	20.4	20.4	11.3
Lititz Twp	Sec+P Rmvl		2.0	1.38	1.73	1.73	19.9	19.9	19.9	11.5
Lower Allen	Sec+P Rmvl		2.0	1.97	1.67	1.67	27.4	27.4	27.4	16.4
Mechanicsburg	Sec+P Rmvl		2.0	1.32	1.74	1.74	19.2	19.2	19.2	11.0
New Cumberland	Sec+P Rmvl		2.0	0.59	2.51	2.51	12.4	12.4	9.8	4.9
Penn Twp	Sec+P Rmvl		2.0	1.64	1.03	1.03	14.1	14.1	14.1	13.7
Shippensburg	Sec+P Rmvl		0.5	1.51	0.51	0.50	6.4	6.4	6.4	6.4
Springettsburg	Secondary		None	7.52	3.89	3.31/2.92	244.0	207.6/183.1	125.4	62.7
Swatara	Secondary		None	2.70	5.00	4.25/3.75	112.6	95.7/84.4	45.0	22.5
Tyrone	Secondary		None	4.87	5.00	4.25/3.75	203.1	172.6/152.3	81.2	40.6
York	Sec+P Rmvl		2.0	10.1	3.09	3.09	260.8	260.8	168.8	84.4
				8.15	1.93	1.93	131.2	131.2	131.2	68.0
Mt. Holly Spgs	Sec+P Rmvl		2.0	0.60	0.89	0.89	4.6	4.6	4.6	4.6
Total				128.0			3083	2782/2582	1782	1056
					Load Reduction			10%/16%	42%	66%

Phosphorus Loads from POTWs > 1 mgd  
Western Chesapeake & Upper Bay Area

Facility	Treatment Level	NPDES Flow(mgd)	NPDES P(mg/l)	1983 Flow(mgd)	Avg P (mg/l)		Avg Load (lb/day)			
					1983	P Bans	1983	P Bans	2 mg/l	1 mg/l
Aberdeen City	Sec+P Rmvl	4.00	2.0	1.10	1.00	1.00	9.2	9.2	9.2	9.2
Aberdeen P.G.	Sec+P Rmvl	4.00	2.0	0.90	2.00	2.00	15.0	15.0	15.0	15.0
Annapolis	Secondary	10.0	None	5.60	5.00	4.25/3.75	233.5	198.5/175.1	93.4	46.7
Back River	Sec+P Rmvl	210.	2.0	56.0	1.00	1.00	467.0	467.0	467.0	467.0
				131.	3.70	3.15/2.78	4042.0	3442/3037	2185.0	1092.5
Broad Creek	Secondary		None	0.23	5.00	4.25/3.75	9.6	8.2/7.2	3.8	1.9
Broad Neck	Secondary	4.00	None	3.20	5.00	4.25/3.75	133.4	113.4/100.1	53.4	26.7
Broadwater	Secondary	2.00	None	0.68	5.00	4.25/3.75	28.4	24.2/21.3	11.3	5.7
Cox Creek	Secondary	10.0	2.0	9.70	5.00	4.25/3.75	404.5	343.8/303.4	161.8	80.9
Edgewood Arsnl	Sec+P Rmvl	3.00	2.0	1.30	0.90	0.90	9.8	9.8	9.8	9.8
Freedom Dist.	Secondary		None	1.20	4.00	3.40/3.00	40.0	34.0/30.0	20.0	10.0
Harve de Grace	Primary	1.50	2.0	1.50	7.40	6.29/5.55	92.6	78.7/69.4	25.0	12.5
Patapsco	Secondary	70.0	2.0	32.0	4.90	4.17/36.8	1307.0	1113/982.1	533.8	266.9
Perryville	Secondary		2.0	0.44	5.00	4.25/3.75	18.4	15.6/13.8	7.3	3.7
Sod Run	Sec+P Rmvl	6.25	2.0	5.20	0.65	0.65	28.2	28.2	28.2	28.2
Total				250			6840	5900/5769	3624	2077
Load Reduction								14%/23%	47%	66%

Phosphorus Loads from POTWs > 1 mgd  
Eastern Shore, Maryland

Facility	Treatment Level	NPDES Flow(mgd)	NPDES P(mg/l)	1983 Flow(mgd)	Avg P (mg/l)		Avg Load (lb/day)			
					1983	P Bans	1983	P Bans	2 mg/l	1 mg/l
Cambridge	Secondary	8.10	None	4.50	5.00	4.25/3.75	187.6	159.5/140.7	75.1	37.5
Crisfield	Secondary	1.00	None	0.78	5.00	4.25/3.75	32.5	27.6/24.4	13.0	6.5
Eastern	Secondary	2.00	None	1.80	5.00	4.25/3.75	75.1	63.8/56.3	30.0	15.0
Elkton	Secondary	1.35	2.0	0.88	5.00	4.25/3.75	36.7	31.2/27.5	14.7	7.3
Hurlock	Secondary	2.00	None	1.00	5.00	4.25/3.75	41.7	35.4/31.3	16.7	8.3
Northeast River	Sec+P Rmvl	2.00	2.0	0.34	0.40	0.40	1.1	1.1	1.1	1.1
Pocomoke City	Secondary	1.47	None	0.90	5.00	4.25/3.75	37.5	31.9/28.2	15.0	7.5
Salisbury	Secondary	6.80	None	3.30	5.00	4.25/3.75	137.6	117.0/103.2	55.0	27.5
Total				13.5			549.1	467.5/412.6	220.6	110.7
Load Reduction								15%/25%	60%	80%

Phosphorus Loads from POTWs > 1 mgd  
Patuxent River

Facility	Treatment Level	NPDES Flow(mgd)	NPDES P(mg/l)	1983 Flow(mgd)	Avg P (mg/l)		Avg Load (lb/day)			
					1983	P Bans	1983	P Bans	2 mg/l	1 mg/l
Bowie	Secondary	3.30	1.0	2.40	6.10	5.19/4.58	122.1	103.9/91.7	40.0	20.0
Ft. Meade	Secondary	4.50	0.3	2.50	0.66	0.66	13.8	13.8	13.8	13.8
Horsepen	Secondary	1.00	None	0.37	2.62	2.62	8.1	8.1	6.2	3.1
Maryland City	Secondary		1.0	0.60	5.00	4.25/3.75	25.0	21.3/18.8	10.0	5.0
Md. House Crctn	Secondary		2.0	1.15	5.00	4.25/3.75	47.9	40.8/36.0	19.2	9.6
Parkway	Secondary	7.50	1.0	4.80	2.18	2.18	85.1	85.1	80.1	40.0
Patuxent	Secondary	4.00	1.0	3.50	4.10	3.49/3.08	119.7	101.9/89.9	58.4	29.2
Savage	Secondary	13.0	1.0	10.2	1.90	1.90	161.6	161.6	161.6	85.1
Western Branch	Secondary	17.6	1.0	11.8	2.29	2.29	224.4	224.4	196.7	98.3
Total				37.3			807.7	760.9/729.4	586.0	304.1
						Load Reduction		5.8%/9.7%	26%	62%

Phosphorus Loads from POTWs > 1 mgd  
Potomac River

Facility	Treatment Level	NPDES Flow(mgd)	NPDES P(mg/l)	1983 Flow(mgd)	Avg P (mg/l)		Avg Load (lb/day)				
					1983	P Bans	1983	P Bans	2 mg/l	1 mg/l	
Alexandria	AWT+P Rmvl	54.0	1.0/0.2	36.91	0.36	0.36	110.8	110.8	110.8	110.8	
Aquia Regional	AWT+P Rmvl	3.0	0.2	1.26	0.39	0.39	4.1	4.1	4.1	4.1	
Arlington	AWT+P Rmvl	30.0	1.0/0.2	25.43	2.22	2.22	470.8	470.8	212.1	106.0	
Dale City	AWT+P Rmvl	4.0	0.4	3.22	0.39	0.39	10.5	10.5	10.5	10.5	
Fishersville	Secondary	2.0	None	1.02	5.00	4.25/3.75	42.5	36.2/31.9	17.0	8.5	
Front Royal	Secondary	2.0	None	2.02	5.00	4.25/3.75	84.2	71.6/63.2	33.7	16.8	
Harrisonburg	Secondary	8.0	None	6.90	5.00	4.25/3.75	287.7	244.6/215.8	115.1	57.5	
Leesburg	AST	1.3	None	1.31	0.67	0.67	7.3	7.3	7.3	7.3	
L. Hunting Ck	AST	6.6	None	4.48	0.22	0.22	8.2	8.2	8.2	8.2	
Lower Potomac	AWT+P Rmvl	36.0	0.2	30.36	0.39	0.39	98.7	98.7	98.7	98.7	
Mainside	AWT+P Rmvl	2.0	0.5	1.59	0.20	0.20	2.7	2.7	2.7	2.7	
Mooney	AWT+P Rmvl	12.0	0.2	8.57	0.25	0.25	17.9	17.9	17.9	17.9	
Staunton	Secondary	4.5	None	2.47	5.00	4.25/3.75	103.0	87.5/77.2	41.2	20.6	
Upper Occoquan	AWT+P Rmvl	15.0	0.1	8.43	0.028	0.028	2.0	2.0	2.0	2.0	
Waynesboro	Secondary	4.0	None	3.50	5.00	4.25/3.75	146.0	124.1/109.5	58.4	29.2	
Winchester	Secondary	5.36	None	3.58	5.00	4.25/3.75	149.3	126.9/111.2	59.7	28.9	
Virginia Total				141.1			1546	1424/1343	799	530	
								Load Reduction	8%/13%	48%	66%
Cumberland	Secondary	15.0	None	10.50	5.00	4.25/3.75	437.9	372.2/328.4	175.1	87.6	
Ft. Dietrick	Secondary	2.0	None	0.76	5.00	4.25/3.75	31.7	26.9/23.8	12.7	6.3	
Frederick	Secondary	7.0	None	5.00	5.00	4.25/3.75	208.5	177.2/156.4	83.4	41.7	
Hagerstown	Secondary	8.0	None	6.00	5.00	4.25/3.75	195.2	212.7/187.7	100.1	50.0	
Halfway	Secondary	1.6	None	1.43	5.00	4.25/3.75	59.6	50.7/44.7	23.9	11.9	
La Plata	Secondary		2.0	0.59	5.00	4.25/3.75	24.6	20.9/18.5	9.8	4.9	
Mattawoman	Secondary	5.0	None	4.30	4.53	3.85/3.40	162.5	138.1/121.9	71.7	35.9	
Pine Hill Run	Secondary	3.0	None	3.18	5.00	4.25/3.75	132.6	112.7/90.2	53.0	26.5	
Piscataway	Sec+P Rmvl	30.0	0.2	17.28	0.13	0.13	18.8	18.8	18.8	18.8	
Seneca Creek	Sec+P Rmvl	5.0	1.3	4.03	1.37	1.37	46.3	46.3	46.3	46.3	
Westminster	Secondary	3.0	None	2.10	5.00	4.25/3.75	87.6	74.4/65.7	35.0	17.5	
Maryland Total				55.0			1405	1251/1102	630	348	
								Load Reduction	11%/22%	55%	75%
Blue Plain	Sec+P Rmvl		0.23	322.	0.47	0.47	1262.2	1262.2	617.7	617.7	
								Load Reduction	0%	51%	51%
Chambersburg	Sec+P Rmvl		None	2.74	1.30	1.30	29.7	29.7	29.7	29.7	
Gettysburg	Secondary		None	1.50	5.00	4.25/3.75	62.6	53.2/46.9	25.1	12.5	
Waynesboro	Secondary		None	0.83	5.00	4.25/3.75	34.6	29.4/26.0	13.8	6.9	
Pennsylvania Total				5.07			126.9	112.3/102.6	68.6	42.7	
								Load Reduction	11%/19%	45%	67%
Potomac Basin Total Loads							4340	4050/3810	2115	1537	
								Load Reduction	7%/12%	51%	65%

Phosphorus Loads from POTWs > 1 mgd  
Rappahannock River

Facility	Treatment Level	NPDES Flow(mgd)	NPDES P(mg/l)	1983 Flow(mgd)	Avg P (mg/l)		Avg Load (lb/day)			
					1983	P Bans	1983	P Bans	2 mg/l	1 mg/l
Culpeper	AWT	3.0	None	1.30	0.20	0.20	2.2	2.2	2.2	2.2
Fredericksburg	Secondary	3.5	None	2.58	2.00	2.00	43.0	43.0	43.0	21.5
Massaponax	Secondary	3.0	None	1.53	6.27	5.33/4.70	80.0	68.0/60.0	25.5	12.8
Stafford Cy.	Secondary	1.5	None	0.82	5.00	4.25/3.75	34.2	29.1/25.6	13.7	6.8
Warrenton	Secondary	1.0	None	1.31	5.00	4.25/3.75	54.6	46.4/41.0	21.9	10.9
Total				7.54			214.0	188.7/171.8	106.3	54.2
					Load Reduction			12%/20%	50%	75%

York River

Ashland	Secondary	1.22	None	0.79	6.60	5.61/4.95	43.5	36.9/32.6	13.2	6.6
Hanover Cy.	Secondary	2.50	None	0.60	1.50	1.50	7.5	7.5	7.5	5.0
York River	Secondary	15.0	None	6.99	7.08	6.02/5.31	412.7	350.9/309.6	116.6	58.3
Total				8.38			463.7	395.3/349.7	137.3	69.9
					Load Reduction			15%/25%	70%	85%

Atlantic

Atlantic	Secondary	36.0	None	15.1	7.30	6.20/5.49	919.9	787.3/690.6	252.0	126.0
					Load Reduction			15%/25%	73%	86%

Phosphorus Loads from POTWs > 1 mgd  
James River

Facility	Treatment Level	NPDES Flow(mgd)	NPDES P(mg/l)	1983 Flow(mgd)	Avg P (mg/l)		Avg Load (lb/day)			
					1983	P Bans	1983	P Bans	2 mg/l	1 mg/l
Army Base	Secondary	14.0	None	13.89	4.65	3.95/3.49	538.7	457.6/404.3	231.7	115.8
Boat Harbor	Secondary	25.0	None	18.21	5.07	4.31/3.80	770.1	654.6/577.1	303.7	151.9
Buena Vista	Secondary	2.25	None	1.85	5.00	4.25/3.75	77.1	65.6/57.9	30.9	15.4
Chesapeake	Secondary	30.0	None	21.39	6.06	5.15/4.55	1081.1	918.7/811.7	356.8	178.4
Clifton Forge	Secondary	2.0	None	1.42	5.00	4.25/3.75	59.2	50.3/44.4	23.7	11.8
Covington	Primary	3.0	None	1.73	5.00	4.25/3.75	72.1	61.3/54.1	28.9	14.4
Falling Creek	Secondary	9.0	None	9.32	8.40	7.14/6.30	652.9	555.0/489.7	155.5	77.7
Farmville	Secondary	1.05	None	0.31	5.00	4.25/3.75	12.9	11.0/9.7	5.2	2.6
Ft. Eustis	Secondary	3.0	None	1.56	5.00	4.25/3.75	65.1	55.3/48.8	26.0	13.0
Hopewell	Secondary	50.0	None	34.16	5.00	4.25/3.75	1424.5	1211.7/1068	569.8	284.9
James River	Secondary	20.0	None	14.72	5.45	4.63/4.09	669.1	568.4/502.1	245.5	122.8
Lamperts Point	Primary	33.0	None	23.86	2.63	2.24/1.97	523.4	445.7/392.0	398.0	199.0
Lexington	Secondary	2.0	None	1.03	5.00	4.25/3.75	43.0	36.5/32.2	17.2	8.6
Lynchburg	Secondary	22.0	None	13.04	5.00	4.25/3.75	543.8	462.2/407.8	217.5	108.8
Moore's Creek	Secondary	15.0	None	9.80	5.00	4.25/3.75	408.7	347.4/306.5	163.5	81.7
Nansemond	Secondary	10.0	None	5.22	7.18	6.10/5.39	312.6	265.6/234.7	87.1	43.5
Petersburg	Secondary	15.0	None	10.38	8.00	6.80/6.00	692.4	588.7/519.4	173.1	86.6
Pinners Point	Primary	15.0	None	9.06	6.20	5.27/4.65	468.5	398.2/351.4	151.1	75.6
Proctors Creek	Secondary	4.0	None	3.42	5.00	4.25/3.75	142.6	121.2/107.0	57.0	28.5
Richmond	Secondary	70.0	None	66.2	6.50	5.53/4.88	3588.7	3053.7/2694.1	1104.2	552.1
Williamsburg	Secondary	9.6	None	8.18	1.80	1.53/1.35	122.8	104.4/92.1	122.8	68.2
Total				268.9			12269	10432/9205	4414	2241
					Load Reduction			15%/25%	63%	81%



APPENDIX I

Phosphorus Loads at POTWs With  
Flows Greater Than 1 mgd  
(1980, 1983, and 1984)

Phosphorus Loads from POTWs > 1 mgd  
Upper Susquehanna River Basin

Facility	Treatment Level	NPDES Flow (mgd)	NPDES P (mg/l)	Avg Flow (mgd)			Avg P (mg/l)			Avg Load (lb/d)		
				1980	1983	1984	1980	1983	1984	1980	1983	1984
Dallas Area	Secondary	2.20	None	1.86	1.92	1.80	6.25	6.25	6.25	97.0	100.1	93.8
Hazelton	Secondary	5.80	None	7.00	5.70	6.20	6.25	6.25	6.25	364.9	297.1	323.2
Jerome-Archbold	Secondary	3.00	None	3.14	2.81	2.73	6.25	6.25	6.25	163.7	146.5	142.3
Lower Lkwa	Secondary	6.00	None	2.12	2.58	2.25	6.25	6.25	6.25	110.5	134.5	117.3
Scranton	Secondary	28.0	None	16.67	14.20	14.25	6.25	6.25	6.25	868.9	740.2	742.8
Throop	Secondary	7.00	None	3.87	4.18	4.40	6.25	6.25	6.25	201.7	217.9	229.4
Wyoming Valley	Primary	40.0	None	31.94	23.40	27.00	7.20	7.20	7.20	1917.9	1405.1	1621.3
Total				66.60	54.79	59.63				3724.6	3041.3	3270.0

Phosphorus Loads from POTWs > 1 mgd  
Lower Susquehanna River Basin

Facility	Treatment Level	NPDES Flow (mgd)	NPDES P (mg/l)	Avg Flow (mgd)			Avg P (mg/l)			Avg Load (lb/d)			SC
				1980	1983	1984	1980	1983	1984	1980	1983	1984	
Altoona East	Secondary	5.50	None	6.10	5.18	7.24	6.25	6.25	6.25	318.0	270.0	377.4	
Altoona West	Secondary	6.50	None	6.30	5.84	4.92	6.25	6.25	6.25	328.4	304.4	256.5	348
Carlisle Boro	Sec+P Rowl	6.00	1.0	2.87	2.86	3.31	6.25	0.83	1.05	149.6	19.8	29.0	23.9
Derry Twp	Sec+P Rowl	5.00	2.0	1.73	2.41	2.69	2.77	1.17	1.18	40.0	23.5	26.5	21.3
Dover Twp	Sec+P Rowl	1.75	2.0	1.42	1.40	2.04	6.25	6.25	6.25	74.0	73.0	105.3	95.4
Dover Boro	Secondary	0.30	None	0.21	0.22	0.22	6.25	6.25	6.25	10.9	11.5	11.5	10.4
E. Pennsboro	Sec+P Rowl	3.70	2.0	1.73	2.09	2.55	3.10	1.24	1.46	44.7	21.6	31.0	26.7
Elizabeth Town	Sec+P Rowl	3.00	2.0	0.89	2.05	1.63	6.25	1.60	2.25	46.4	27.4	30.6	17.9
Ephrata STP	Secondary	3.80	2.0	2.15	2.80	2.41	6.25	6.25	3.59	112.1	146.0	72.2	30.4
Hampton STP	Sec+P Rowl	1.76	2.0	1.99	1.31	1.51	2.00	2.58	1.28	33.2	31.5	16.1	16.3
Hanover	Secondary	2.88	None	2.46	2.60	3.09	6.25	6.01	9.48	128.2	130.3	244.3	
Harrisburg	Sec+P Rowl	30.9	2.0	22.80	24.70	28.40	1.58	1.05	1.29	300.4	216.3	305.5	
Huntington	Primary	2.50	None	1.93	1.58	1.96	6.20	6.20	6.20	99.8	81.7	101.3	111.7
Lancaster	Secondary	11.4	None	2.46	4.37	5.61	6.25	6.25	6.25	128.2	227.8	292.4	307.7
Lancaster North	Secondary	-	None	8.28	9.80	10.10	6.25	1.69	1.92	431.6	138.1	161.7	192.8
Lancaster South	Secondary	29.73	None	8.66	9.54	11.30	6.25	5.04	5.23	451.4	461.0	492.9	378.6
Lebanon STP	Sec+P Rowl	6.60	2.0	3.94	3.95	5.47	1.38	1.67	1.65	45.3	55.0	75.3	24.7
Leboyne	Sec+P Rowl	2.10	2.0	1.48	1.54	1.69	3.96	2.16	2.21	48.9	27.7	31.1	25.9
Haspden Twp	Sec+P Rowl	2.50	2.0	3.62	1.36	1.34	6.25	1.80	1.81	188.7	20.4	20.2	16.6
Lititz Twp	Sec+P Rowl	3.50	2.0	1.37	1.38	2.03	6.25	1.73	1.24	71.4	19.9	21.0	22.7
Lower Allen	Sec+P Rowl	5.95	2.0	1.90	1.97	3.14	2.16	1.67	2.01	34.2	27.4	52.6	37.5
Mechanicsburg	Sec+P Rowl	2.08	2.0	1.02	1.32	1.54	6.25	1.74	0.95	53.2	19.2	12.2	7.2
New Cumberland	Sec+P Rowl	1.25	2.0	1.07	0.59	0.53	2.08	2.51	3.14	18.6	12.4	13.9	5.6
Penn Twp	Sec+P Rowl	4.2	2.0	1.54	1.64	1.68	3.40	1.03	0.77	43.7	14.1	10.8	9.9
Shippensburg	Sec+P Rowl	2.75	0.5	1.20	1.51	1.87	6.25	0.51	0.31	62.6	6.4	4.9	3.9
Springettsburg	Secondary	12.8	None	6.61	7.52	7.10	6.25	3.89	2.83	344.5	244.0	187.6	102.6
Swatara	Secondary	3.00	None	1.67	2.70	2.67	6.25	6.25	6.25	87.0	140.7	139.2	219.1
Tyrone	Secondary	9.00	None	6.50	4.87	4.60	6.25	6.25	6.25	338.8	253.8	243.9	285.8
York	Sec+P Rowl	26.0	2.0	9.48	10.10	9.75	3.37	3.09	4.00	266.4	260.3	325.3	105.3
				6.77	6.15	8.47	2.39	1.93	1.90	134.9	131.2	134.2	
Ht. Holly Spgs	Sec+P Rowl	0.60	2.0	0.55	0.60	0.58	6.25	0.89	0.57	28.7	4.5	2.8	2.3
<b>Total</b>				<b>120.70</b>	<b>127.95</b>	<b>141.52</b>				<b>4463.9</b>	<b>3360.8</b>	<b>3910.2</b>	<b>3518</b>

Phosphorus Loads from POTWs > 1 mgd  
Western Chesapeake & Upper Bay Area

Facility	Treatment Level	NPDES Flow (mgd)	NPDES P (mg/l)	Avg Flow (mgd)			Avg P (mg/l)			Avg Load (lb/d)		
				1980	1983	1984	1980	1983	1984	1980	1983	1984
Aberdeen City	Sec+P Rowl	4.00	2.0	1.20	1.10	1.64	6.25	1.00	1.00	62.6	9.2	13.7
Aberdeen P.E.	Sec+P Rowl	4.00	2.0	1.00	0.95	0.95	6.25	2.00	2.00	52.1	15.8	15.8
Annapolis	Secondary	10.0	None	4.70	5.60	6.17	6.25	6.25	6.25	245.0	291.9	321.6
Back River	Sec+P Rowl	180.	2.0	180.00	56.00	73.97	6.25	1.00	2.80	9382.5	467.0	1727.3
					131.00	106.03	6.25	3.70	2.90		4042.4	2564.4
Broad Creek	Secondary	0.50	None	0.22	0.23	0.35	6.25	6.25	6.25	11.5	12.0	18.2
Broadneck	Secondary	4.00	None	2.10	3.20	3.19	6.25	6.25	6.25	109.5	166.8	166.3
Broadwater	Secondary	2.00	None	0.40	0.68	0.62	6.25	6.25	6.25	20.9	35.4	32.3
Cox Creek	Secondary	12.5	2.0	6.40	9.70	9.62	6.25	6.25	6.25	333.6	505.6	501.4
Edgewood Arsenl	Sec+P Rowl	3.00	2.0	0.97	1.30	1.30	6.25	0.90	1.00	50.6	9.8	10.8
Freedom Dist.	Secondary	1.80	None	0.80	1.20	1.52	6.25	4.00	4.00	41.7	40.0	50.7
Harve de Grace	Primary	1.50	2.0	1.10	1.50	1.61	7.40	7.40	7.40	67.9	92.6	99.4
Patapsco	Secondary	70.0	2.0	26.00	32.00	38.43	6.25	4.90	3.50	1355.3	1307.7	1121.8
Perryville	Sec+P Rowl	1.65	2.0	0.78	0.80	0.59	6.25	2.00	2.00	40.7	13.3	9.8
Sod Run	Sec+P Rowl	10.0	2.0	3.40	5.20	5.97	6.25	0.65	0.65	177.2	28.2	32.4
Total				229.07	250.46	251.96				11950.8	7037.8	6686.1

Phosphorus Loads from POTWs > 1 mgd  
Eastern Shore, Maryland

Facility	Treatment Level	NPDES Flow (mgd)	NPDES P (mg/l)	Avg Flow (mgd)			Avg P (mg/l)			Avg Load (lb/d)		
				1980	1983	1984	1980	1983	1984	1980	1983	1984
Cambridge	Secondary	8.10	None	4.40	4.50	4.50	6.25	6.25	6.25	229.4	234.6	234.6
Crisfield	Secondary	1.00	None	0.76	0.78	0.80	6.25	6.25	6.25	39.6	40.7	41.7
Eastern	Secondary	2.00	None	1.60	1.80	1.74	6.25	6.25	6.25	83.4	93.8	90.7
Elkton	Secondary	1.35	2.0	0.80	0.88	0.85	6.25	6.25	6.25	41.7	45.9	44.3
Hurlock	Secondary	1.10	None	1.00	1.00	0.76	6.25	6.25	6.25	52.1	52.1	39.6
Northeast River	Sec+P Rawl	2.00	2.0	0.25	0.34	0.52	6.25	0.40	0.80	13.0	1.1	3.5
Pocomoke City	Secondary	1.00	None	0.81	0.90	0.90	6.25	6.25	6.25	42.2	46.9	46.9
Salisbury	Secondary	6.80	None	3.50	3.30	3.65	6.25	6.25	6.25	182.4	172.0	190.3
Total				13.12	13.50	13.72				683.9	687.1	691.5

Phosphorus Loads from POTWs > 1 mgd  
Patuxent River Basin

Facility	Treatment Level	NPDES Flow(mgd)	NPDES P(mg/l)	Avg Flow (mgd)			Avg P (mg/l)			Avg Load (lb/d)		
				1980	1983	1984	1980	1983	1984	1980	1983	1984
Bowie	Secondary	3.30	1.0	2.50	2.40	2.53	6.25	6.10	6.10	130.3	122.1	128.7
Ft. Meade	Sec+P Rmvl	4.50	0.3	2.40	2.50	2.50	6.25	0.66	0.50	125.1	13.8	10.4
Horsepen	Secondary	1.00	None		0.37	0.43	6.25	2.62	3.65	0.0	8.1	13.1
Maryland City	Secondary	0.75	1.0	0.70	0.60	0.65	6.25	6.25	6.25	36.5	31.3	33.9
Md. House Crctn	Secondary		2.0	0.85	1.15	1.15	6.25	6.25	6.25	44.3	59.9	59.9
Parkway	Secondary	7.50	1.0	5.20	4.80	4.50	6.25	2.18	3.39	271.1	87.3	127.2
Patuxent	Secondary	4.00	1.0	3.60	3.50	3.99	6.25	4.10	4.10	187.7	119.7	136.4
L. Patuxent	Sec+P Rmvl	13.4	1.0	7.50	10.20	12.53	6.25	1.90	1.00	390.9	161.6	104.5
Western Branch	Secondary	17.6	1.0	12.60	11.79	11.20	6.25	2.29	2.80	656.8	225.2	261.5
Total				35.35	37.31	39.48				1842.6	828.9	875.8

Phosphorus Loads from POTWs > 1 mgd  
Potomac River Basin

Facility	Treatment Level	NPDES Flow(mgd)	NPDES P(mg/l)	Avg Flow (mgd)			Avg P (mg/l)			Avg Load (lb/d)		
				1980	1983	1984	1980	1983	1984	1980	1983	1984
Alexandria	AWT+P Rowl	54.0	1.0/0.2	26.96	36.91	41.31	0.90	0.36	0.22	202.4	110.8	75.8
Aquia Regional	AWT+P Rowl	3.0	0.2	0.34	1.26	1.41	6.20	0.39	0.66	17.6	4.1	7.8
Arlington	AWT+P Rowl	30.0	1.0/0.2	22.27	25.43	26.15	2.41	2.22	0.57	447.6	470.8	124.3
Dale City #1	AWT+P Rowl	4.0	0.4	3.10	3.22	3.31	0.40	0.39	0.31	10.3	10.5	8.6
Dale City #8	AWT+P Rowl	2.0	0.4	2.00	3.19	3.00	1.50	0.40	0.40	25.02	10.6	10.0
Fishersville	Secondary	2.0	None	0.89	1.02	1.01	6.25	6.25	6.25	46.4	53.2	52.6
Front Royal	Secondary	2.0	None	1.30	2.08	2.06	6.25	6.25	6.25	67.8	108.4	107.4
Harrisonburg	Secondary	8.0	None	5.78	6.90	7.05	6.25	6.25	6.25	301.3	359.7	367.5
Leesburg	AST	1.3	None	1.03	1.31	1.53	0.20	0.67	0.67	1.7	7.3	8.5
L. Hunting Ck	AST	6.6	None	4.83	4.48	4.54	3.40	0.22	0.21	137.0	8.2	8.0
Lower Potomac	AWT+P Rowl	36.0	0.2	17.86	30.36	33.22	2.30	0.39	0.15	342.6	98.7	41.6
Mainside	AWT+P Rowl	2.0	0.5	0.13	1.59	1.68	1.30	0.20	0.40	1.4	2.7	5.6
Mooney	AWT+P Rowl	12.0	0.2		8.57	9.06		0.25	0.18	0.0	17.9	13.6
Staunton	Secondary	4.5	None	2.62	2.99	2.93	6.25	6.25	6.25	136.6	155.9	152.7
Upper Occoquan	AWT+P Rowl	15.0	0.1	6.94	8.43	9.91	0.03	0.03	0.04	1.9	2.0	3.3
Waynesboro	Secondary	4.0	None	2.39	3.50	3.60	6.25	6.25	6.25	124.6	182.4	187.7
Winchester	Secondary	5.36	None	3.87	3.58	4.16	6.25	6.25	6.25	201.7	186.6	216.8
Virginia Total				102.31	144.82	155.93				2065.8	1789.8	1391.7
Cumberland	Secondary	15.0	None	10.10	10.50	10.12	6.25	6.25	6.25	526.5	547.3	527.5
Ft. Dietrick	Secondary	2.0	None	1.03	0.76	0.80	6.25	6.25	6.25	53.7	39.6	41.7
Frederick	Secondary	7.0	None	4.40	5.00	5.59	6.25	6.25	6.25	229.4	260.6	291.4
Hagerstown	Secondary	8.0	None	6.20	6.00	7.56	6.25	6.25	6.25	323.2	312.8	394.1
Halfway	Secondary	1.6	None	0.90	1.43	1.68	6.25	6.25	6.25	46.9	74.5	87.6
La Plata	Secondary	1.0	2.0	0.39	0.59	0.60	6.25	6.25	6.25	20.3	30.8	31.3
Mattawoman	Secondary	5.0	None	2.20	4.30	4.45	6.25	6.25	6.25	114.7	224.1	232.0
Pine Hill Run	Secondary	4.5	None	2.20	2.50	2.06	6.25	6.25	6.25	114.7	130.3	107.4
Piscataway	Sec+P Rowl	30.0	0.2	15.00	17.28	16.28	6.25	0.13	0.17	781.9	18.7	23.1
Seneca Creek	Sec+P Rowl	5.0	1.3	4.20	4.03	4.27	2.00	1.37	1.49	70.1	46.0	53.1
Westminster	Secondary	3.0	None	1.90	2.10	2.43	6.25	6.25	6.25	99.0	109.5	126.7
Maryland Total				48.52	54.49	55.84				2380.2	1794.3	1915.6
Blue Plain	Sec+P Rowl		0.23	317.00	322.00	323.00	0.58	0.47	0.15	1533.4	1262.2	404.1
Chambersburg	Sec+P Rowl		None	3.54	2.74	2.74	1.30	1.30	1.30	38.4	29.7	29.7
Gettysburg	Secondary		None	1.39	1.50	1.50	6.25	6.25	6.25	72.5	78.2	78.2
Waynesboro	Secondary		None	0.48	0.83	0.90	6.25	6.25	6.25	25.0	43.3	46.9
Pennsylvania Total				5.41	5.07	5.14				135.9	151.2	154.8

End of Table

Phosphorus Loads from POTWs > 1 mgd  
Rappahannock River Basin

Facility	Treatment Level	NPDES Flow (mgd)	NPDES P (mg/l)	Avg Flow (mgd)			Avg P (mg/l)			Avg Load (lb/d)		
				1980	1983	1984	1980	1983	1984	1980	1983	1984
Culpeper	AWT	3.0	None	1.38	1.30	1.59	2.50	2.50	2.50	28.8	27.1	33.2
Fredericksburg	Secondary	3.5	None	2.03	2.58	2.77	6.25	6.25	6.25	105.8	134.5	144.4
Massaponax	Secondary	3.0	None	1.21	1.53	1.67	4.92	6.27	6.27	49.6	80.0	87.3
Stafford Cy.	Secondary	1.5	None	0.79	0.82	0.85	6.25	6.25	6.25	41.2	42.7	44.3
Warrenton	Secondary	1.0	None	0.81	1.31	1.36	6.25	6.25	6.25	42.2	68.3	70.9
Total				6.22	7.54	8.24				267.6	352.6	380.1

York River Basin

Ashland	Secondary	1.22	None	0.76	0.79	0.82	6.25	6.25	6.25	39.6	41.2	42.7
Hanover Cy.	Secondary	2.50	None	0.52	1.72	1.72	1.00	1.00	1.00	4.3	14.3	14.3
York River	Secondary	15.0	None		6.99	6.06		7.08	7.12		412.7	359.8
Total				1.28	9.50	8.60				44.0	468.3	416.9



Phosphorus Loads from POTWs > 1 mgd  
James River Basin

Facility	Treatment Level	NPDES Flow(mgd)	NPDES P(mg/l)	Avg Flow (mgd)			Avg P (mg/l)			Avg Load (lb/d)		
				1980	1983	1984	1980	1983	1984	1980	1983	1984
Army Base	Secondary	14.0	None	12.38	13.39	14.15	5.60	4.65	4.51	578.2	519.3	532.2
Boat Harbor	Secondary	25.0	None	19.12	18.21	17.81	3.50	5.07	6.00	558.1	770.0	891.2
Buena Vista	Primary	2.25	None	1.32	1.85	1.98	7.20	7.20	7.20	79.3	111.1	118.9
Chesapeake	Secondary	30.0	None	23.09	21.39	16.83	6.10	6.06	6.83	1174.7	1081.1	958.7
Clifton Forge	Secondary	2.0	None	0.56	1.42	1.24	6.25	6.25	6.25	29.2	74.0	64.6
Covington	Primary	3.0	None	1.90	1.73	1.93	7.20	7.20	7.20	114.1	103.9	115.9
Falling Creek	Secondary	9.0	None	7.58	9.32	9.91	8.40	8.40	8.40	531.0	652.9	694.3
Farmville	Secondary	1.05	None	0.17	0.31	0.31	6.25	6.25	6.25	8.9	16.2	16.4
Ft. Eustis	Secondary	3.0	None	1.30	1.56	1.59	6.25	6.25	6.25	67.8	81.3	82.9
Hopewell	Secondary	50.0	None	36.31	34.16	33.49	1.45	1.45	1.45	439.1	413.1	405.0
James River	Secondary	20.0	None	14.26	14.72	10.25	7.40	5.45	6.26	880.1	669.1	535.1
Lamberts Point	Primary	33.0	None	20.61	23.86	18.51	4.50	2.63	3.83	773.5	523.4	591.3
Lexington	Secondary	2.0	None	0.77	1.03	1.01	6.25	6.25	6.25	40.1	53.7	52.6
Lynchburg	Secondary	22.0	None	11.50	13.04	13.00	6.25	6.25	6.25	599.4	679.7	677.6
Moore's Creek	Secondary	15.0	None	5.86	9.80	9.91	6.25	6.25	6.25	305.5	510.8	516.6
Nansemond	Secondary	10.0	None		5.22	6.64		7.18	6.62		312.6	366.6
Petersburg	Secondary	15.0	None	11.18	10.38	10.31	6.21	9.60	9.60	579.0	831.1	825.5
Pinners Point	Primary	15.0	None	9.69	9.06	9.74	7.20	7.20	7.20	581.9	544.0	584.9
Proctors Creek	Secondary	4.0	None	2.05	3.42	3.78	6.25	6.25	4.90	106.9	178.3	154.5
Richmond	Secondary	70.0	None	61.03	66.20	66.78	6.50	6.50	6.50	3308.4	3588.7	3620.1
Williamsburg	Secondary	9.6	None	7.27	8.18	9.05	3.70	1.80	2.75	224.3	122.8	207.6
Total				247.95	268.25	258.22				10979.4	11836.9	12012.4

APPENDIX II

Phosphorus Loads at POTWs With  
Flows Greater Than 1 mgd  
(NPDES and Future Reduced Loads)

Phosphorus Loads at POTWs > 1 mgd  
Upper Susquehanna River Basin

Facility	Treatment Level	NPDES P (mg/l)	NPDES Flow (mgd)	NPDES (lb/day)	P Loads (lb/day) - Various Control Programs				
					15%	25%	2 mg/l	1 mg/l	.5 mg/l
Dallas Area	Secondary	None	2.20	114.7	97.5	86.0	36.7	18.3	9.2
Hazleton	Secondary	None	5.80	302.3	257.0	226.7	96.7	48.4	24.2
Jermy-Archbold	Secondary	None	3.00	156.4	132.9	117.3	50.0	25.0	12.5
Lower Lkwna	Secondary	None	6.00	312.8	265.8	234.6	100.1	50.0	25.0
Scranton	Secondary	None	28.00	1459.5	1240.6	1094.6	467.0	233.5	116.8
Throop	Secondary	None	7.00	364.9	310.1	273.7	116.8	58.4	29.2
Wyoming Valley	Primary	None	40.00	2401.9	2041.6	1801.4	667.2	333.6	166.8
Total			92.00	5112.4	4345.6	3834.3	1534.6	767.3	383.6
Load Reduction (%)					15.0	25.0	70.0	85.0	92.5

Phosphorus Loads at POTWs > 1 mgd  
Lower Susquehanna River Basin

Facility	Treatment Level	NPDES P(mg/l)	NPDES Flow(mgd)	NPDES Load (lb/day)	P Loads (lb/day) - Various Control Programs				
					15%	25%	2 mg/l	1 mg/l	.5 mg/l
Altoona East	Secondary	None*	5.50	286.7	243.7	215.0	91.7	45.9	22.9
Altoona West	Secondary	None*	6.50	338.8	288.0	254.1	108.4	54.2	27.1
Carlise Boro	Sec+P Rvvl	1.0	6.00	50.0	50.0	50.0	50.0	50.0	25.0
Derry Twp	Sec+P Rvvl	2.0	5.00	83.4	83.4	83.4	83.4	41.7	20.9
Dover Twp	Sec+P Rvvl	None*	1.75	0.0	0.0	0.0	29.2	14.6	7.3
Dover Boro	Secondary	None*	0.30	15.6	13.3	11.7	5.0	2.5	1.3
E. Pennsboro	Sec+P Rvvl	2.0	3.70	61.7	61.7	61.7	61.7	30.9	15.4
Elizabeth Town	Sec+P Rvvl	2.0	3.00	50.0	50.0	50.0	50.0	25.0	12.5
Ephrata STP	Secondary	2.0	3.80	63.4	63.4	63.4	63.4	31.7	15.8
Hampton STP	Sec+P Rvvl	2.0	1.76	29.4	29.4	29.4	29.4	14.7	7.3
Hanover	Secondary	None*	2.88	150.1	127.6	112.6	48.0	24.0	12.0
Harrisburg	Sec+P Rvvl	2.0	30.90	515.4	515.4	515.4	515.4	257.7	128.9
Huntington	Primary	None*	2.50	150.1	127.6	112.6	41.7	20.9	10.4
Lancaster	Secondary	None*	11.40	594.2	505.1	445.7	190.2	95.1	47.5
Lancaster North	Secondary	None*			***** to be abandoned *****				
Lancaster South	Secondary	None*	29.73	1549.7	1317.2	1162.3	495.9	247.9	124.0
Lebanon STP	Sec+P Rvvl	2.0	6.60	110.1	110.1	110.1	110.1	55.0	27.5
Lemoyne	Sec+P Rvvl	2.0	2.10	35.0	35.0	35.0	35.0	17.5	8.8
Hampden Twp	Sec+P Rvvl	2.0	2.50	41.7	41.7	41.7	41.7	20.9	10.4
Lititz Twp	Sec+P Rvvl	2.0	3.50	58.4	58.4	58.4	58.4	29.2	14.6
Lower Allen	Sec+P Rvvl	2.0	5.95	99.2	99.2	99.2	99.2	49.6	24.8
Mechanicsburg	Sec+P Rvvl	2.0	2.08	34.7	34.7	34.7	34.7	17.3	8.7
New Cumberland	Sec+P Rvvl	2.0	1.25	20.9	20.9	20.9	20.9	10.4	5.2
Penn Twp	Sec+P Rvvl	2.0	4.20	70.1	70.1	70.1	70.1	35.0	17.5
Shippensburg	Sec+P Rvvl	0.5	2.75	11.5	11.5	11.5	45.9	22.9	11.5
Springettsburg	Secondary	None*	12.80	667.2	567.1	500.4	213.5	106.8	53.4
Swatara	Secondary	None*	3.00	156.4	132.9	117.3	50.0	25.0	12.5
Tyrone	Secondary	None*	9.00	469.1	398.8	351.8	150.1	75.1	37.5
York	Sec+P Rvvl	2.0	26.00	433.7	433.7	433.7	433.7	216.8	108.4
Mt. Holly Spgs	Sec+P Rvvl	2.0	0.60	10.0	10.0	10.0	10.0	5.0	2.5
Total			197.05	6156.5	5499.8	5062.0	3236.8	1643.4	821.7
Load Reduction (%)					10.7	17.8	47.4	73.3	86.7

\* 6.25 mg/l for NPDES loads (secondary treatment)  
7.20 mg/l for NPDES loads (primary treatment)

Phosphorus Loads at POTWs > 1 mgd  
Western Chesapeake & Upper Bay Area

Facility	Treatment Level	NPDES P (mg/l)	NPDES Flow (mgd)	NPDES Load (lb/day)	P Loads (lb/day) - Various Control Programs				
					15%	25%	2 mg/l	1 mg/l	.5 mg/l
Aberdeen City	Sec+P Rowl	2.0	4.00	66.7	66.7	66.7	66.7	33.4	16.7
Aberdeen P.G.	Sec+P Rowl	2.0	4.00	66.7	66.7	66.7	66.7	33.4	16.7
Annapolis	Secondary	None*	10.00	522.1	443.8	391.6	166.8	83.4	41.7
Back River	Sec+P Rowl	3.0	180.00	4503.6	4503.6	4503.6	3002.4	1501.2	750.6
Broad Creek	Secondary	None*	0.50	26.1	22.2	19.5	8.3	4.2	2.1
Broad Neck	Secondary	None*	4.00	208.5	177.2	156.4	66.7	33.4	16.7
Broadwater	Secondary	None*	2.00	104.3	88.6	78.2	33.4	16.7	8.3
Cox Creek	Secondary	2.0	12.50	208.5	208.5	208.5	208.5	104.3	52.1
Edgewood Arsnl	Sec+P Rowl	2.0	3.00	50.0	50.0	50.0	50.0	25.0	12.5
Freedom Dist.	Secondary	None*	1.80	93.8	79.8	70.4	30.0	15.0	7.5
Harve de Grace	Primary	2.0	1.50	25.0	25.0	25.0	25.0	12.5	6.3
Patapsco	Secondary	2.0	70.00	1167.6	1167.6	1167.6	1167.6	583.8	291.9
Perryville	Secondary	2.0	1.65	27.5	27.5	27.5	27.5	13.8	6.9
Sod Run	Sec+P Rowl	2.0	10.00	166.8	166.8	166.8	166.8	83.4	41.7
Total			304.95	7237.2	7094.0	6998.6	5086.6	2543.3	1271.6
Load Reduction (%)					2.0	3.3	29.7	64.9	82.4

\* 6.25 mg/l for NPDES loads (secondary treatment)

Phosphorus Loads at POTWs > 1 mgd  
Eastern Shore, Maryland

Facility	Treatment Level	NPDES P (mg/l)	NPDES Flow (mgd)	NPDES Load (lb/day)	P loads (lb/day) - Various Control Programs				
					15%	25%	2 mg/l	1 mg/l	.5 mg/l
Cambridge	Secondary	None*	8.10	422.2	358.9	316.7	135.1	67.6	33.8
Crisfield	Secondary	None*	1.00	52.1	44.3	39.1	16.7	8.3	4.2
Eastern	Secondary	None*	2.00	104.3	88.6	78.2	33.4	16.7	8.3
Elkton	Secondary	2.0	1.35	22.5	22.5	22.5	22.5	11.3	5.6
Hurlock	Secondary	None*	1.10	57.3	48.7	43.0	18.3	9.2	4.6
Northeast River	Sec+P Rowl	2.0	2.00	33.4	33.4	33.4	33.4	16.7	8.3
Pocomoke City	Secondary	None*	1.00	52.1	44.3	39.1	16.7	8.3	4.2
Salisbury	Secondary	None*	6.80	354.5	301.3	265.8	113.4	56.7	28.4
Total			23.35	1098.4	942.0	837.8	389.5	194.7	97.4
Load Reduction (%)					14.2	23.7	64.5	82.3	91.1

\* 6.25 mg/l for NPDES loads (secondary treatment)

Phosphorus Loads at POTWs > 1 mgd  
Patuxent River Basin

Facility	Treatment Level	NPDES P (mg/l)	NPDES Flow (mgd)	NPDES Load (lb/day)	P Loads (lb/day) - Various Control Programs				
					15%	25%	2 mg/l	1 mg/l	.5 mg/l
Bowie	Secondary	1.0	3.30	27.5	27.5	27.5	27.5	27.5	13.8
Ft. Meade	Sec+P Rmvl	0.3	4.50	11.3	11.3	11.3	11.3	11.3	11.3
Horsepen	Secondary	None*	1.00	52.1	44.3	39.1	16.7	8.3	4.2
Maryland City	Secondary	1.0	0.75	6.3	6.3	6.3	6.3	6.3	3.1
Md. House Crctn	Secondary	2.0	1.15	19.2	19.2	19.2	19.2	9.6	4.8
Parkway	Secondary	1.0	7.50	62.6	62.6	62.6	62.6	62.6	31.3
Patuxent	Secondary	1.0	4.00	33.4	33.4	33.4	33.4	33.4	16.7
L. Patuxent	Sec+P Rmvl	1.0	13.40	111.8	111.8	111.8	111.8	111.8	55.9
Western Branch	Secondary	1.0	17.60	146.8	146.8	146.8	146.8	146.8	73.4
Total			53.20	470.8	463.0	457.8	435.3	417.4	214.3
Load Reduction (%)					1.7	2.8	7.5	11.3	54.5

\* 6.25 mg/l for NPDES load (secondary treatment)

Phosphorus Loads at POTWs > 1 mgd  
Potomac River Basin

Facility	Treatment Level	NPDES P(mg/l)	NPDES Flow(mgd)	NPDES Load (lb/day)	P Loads (lb/day) - Various Control Programs				
					15%	25%	2 mg/l	1 mg/l	.5 mg/l
Alexandria	AWT+P Rmvl	1.0/0.2	54.00	330.3	330.3	330.3	330.3	330.3	150.1
Aquia Regional	AWT+P Rmvl	2.0	3.00	50.0	50.0	50.0	50.0	25.0	12.5
Arlington	AWT+P Rmvl	1.0/0.2	30.00	183.5	183.5	183.5	183.5	183.5	100.1
Dale City #1	AWT+P Rmvl	0.4	4.00	13.3	13.3	13.3	13.3	13.3	13.3
Dale City #B	AWT+P Rmvl	0.4	2.00	6.7	6.7	6.7	6.7	6.7	6.7
Fishersville	Secondary	None*	2.00	104.3	88.6	78.2	33.4	16.7	8.3
Front Royal	Secondary	None*	2.00	104.3	88.6	78.2	33.4	16.7	8.3
Harrisonburg	Secondary	None*	8.00	417.0	354.5	312.8	133.4	66.7	33.4
Leesburg	AST	None*	1.30	67.8	57.6	50.8	21.7	10.8	5.4
L. Hunting Ck	AST	None*	6.60	344.0	292.4	258.0	110.1	55.0	27.5
Lower Potomac	AWT+P Rmvl	0.2	36.00	60.0	60.0	60.0	60.0	60.0	60.0
Mainside	AWT+P Rmvl	0.5	2.00	8.3	8.3	8.3	8.3	8.3	8.3
Mooney	AWT+P Rmvl	0.2	12.00	20.0	20.0	20.0	20.0	20.0	20.0
Staunton	Secondary	None*	4.50	234.6	199.4	175.9	75.1	37.5	18.8
Upper Occoquan	AWT+P Rmvl	0.1	15.00	12.5	12.5	12.5	12.5	12.5	12.5
Waynesboro	Secondary	None*	4.00	208.5	177.2	156.4	66.7	33.4	16.7
Winchester	Secondary	None*	5.36	199.5	169.6	149.6	89.4	44.7	22.4
	Virginia Total		191.76	2364.6	2112.6	1944.6	1247.8	941.3	554.4
	Load Reduction (%)				10.7	17.8	47.2	60.2	76.6
Cumberland	Secondary	None*	15.00	781.9	664.6	586.4	250.2	125.1	62.6
Ft. Dietrick	Secondary	None*	2.00	104.3	88.6	78.2	33.4	16.7	8.3
Frederick	Secondary	None*	7.00	364.9	310.1	273.7	116.8	58.4	29.2
Hagerstown	Secondary	None*	8.00	417.0	354.5	312.8	133.4	66.7	33.4
Halfway	Secondary	None*	1.60	83.4	70.9	62.6	26.7	13.3	6.7
La Plata	Secondary	2.0	1.00	16.7	16.7	16.7	16.7	8.3	4.2
Mattawoman	Secondary	None*	5.00	260.6	221.5	195.5	83.4	41.7	20.9
Pine Hill Run	Secondary	None*	4.50	234.6	199.4	175.9	75.1	37.5	18.8
Piscataway	Sec+P Rmvl	0.2	30.00	50.0	50.0	50.0	50.0	50.0	50.0
Seneca Creek	Sec+P Rmvl	1.3	5.00	54.2	54.2	54.2	54.2	41.7	20.9
Westminster	Secondary	None*	3.00	156.4	132.9	117.3	50.0	25.0	12.5
	Maryland Total		82.10	2523.9	2163.4	1923.2	889.9	484.6	267.3
	Load Reduction (%)				14.3	23.8	64.7	80.8	89.4
Blue Plain	Sec+P Rmvl	0.23	309.00	592.7	592.7	592.7	592.7	592.7	592.7
	Load Reduction (%)				0.0	0.0	0.0	<del>100.0</del> 60.0	0.0
Chambersburg	Sec+P Rmvl	None*	2.74	142.8	121.4	107.1	45.7	22.9	11.4
Gettysburg	Secondary	None*	1.50	78.2	66.5	58.6	25.0	12.5	6.3
Waynesboro	Secondary	None*	0.90	46.9	39.9	35.2	15.0	7.5	3.8
	Pennsylvania Total		5.14	267.9	227.7	200.9	85.7	42.9	21.4
	Load Reduction (%)				15.0	25.0	68.0	84.0	92.0
	Potomac Basin Total		588.00	5749.1	5096.5	4661.4	2816.2	2061.4	1435.9
	Load Reduction (%)				11.4	18.9	51.0	64.1	75.0

\* 6.25 mg/l for NPDES loads (secondary treatment)



Phosphorus Loads at POTWs > 1 mgd  
Rappahannock River Basin

Facility	Treatment Level	NPDES P(mg/l)	NPDES Flow(mgd)	NPDES load (lb/day)	P Loads (lb/day) - Various Control Programs				
					15%	25%	2 mg/l	1 mg/l	.5 mg/l
Culpeper	AWT	None*	3.00	156.4	132.9	117.3	50.0	25.0	12.5
Fredericksburg	Secondary	None*	3.50	182.4	155.1	136.8	58.4	29.2	14.6
Massaponax	Secondary	None*	3.00	156.4	132.9	117.3	50.0	25.0	12.5
Stafford Cy.	Secondary	None*	1.50	78.2	66.5	58.6	25.0	12.5	6.3
Warrenton	Secondary	None*	1.00	52.1	44.3	39.1	16.7	8.3	4.2
Basin Total			12.00	625.5	531.7	469.1	200.2	100.1	50.0
Load Reduction (%)					15.0	25.0	68.0	84.0	92.0

Phosphorus Loads at POTWs > 1 mgd  
York River Basin

Ashland	Secondary	None*	1.22	63.6	54.1	47.7	20.3	10.2	5.1
Hanover Cy.	Secondary	None*	2.50	130.3	110.8	97.7	41.7	20.9	10.4
York River	Secondary	None*	15.00	781.9	664.6	586.4	250.2	125.1	62.6
Basin Total			18.72	975.8	829.4	731.8	312.2	156.1	78.1
Load Reduction (%)					15.0	25.0	68.0	84.0	92.0

\* 6.25 mg/l for NPDES loads (secondary treatment)

Phosphorus Loads at POTWs > 1 mgd  
James River Basin

Facility	Treatment Level	NPDES P (mg/l)	NPDES Flow (mgd)	NPDES load (lb/day)	P Loads (lb/day) - Various Control Programs				
					15%	25%	2 mg/l	1 mg/l	.5 mg/l
Army Base	Secondary	None*	14.00	729.8	626.3	547.3	233.5	116.8	58.4
Boat Harbor	Secondary	None*	25.00	1303.1	1107.7	977.3	417.0	208.5	104.3
Buena Vista	Primary	None*	2.25	135.1	114.8	101.3	37.5	18.8	9.4
Chesapeake	Secondary	None*	30.00	1563.8	1329.2	1172.8	500.4	250.2	125.1
Clifton Forge	Secondary	None*	2.00	104.3	88.6	78.2	33.4	16.7	8.3
Covington	Primary	None*	3.00	180.1	153.1	135.1	50.0	25.0	12.5
Falling Creek	Secondary	None*	9.00	469.1	398.8	351.8	150.1	75.1	37.5
Faraville	Secondary	None*	1.05	54.7	46.5	41.0	17.5	8.8	4.4
Ft. Eustis	Secondary	None*	3.00	156.4	132.9	117.3	50.0	25.0	12.5
Hopewell	Secondary	None*	50.00	604.7	514.0	453.5	934.0	417.0	208.5
James River	Secondary	None*	20.00	1042.5	886.1	781.9	333.6	166.8	83.4
Lapperts Point	Primary	None*	33.00	1981.6	1684.3	1486.2	550.4	275.2	137.6
Lexington	Secondary	None*	2.00	104.3	88.6	78.2	33.4	16.7	8.3
Lynchburg	Secondary	None*	22.00	1146.8	974.7	860.1	367.0	183.5	91.7
Moore's Creek	Secondary	None*	15.00	781.9	664.6	586.4	250.2	125.1	62.6
Nansemond	Secondary	None*	10.00	521.3	443.1	390.9	166.8	83.4	41.7
Petersburg	Secondary	None*	15.00	781.9	664.6	586.4	250.2	125.1	62.6
Pipers Point	Primary	None*	15.00	900.7	765.6	675.5	250.2	125.1	62.6
Proctors Creek	Secondary	None*	4.00	208.5	177.2	156.4	65.7	33.4	16.7
Richmond	Secondary	None*	70.00	3648.8	3101.4	2736.6	1167.6	583.8	291.9
Williamsburg	Secondary	None*	9.60	220.2	187.1	165.1	160.1	80.1	40.0
Basin Total			354.90	16639.2	14143.4	12479.4	5919.7	2959.9	1479.9
Load Reduction (%)					15.0	25.0	64.4	82.2	91.1

\* 6.25 mg/l for NPDES loads (secondary treatment)  
 7.20 mg/l for NPDES loads (primary treatment)  
 1.45 mg/l for Hopewell STP  
 2.75 mg/l for Williamsburg STP