Technical Report No. 12B

Preliminary Economic Analysis of the Draft Plan for the Lake Champlain Basin Program

Lake Champlain Basin Program

Prepared by
Timothy P. Holmes, Holmes & Associates and
Anthony Artuso, Institute for Public Affiars
and Policy Studies, University of Charleston

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Mid-Range Reduction Scenario

	s ($millions)		Retrofit Costs ($millions)			Retrofit Costs ($millions)		Tot. Costs to Meet Policy 2	
	Feed		FILTER	FILTER		CLAR	CLAR	($ millions)	
FACILITY	O/M	FILTER?	CAP	O/M	CLAR?	CAP	O/M	CAP	O/M

Benson	0.0082	Y	0.225	0.0059	Y	0.175	0.0025		
West Pawlet	0.0092	Y	0.225	0.0075	Y	0.053	0.0012		
Fort Ann	0.0124	Y	0.238	0.0104	Y	0.105	0.0040	0	0
Washington Correctional									
Orwell	0.0088	Y	0.225	0.0072	Y	0.175	0.0032		
International Paper Co.									
Westport	0.0128	Y	0.252	0.0110	Y	0.105	0.0042	0	0
Pittsford	0.011	Y	0.225	0.0088	Y	0.053	0.0023		
Wallingford	0.013	Y	0.25	0.011	Y	0.059	0.0028		
Green Mt. Trout Farm									
Pittsford Fish Hatchery									
Marshfield	0.0095	Y	0.225	0.0077	Y	0.175	0.0037		
Plainfield	0.0122	Y	0.225	0.0098	Y	0.053	0.0026		
Stowe		N			N			0	0
Williamstown	0.014	Y	0.29	0.013	Y	0.225	0.006		
IBM									
Weed Fish Culture Station									
Ausable Forks	0.0138	Y	0.288	0.0128	Y	0.222	0.0060	0	0
Peru/Valcour	0.0095	Y	0.225	0.0077	Y	0.105	0.0028	0	0
Wadhams	0.0081	Y	0.225	0.0056	Y	0.105	0.0020	0	0
Plattsburgh/Champlain Park	0.0000	Y	6.500	0.3300	Y	1.380	0.0310	0.000	0.0310
St. Armand	0.0102	Y	0.225	0.0083	Y	0.175	0.0042	0	0
Adirondak Fish Culture Station									
Fairfax	0.011	Y	0.225	0.0087	Y	0.175	0.0048		
Northwest State Correctional									
St. Albans City		N			N			0	
Newport Center		N			N				
North Troy	0.0125	Y	0.235	0.0105	Y	0.056	0.0027		
Sheldon Springs	0.01	Y	0.225	0.0082	Y	0.053	0.0012		
Rock Tenn									
Abercorn									
Eastman									

Mid-Range Reduction Scenario

	Scenario Costs - 0.8 mg/l			Tot. Costs to Meet Policy		Inc. Costs to Meet Policy 3		Inc. Scenario Costs -	
	Pres. Val.	Annualized	Unit Cost	($ millions)		($ millions)		Pres. Val.	Annualized
FACILITY	($ 000's)	($ 000's)	($ /kg-yr)	CAP	O/M	CAP	O/M	($ 000's)	($ 000's)

	0	0						0	0
Benson	0	0	0	0.465	0.0166	0.465	0.0166	0	0
West Pawlet	0	0	0	0.343	0.0179	0.343	0.0179	0	0
Fort Ann	0	0	0	0.408	0.0268	0.408	0.0268	0	0
Washington Correctional	0	0	0					0	0
Orwell	0	0	0	0.465	0.0192	0.465	0.0192	0	0
International Paper Co.	0	0	0					0	0
Westport	0	0	0	0.422	0.0280	0.422	0.028	0	0
Pittsford	0	0	0	0.343	0.0221	0.343	0.0221	0	0
Wallingford	0	0	0	0.374	0.0268	0.374	0.0268	0	0
Green Mt. Trout Farm	0	0	0					0	0
Pittsford Fish Hatchery	0	0	0					0	0
Marshfield	0	0	0	0.465	0.0209	0.465	0.0209	0	0
Plainfield	0	0	0	0.343	0.0246	0.343	0.0246	0	0
Stowe	0	0	0	0	0	0	0	0	0
Williamstown	0	0	0	0.58	0.033	0.58	0.033	0	0
IBM	0	0	0					0	0
Weed Fish Culture Station	0	0	0					0	0
Ausable Forks	0	0	0	0.575	0.0326	0.575	0.0326	0	0
Peru/Valcour	0	0	0	0.395	0.0200	0.395	0.02	0	0
Wadhams	0	0	0	0.395	0.0157	0.395	0.0157	0	0
Plattsburgh/Champlain Park	0	0	0	1.500	0.0310	1.5	0	0	0
St. Armand	0	0	0	0.465	0.0227	0.465	0.0227	0	0
Adirondak Fish Culture Station	0	0	0					0	0
Fairfax	0	0	0	0.465	0.0245	0.465	0.0245	0	0
Northwest State Correctional	0	0	0					0	0
St. Albans City	0	0	0	0	0	0	0	0	0
Newport Center	0	0	0			0	0	0	0
North Troy	0	0	0	0.356	0.0257	0.356	0.0257	0	0
Sheldon Springs	0	0	0	0.343	0.0194	0.343	0.0194	0	0
Rock Tenn	0	0	0					0	0
Abercorn	0	0	0					0	0
Eastman	0	0	0					0	0

Mid-Range Reduction Scenario

	0.5 mg/l	Total Point Source Scenario Costs			
	Unit Cost	Total Cap.	Total O&M	Pres. Value	Total Annualized
FACILITY	($ /kg-yr)	($ 000's)	($ 000's)	($ 000's)	($ 000's)

		0	0		
Benson	0	0	0	0	0
West Pawlet	0	0	0	0	0
Fort Ann	0	0	0	0	0
Washington Correctional	0	0	0	0	0
Orwell	0	0	0	0	0
International Paper Co.	0	0	0	0	0
Westport	0	0	0	0	0
Pittsford	0	0	0	0	0
Wallingford	0	0	0	0	0
Green Mt. Trout Farm	0	0	0	0	0
Pittsford Fish Hatchery	0	0	0	0	0
Marshfield	0	0	0	0	0
Plainfield	0	0	0	0	0
Stowe	0	0	0	0	0
Williamstown	0	0	0	0	0
IBM	0	0	0	0	0
Weed Fish Culture Station	0	0	0	0	0
Ausable Forks	0	0	0	0	0
Peru/Valcour	0	0	0	0	0
Wadhams	0	0	0	0	0
Plattsburgh/Champlain Park	0	0	0	0	0
St. Armand	0	0	0	0	0
Adirondak Fish Culture Station	0	0	0	0	0
Fairfax	0	0	0	0	0
Northwest State Correctional	0	0	0	0	0
St. Albans City	0	0	0	0	0
Newport Center	0	0	0	0	0
North Troy	0	0	0	0	0
Sheldon Springs	0	0	0	0	0
Rock Tenn	0	0	0	0	0
Abercorn	0	0	0	0	0
Eastman	0	0	0	0	0

Mid-Range Reduction Scenario

FACILITY	*LAKE SEGMENT	STATE	TYPE	BASIN	EXISTING FLOW (mgd)	PERMITTED FLOW (mgd)	EXISTING CONC. (mg/l)	PERMITTED LOAD (kg/yr)	EXISTING LOAD (kg/yr)
---	---	---	---	---	---	---	---	---	---
Notre-Dame-de-Stanbridge	12	PQ	MUN	PIKE	0.111	0.111	4	613	613
Potton	12	PQ	MUN	MISS	0.079	0.079	4	436	436
Synder et Fils*	12	PQ	IND	PIKE	0.17	0	4	0	939
Stanbridge Station	12	PQ	MUN	PIKE	0.066	0.066	4	365	365
Stukely-Sud	12	PQ	MUN	MISS	0.016	0.016	4	88	88
Alburg	13	VT	MUN	LAKE	0.069	0.13	0.03	5	2.85867
Altona Correctional	13	NY	IND	GCHA	0.066	0.08	2	221	182.292
Vergennes	4	VT	MUN	LAKE	0.467	0.66	0.7	911	451
Middlebury	4	VT	MUN	OTTE	1.103	2.2	28.69	87,166	43,702
Essex Jct.	5	VT	MUN	WINO	1.487	2.75	0.78	3798	1,602
South Burlington Airport Park.	5	VT	MUN	WINO	1.313	2.3	0.76	3176	1,378
Winooski	5	VT	MUN	WINO	0.837	1.2	0.52	1657	601
Hinesburg	6	VT	MUN	LAPL	0.177	0.25	17.09	345	4177.42833
Shelburne F.D.#1	6	VT	MUN	LAKE	0.306	0.31	0.67	428	283.13262
Shelburne F.D.#2	6	VT	MUN	LAKE	0.278	0.45	0.7	621	268.7426
South Burlington Bart. Bay	6	VT	MUN	LAKE	0.727	0.8	0.58	1105	582.31246
Burlington Main	7	VT	MUN	LAKE	3.841	5.3	2.12	7319	11,245
Swanton	12	VT	MUN	LAKE	0.742	0.9	2.38	1243	2,439
Castleton	1	VT	MUN	POUL	0.263	0.36	2.15	1069	780.88645
Fair Haven	1	VT	MUN	POUL	0.289	0.5	3.02	2085	1205.30918
Poultney	1	VT	MUN	POUL	0.318	0.35	2.14	1034	939.79812
Granville	1	NY	MUN	METT	0.793	0.65	1.5	1346	1642.6995
Whitehall	1	NY	MUN	LAKE	0.539	0.6	0.96	795	714.58464
Great Meadows Correctional	1	NY	IND	BACA	0.371	0.356	2	983	1024.702
Ticonderoga	2	NY	MUN	LAKE	0.902	1	1.12	1,547	1,395
Port Henry	3	NY	MUN	LAKE	0.588	0.44	1.92	1167	1559.09376
Brandon	4	VT	MUN	OTTE	0.327	0.7	1.4	1,353	632
Proctor	4	VT	MUN	OTTE	0.248	0.325	2.18	978	747
Rutland City	4	VT	MUN	OTTE	5.407	6.8	2.03	19,063	15,158
West Rutland	4	VT	MUN	OTTE	0.236	0.325	2	898	652
Barre City	5	VT	MUN	WINO	2.938	3.8	1.36	7137	5,518
Burlington East	5	VT	MUN	WINO	0.805	1	0.68	1381	756

Mid-Range Reduction Scenario

FACILITY	POLICY 1 CONC. (mg/l)	POLICY 1 LOAD (kg/yr)	POLICY 2 CONC. (mg/l)	POLICY 2 LOAD (kg/yr)	POLICY 3 CONC. (mg/l)	POLICY 3 LOAD (kg/yr)	Retrofit for Pol. 2 (0=No, 1=Yes)	Retrofit for Pol. 3 (0=No, 1=Yes)
Notre-Dame-de-Stanbridge	1	153	1	153	1.00	153	0.00	0.00
Potton	1	109	1	109	1.00	109	0.00	0.00
Synder et Fils*	0	0	0	0	0.00	0	0.00	0.00
Stanbridge Station	1	91	1	91	1.00	91	0.00	0.00
Stukely-Sud	1	22	1	22	1.00	22	0.00	0.00
Alburg	0.03	5	0.03	5	0.03	5	0.00	0.00
Altona Correctional	2	221	2.00	221	2.00	221	0.00	0.00
Vergennes	1	911	1	911	0.50	456	1.00	1.00
Middlebury	0.8	2431	0.8	2431	0.50	1519	1	0.00
Essex Jct.	0.8	3038	0.8	3038	0.50	1899	1	0.00
South Burlington Airport Park.	0.8	2541	0.8	2541	0.50	1588	1.00	1
Winooski	0.8	1326	0.8	1326	0.50	829	1.00	1
Hinesburg	0.8	276	0.8	276	0.50	173	1.00	0
Shelburne F.D.#1	0.8	342	0.8	342	0.50	214	1.00	0
Shelburne F.D.#2	0.8	497	0.8	497	0.50	311	1.00	0
South Burlington Bart. Bay	0.8	884	0.8	884	0.50	552	1.00	0
Burlington Main	0.8	5855	0.8	5855	0.50	3660	1.00	0
Swanton	1	1243	1	1243	0.50	621	1.00	1
Castleton	0.8	398	0.8	398	0.50	249	1	0
Fair Haven	0.8	552	0.8	552	0.50	345	1	0
Poultney	0.8	387	0.8	387	0.50	242	1	0
Granville	1.5	1346	0.80	718	0.50	449	1	0
Whitehall	0.96	795	0.80	663	0.50	414	0	0
Great Meadows Correctional	2	983	0.80	393	0.50	246	1	1
Ticonderoga	1.12	1547	0.80	1105	0.50	691	0	0
Port Henry	1.92	1167	0.80	486	0.50	304	1	0
Brandon	0.8	773	0.8	773	0.50	483	1	0
Proctor	2.18	978	2.18	978	0.50	224	1	1
Rutland City	0.8	7513	0.8	7513	0.50	4695	1	0
West Rutland	0.8	359	0.8	359	0.50	224	1	0
Barre City	0.8	4198	0.8	4198	0.50	2624	1	1
Burlington East	0.8	1105	0.8	1105	0.50	691	1	1

Mid-Range Reduction Scenario

FACILITY	Reduction Pol. 0-2 (kg/yr)	Reduction Pol. 2-3 (kg/yr)	Final Permitted. Load (kg/yr)		TYPE	DESIGN FLOW	CHEM?	Retrofit Cos Chem CAP

Notre-Dame-de-Stanbridge	0	0	153					
Potton	0	0	109					
Synder et Fils*	0	0	0					
Stanbridge Station	0	0	91					
Stukely-Sud	0	0	22					
Alburg	0	0	5		SS	0.13	N	
Altona Correctional	0	0	221					
Vergennes	0	456	456		AL	0.66	N	
Middlebury	84732	911	1,523		AS	2.2	Y	0.132
Essex Jct.	759	1139	1,899		AS	2.75	N	
South Burlington Airport Park.	635	953	1,588		AS	2.3	N	
Winooski	331	497	829		AS	1.2	N	
Hinesburg	69	0	276		AL	0.25	N	
Shelburne F.D.#1	86	0	342		AS	0.31	N	
Shelburne F.D.#2	124	0	497		AS	0.45	N	
South Burlington Bart. Bay	221	0	884		AS	0.8	N	
Burlington Main	1464	0	5,855		AS	5.3	N	
Swanton	0	621	622		AL	0.9	N	
Castleton	671	0	398		AS	0.36	Y	0.073
Fair Haven	1518	0	567		AS	0.5	Y	0.08
Poultney	647	0	387		AS	0.35	Y	0.073
Granville	628	0	718		AS	0.650	Y	0.083
Whitehall	0	0	795		AS	0.600	Y	0.082
Great Meadows Correctional	590	147	246					
Ticonderoga	0	0	1,547		AS	1.000	Y	0.094
Port Henry	681	0	486		AS	0.440	Y	0.078
Brandon	580	0	773		AS	0.7	Y	0.085
Proctor	0	754	224		AL	0.325	Y	0.071
Rutland City	11551	0	7,513		AS	6.8	Y	0.27
West Rutland	539	0	359		AS	0.325	Y	0.071
Barre City	2939	1574	2,624		AS	3.8	Y	0.178
Burlington East	276	414	691		AS	1	N	

Mid-Range Reduction Scenario

	s ($millions)		Retrofit Costs ($millions)			Retrofit Costs ($millions)		Tot. Costs to Meet Policy 2	
	Feed		FILTER	FILTER		CLAR	CLAR	($ millions)	
FACILITY	O/M	FILTER?	CAP	O/M	CLAR?	CAP	O/M	CAP	O/M

Notre-Dame-de-Stanbridge									
Potton									
Synder et Fils*								0	0
Stanbridge Station									
Stukely-Sud									
Alburg		N			N				
Altona Correctional									
Vergennes		N			N			0	0
Middlebury	0.0165	N			Y	0.45	0.014	0.582	0.0305
Essex Jct.		N			N			0	0
South Burlington Airport Park.		Y	1.77	0.08	N			0	0
Winooski		Y	1.15	0.053	N			0	0
Hinesburg		Y	0.4	0.018	Y	0.3	0.0074	0.3	0.0074
Shelburne F.D.#1		Y	0.465	0.021	N			0	0
Shelburne F.D.#2		Y	0.6	0.0275	N			0	0
South Burlington Bart. Bay		Y	0.875	0.04	N			0	0
Burlington Main		Y	3.1	0.15	N			0	0
Swanton		Y	0.95	0.044	N			0	0
Castleton	0.022	Y	0.52	0.023	Y	0.148	0.0065	0.221	0.0285
Fair Haven	0.028	Y	0.65	0.029	Y	0.18	0.0074	0.26	0.0354
Poultney	0.022	Y	0.5	0.026	Y	0.145	0.0063	0.218	0.0283
Granville	0.0335	Y	0.770	0.0350	Y	0.210	0.0083	0.293	0.0418
Whitehall	0.0315	Y	0.725	0.0330	Y	0.201	0.0080	0.283	0.0395
Great Meadows Correctional								0	0
Ticonderoga	0.0442	Y	1.020	0.0465	Y	0.270	0.0097	0.364	0.0539
Port Henry	0.0255	Y	0.590	0.0268	Y	0.167	0.0070	0.245	0.0325
Brandon	0.035	Y	0.8	0.033	Y	0.221	0.0085	0.306	0.0435
Proctor	0.021	Y	0.48	0.0215	Y	0.35	0.0083	0.421	0.0293
Rutland City	0.24	Y	3.6	0.16	Y	0.828	0.022	1.098	0.262
West Rutland	0.021	Y	0.48	0.0215	Y	0.136	0.006	0.207	0.027
Barre City	0.132	Y	2.45	0.118	Y	0.588	0.0175	0.766	0.1495
Burlington East		Y	1.03	0.047	N			0	0

	Scenario Costs - 0.8 mg/l			Tot. Costs to Meet Policy		Inc. Costs to Meet Policy 3		Inc. Scenario Costs -	
	Pres. Val.	Annualized	Unit Cost	($ millions)		($ millions)		Pres. Val.	Annualized
FACILITY	($ 000's)	($ 000's)	($ /kg-yr)	CAP	O/M	CAP	O/M	($ 000's)	($ 000's)

Notre-Dame-de-Stanbridge	0	0	0					0	0
Potton	0	0	0					0	0
Synder et Fils*	0	0	0	0	0			0	0
Stanbridge Station	0	0	0					0	0
Stukely-Sud	0	0	0					0	0
Alburg	0	0	0					0	0
Altona Correctional	0	0	0					0	0
Vergennes	0	0	0	0	0	0	0	0	0
Middlebury	1,051	68	1	0.582	0.0305	0	0	0	0
Essex Jct.	0	0	0	0	0	0	0	0	0
South Burlington Airport Park.	0	0	0	1.77	0.08	1.77	0.08	3,000	195
Winooski	0	0	0	1.15	0.053	1.15	0.053	1,965	128
Hinesburg	414	27	390	0.7	0.0254	0.4	0.018	0	0
Shelburne F.D.#1	0	0	0	0.465	0.021	0.465	0.021	0	0
Shelburne F.D.#2	0	0	0	0.6	0.0275	0.6	0.0275	0	0
South Burlington Bart. Bay	0	0	0	0.875	0.04	0.875	0.04	0	0
Burlington Main	0	0	0	3.1	0.15	3.1	0.15	0	0
Swanton	0	0	0	0.95	0.044	0.95	0.044	1,625	106
Castleton	659	43	64	0.741	0.0515	0.52	0.023	0	0
Fair Haven	796	52	34	0.91	0.0644	0.65	0.029	0	0
Poultney	652	42	66	0.718	0.0543	0.5	0.026	0	0
Granville	935	61	97	1.063	0.0768	0.77	0.035	0	0
Whitehall	0	0	0	1.008	0.0725	0.725	0.033	0	0
Great Meadows Correctional	0	0	0	0	0			0	0
Ticonderoga	0	0	0	1.384	0.1004	1.02	0.0465	0	0
Port Henry	745	48	71	0.835	0.0593	0.59	0.0268	0	0
Brandon	975	63	109	1.106	0.0765	0.8	0.033	0	0
Proctor	871	57	0	0.901	0.0508	0.48	0.0215	811	53
Rutland City	5,126	333	29	4.698	0.422	3.6	0.16	0	0
West Rutland	622	40	75	0.687	0.0485	0.48	0.0215	0	0
Barre City	3,064	199	68	3.216	0.2675	2.45	0.118	4,264	277
Burlington East	0	0	0	1.03	0.047	1.03	0.047	1,753	114

	0.5 mg/l	Total Point Source Scenario Costs			
	Unit Cost	Total Cap.	Total O&M	Pres. Value	Total Annualized
FACILITY	($ /kg-yr)	($ 000's)	($ 000's)	($ 000's)	($ 000's)

Notre-Dame-de-Stanbridge	0	0	0	0	0
Potton	0	0	0	0	0
Synder et Fils*	0	0	0	0	0
Stanbridge Station	0	0	0	0	0
Stukely-Sud	0	0	0	0	0
Alburg	0	0	0	0	0
Altona Correctional	0	0	0	0	0
Vergennes	0	0	0	0	0
Middlebury	0	582	30	1,051	68
Essex Jct.	0	0	0	0	0
South Burlington Airport Park.	205	1,770	80	3,000	195
Winooski	257	1,150	53	1,965	128
Hinesburg	0	300	7	414	27
Shelburne F.D.#1	0	0	0	0	0
Shelburne F.D.#2	0	0	0	0	0
South Burlington Bart. Bay	0	0	0	0	0
Burlington Main	0	0	0	0	0
Swanton	170	949	44	1,625	106
Castleton	0	221	29	659	43
Fair Haven	0	257	35	796	52
Poultney	0	218	28	652	42
Granville	0	293	42	935	61
Whitehall	0	0	0	0	0
Great Meadows Correctional	0	0	0	0	0
Ticonderoga	0	0	0	0	0
Port Henry	0	245	33	745	48
Brandon	0	306	44	975	63
Proctor	70	901	51	1,682	109
Rutland City	0	1,098	262	5,126	333
West Rutland	0	207	27	622	40
Barre City	176	3,216	268	7,328	477
Burlington East	275	1,030	47	1,753	114

FACILITY	*LAKE SEGMENT	STATE	TYPE	BASIN	EXISTING FLOW (mgd)	PERMITTED FLOW (mgd)	EXISTING CONC. (mg/l)	PERMITTED LOAD (kg/yr)	EXISTING LOAD (kg/yr)
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Burlington North	5	VT	MUN	LAKE	1.303	2	1.91	2762	3,437
Montpelier	5	VT	MUN	WINO	2.044	3.97	2.52	13816	7,113
Northfield	5	VT	MUN	WINO	1.096	1.63	2.35	5290	3,557
Richmond	5	VT	MUN	WINO	0.083	0.222	6.12	1876	701
Waterbury	5	VT	MUN	WINO	0.239	0.51	4.95	3486	1,634
Keeseville	5	NY	MUN	AUSA	0.264	0.3	3.25	1346	1,185
Lake Placid	5	NY	MUN	AUSA	1.341	2.5	2.27	7837	4,204
Peru	5	NY	MUN	LAUS	0.254	0.5	4	2762	1,403
Dannemora	8	NY	MUN	SARA	0.699	1.5	3.08	6380	2,973
Plattsburgh City (1.74)	8	NY	MUN	LAKE	8.402	16	0.8	17677	9,283
Saranac Lake	8	NY	MUN	SARA	1.884	2.8	2.06	7966	5,360
Hardwick	9	VT	MUN	LAMO	0.216	0.371	2.75	1,409	820
Jeffersonville	9	VT	MUN	LAMO	0.032	0.077	2	213	88
Johnson	9	VT	MUN	LAMO	0.154	0.2	1.82	503	387
Milton	9	VT	MUN	LAMO	0.163	0.225	0.56	174	126
Morrisville	9	VT	MUN	LAMO	0.335	0.425	2.7	1,585	1,249
Vermont Whey	9	VT	IND	LAMO	0.333	0.425	0.36	458	166
Enosburg Falls	12	VT	MUN	MISS	0.364	0.45	2.65	1647	1,332
Richford	12	VT	MUN	MISS	0.347	0.38	1.04	546	498
Troy/Jay	12	VT	MUN	MISS	0.044	0.2	10.2	2817	620
Bedford	12	PQ	MUN	PIKE	0.729	0.729	4	4027	4,027
Sutton	12	PQ	MUN	MISS	0.268	0.268	4	1480	1,480
Champlain	13	NY	MUN	GCHA	0.323	0.4	2.05	1132	914.42915
Rouses Point	13	NY	MUN	LAKE	0.814	2	1.62	4474	1821.09708
Wyeth-Ayerst, Chazy*	13	NY	IND	LAKE	0.039	0.026	83.8	3009	4513.3842

Mid-Range Reduction Scenario

FACILITY	POLICY 1 CONC. (mg/l)	POLICY 1 LOAD (kg/yr)	POLICY 2 CONC. (mg/l)	POLICY 2 LOAD (kg/yr)	POLICY 3 CONC. (mg/l)	POLICY 3 LOAD (kg/yr)	Retrofit for Pol. 2 (0=No, 1=Yes)	Retrofit for Pol. 3 (0=No, 1=Yes)
Burlington North	0.8	2210	0.8	2210	0.50	1381	1	1
Montpelier	0.8	4386	0.8	4386	0.50	2741	1	1
Northfield	0.8	1801	0.8	1801	0.50	1126	1	1
Richmond	0.8	245	0.8	245	0.50	153	1	1
Waterbury	4.95	3486	4.95	3486	0.50	352	1	1
Keeseville	3.25	1346	0.80	331	0.50	207	1	1
Lake Placid	2.27	7837	0.80	2762	0.50	1726	1	1
Peru	4	2762	0.80	552	0.50	345	1	1
Dannemora	3.08	6380	3.08	6380	0.50	1036	1	1
Plattsburgh City (1.74)	0.87	19224	0.80	17677	0.50	11048	1	1
Saranac Lake	2.06	7966	0.80	3093	0.50	1933	1	1
Hardwick	2.75	1,409	2.75	1409	0.50	256	0	0
Jeffersonville	2	213	2	213	2.00	213	0	0
Johnson	0.8	221	0.8	221	0.50	138	0	0
Milton	0.56	174	0.56	174	0.50	155	0	0
Morrisville	0.8	470	0.8	470	0.50	293	0	0
Vermont Whey	0.78	458	0.78	458	0.50	293	0	0
Enosburg Falls	0.8	497	0.8	497	0.50	311	1	0
Richford	1.04	546	1.04	546	0.50	262	1	1
Troy/Jay	10.2	2817	10.2	2817	0.50	138	1	1
Bedford	1	1007	1	1007	0.50	503	1	1
Sutton	1	370	1	370	0.50	185	1	0
Champlain	2.05	1132	0.80	442	0.50	276	0	0
Rouses Point	1.62	4474	0.80	2210	0.50	1381	0	0
Wyeth-Ayerst, Chazy*	1	36	1.00	36	1.00	36	0	0

Mid-Range Reduction Scenario

FACILITY	Reduction Pol. 0-2 (kg/yr)	Reduction Pol. 2-3 (kg/yr)	Final Permitted. Load (kg/yr)		TYPE	DESIGN FLOW	CHEM?	Retrofit Cos Chem CAP

Burlington North	552	829	1,381		AS	2	N	
Montpelier	9430	1645	2,741		AS	3.97	Y	0.185
Northfield	3489	675	1,126		AS	1.63	Y	0.118
Richmond	1631	92	153		AS	0.222	Y	0.067
Waterbury	0	3134	352		AL	0.51	Y	0.08
Keeseville	1015	124	207		AS	0.300	Y	0.072
Lake Placid	5075	1036	1,726		AS	2.500	Y	0.144
Peru	2210	207	345		AS	0.500	Y	0.079
Dannemora	0	5344	1,036		AL	1.500	Y	0.113
Plattsburgh City (1.74)	0	6629	11,048		AS	0.162	Y	0.065
Saranac Lake	4872	1160	1,933		AS	2.800	N	0
Hardwick	0	0	1,409		AL	0.371	Y	0.074
Jeffersonville	0	0	213		AL	0.077	Y	0.065
Johnson	0	0	503		AS	0.2	Y	0.065
Milton	0	0	174		AL	0.225	Y	0.067
Morrisville	0	0	1,585		AS	0.425	Y	0.076
Vermont Whey	0	0	458		AS??	0.425	Y??	0.076
Enosburg Falls	1150	0	497		AS	0.45	Y	0.078
Richford	0	283	262		AL	0.38	Y	0.074
Troy/Jay	0	2679	138		AL	0.2	Y	0.067
Bedford	3020	503	503		??	0.04	Y??	0.1185
Sutton	1110	0	370		??	0.268	Y??	0
Champlain	0	0	1,132		AS	0.400	Y	0.076
Rouses Point	0	0	4,474		AS	2.000	Y	0.128
Wyeth-Ayerst, Chazy*	0	0	3,009					

Mid-Range Reduction Scenario

	s ($millions)		Retrofit Costs ($millions)			Retrofit Costs ($millions)		Tot. Costs to Meet Policy 2	
	Feed		FILTER	FILTER		CLAR	CLAR	($ millions)	
FACILITY	O/M	FILTER?	CAP	O/M	CLAR?	CAP	O/M	CAP	O/M

Burlington North		Y	1.6	0.075	N			0	0
Montpelier	0.145	Y	2.1	0.12	Y	0.6	0.018	0.785	0.163
Northfield	0.065	Y	1.4	0.065	Y	0.36	0.012	0.478	0.077
Richmond	0.016	Y	0.36	0.016	Y	0.113	0.0053	0.18	0.0213
Waterbury	0.0285	Y	0.65	0.0295	Y	0.46	0.01	0.54	0.0385
Keeseville	0.0202	Y	0.460	0.0205	Y	0.135	0.0060	0.207	0.0262
Lake Placid	0.1020	Y	1.860	0.0880	Y	0.465	0.0150	0.609	0.117
Peru	0.0280	Y	0.640	0.0290	Y	0.180	0.0074	0.259	0.0354
Dannemora	0.0600	Y	1.330	0.0620	Y	1.000	0.0158	1.113	0.0758
Plattsburgh City (1.74)	0.0143	Y	0.305	0.0130	Y	0.105	0.0047	0.17	0.019
Saranac Lake	0.0000	Y	2.000	0.0950	Y	0.492	0.0153	0.492	0.0153
Hardwick	0.0225	Y	0.52	0.0235	Y	0.39	0.0087	0.464	0.0312
Jeffersonville	0.0115	Y	0.225	0.009	Y	0.175	0.0048	0.24	0.0163
Johnson	0.0155	Y	0.35	0.0155	Y	0.105	0.005	0.17	0.0205
Milton	0.0083	Y	0.38	0.0165	Y	0.28	0.0069	0.347	0.0152
Morrisville	0.025	Y	0.58	0.026	Y	0.162	0.0068	0.238	0.0318
Vermont Whey	0.025	Y??	0.58	0.026	Y??	0.162	0.0068	0.238	0.0318
Enosburg Falls	0.0255	Y	0.6	0.0275	Y	0.168	0.0072	0.246	0.0327
Richford	0.023	Y	0.54	0.024	Y	0.395	0.0088	0.469	0.0318
Troy/Jay	0.0155	Y	0.35	0.0155	Y	0.265	0.0068	0.332	0.0223
Bedford	0.0420	Y	0.960	0.0435	Y	0.270	0.0111	0.3885	0.0531
Sutton	0	Y	0.460	0.0205	Y	0.135	0.0060	0.135	0.006
Champlain	0.0245	Y	0.555	0.0250	Y	0.159	0.0067	0.235	0.0312
Rouses Point	0.0780	Y	1.600	0.0750	Y	0.408	0.0132	0.536	0.0912
Wyeth-Ayerst, Chazy*									

Mid-Range Reduction Scenario

	Scenario Costs - 0.8 mg/l			Tot. Costs to Meet Policy		Inc. Costs to Meet Policy 3		Inc. Scenario Costs -	
	Pres. Val.	Annualized	Unit Cost	($ millions)		($ millions)		Pres. Val.	Annualized
FACILITY	($ 000's)	($ 000's)	($ /kg-yr)	CAP	O/M	CAP	O/M	($ 000's)	($ 000's)

Burlington North	0	0	0	1.6	0.075	1.6	0.075	2,753	179
Montpelier	3,291	214	23	2.885	0.283	2.1	0.12	3,945	257
Northfield	1,662	108	31	1.878	0.142	1.4	0.065	2,399	156
Richmond	507	33	20	0.54	0.0373	0.36	0.016	606	39
Waterbury	1,132	74	0	1.19	0.068	0.65	0.0295	1,103	72
Keeseville	610	40	39	0.667	0.0467	0.46	0.0205	775	50
Lake Placid	2,408	157	31	2.469	0.205	1.86	0.088	3,213	209
Peru	803	52	24	0.899	0.0644	0.64	0.029	1,086	71
Dannemora	2,278	148	0	2.443	0.1378	1.33	0.062	2,283	149
Plattsburgh City (1.74)	462	30	0	0.475	0.032	0.305	0.013	505	33
Saranac Lake	727	47	10	2.492	0.1103	2	0.095	3,460	225
Hardwick	0	0	0	0.984	0.0547	0.52	0.0235	0	0
Jeffersonville	0	0	0	0.465	0.0253	0.225	0.009	0	0
Johnson	0	0	0	0.52	0.036	0.35	0.0155	0	0
Milton	0	0	0	0.727	0.0317	0.38	0.0165	0	0
Morrisville	0	0	0	0.818	0.0578	0.58	0.026	0	0
Vermont Whey	0	0	0	0.818	0.0578	0.58	0.026	0	0
Enosburg Falls	749	49	42	0.846	0.0602	0.6	0.0275	0	0
Richford	958	62	0	1.009	0.0558	0.54	0.024	909	59
Troy/Jay	674	44	0	0.682	0.0378	0.35	0.0155	588	38
Bedford	1,205	78	26	1.3485	0.0966	0.96	0.0435	1,629	106
Sutton	227	15	13	0.595	0.0265	0.46	0.0205	0	0
Champlain	0	0	0	0.79	0.0562	0.555	0.025	0	0
Rouses Point	0	0	0	2.136	0.1662	1.6	0.075	0	0
Wyeth-Ayerst, Chazy*	0	0	0	0	0			0	0

Mid-Range Reduction Scenario

	0.5 mg/l	Total Point Source Scenario Costs			
	Unit Cost	Total Cap.	Total O&M	Pres. Value	Total Annualized
FACILITY	($ /kg-yr)	($ 000's)	($ 000's)	($ 000's)	($ 000's)

Burlington North	216	1,600	75	2,753	179
Montpelier	156	2,885	283	7,235	471
Northfield	231	1,878	142	4,061	264
Richmond	429	540	37	1,113	72
Waterbury	23	1,190	68	2,235	145
Keeseville	406	667	47	1,385	90
Lake Placid	202	2,469	205	5,620	366
Peru	341	899	64	1,889	123
Dannemora	28	2,443	138	4,561	297
Plattsburgh City (1.74)	5	475	32	967	63
Saranac Lake	194	2,492	110	4,188	272
Hardwick	0	0	0	0	0
Jeffersonville	0	0	0	0	0
Johnson	0	0	0	0	0
Milton	0	0	0	0	0
Morrisville	0	0	0	0	0
Vermont Whey	0	0	0	0	0
Enosburg Falls	0	246	33	749	49
Richford	209	1,009	56	1,867	121
Troy/Jay	14	682	38	1,262	82
Bedford	210	1,349	97	2,833	184
Sutton	0	135	6	227	15
Champlain	0	0	0	0	0
Rouses Point	0	0	0	0	0
Wyeth-Ayerst, Chazy*	0	0	0	0	0

Mid-Range Reduction Scenario

	Design storm event (cm)			8							min
	Urban runoff coeff.			0.6			O&M Cost Non-structural Urban BMP's ($/ha served)				50
	Area served (ha/1000m^3 of storage)			2.08			Average effectiveness			10%	
	Depth of basin (m)			2.5			Cost effectiveness ($/kg-yr)				$450
	Annual runoff (cm)			40			Total Cost of Structural Urban BMP's ($/ha served)				$7,374
	Urban loading coeff. (Mg/l)			0.28			Annual O&M Cost as % of Cap. Cost				5%
				min	max		Average effectiveness			45%	
	Const. cost of basin ($/m^3)			14.37	35.937		Cost effectiveness ($/kg-yr)				$1,636
	Opp. cost of land ($/acre)			10,000	100,000						
	Tot. Cost of basin ($/m^3)			15.36	45.82						
	D/F Measured	Bud/Meals	Est. Alloc. by Land Use			Est. NPS Load by Land Use (mt/yr)			Urban	est. untreated	High Erosion
Lake Segment	NPS Load (mt/y	Load	Forest	Agric.	Urban	Forest	Agric.	Urban	Land (ha)	anim units	Cropland (ha)
South Lake B	49.5	47.8	12.76%	73.44%	13.80%	6.32	36.35	6.83	4705	27,652	0
South Lake A	5.7	1.3	23.43%	61.71%	14.86%	1.34	3.52	0.85	1564	3,839	0
Port Henry	3	0.6	17.86%	58.80%	23.34%	0.54	1.76	0.70	848	2,192	0
Otter Creek	58.1	58.7	11.06%	79.11%	9.83%	6.43	45.96	5.71	4937	36,822	0
Main Lake	92.8	89.7	21.03%	49.35%	29.62%	19.52	45.80	27.49	20151	22,739	0
Shelburne Bay	11.1	7.6	3.01%	83.60%	13.39%	0.33	9.28	1.49	1908	2,400	0
Burlington Bay	0.3	0	0.33%	23.76%	75.91%	0.00	0.07	0.23	2782	200	0
Cumberland Bay	8.9	7.7	33.40%	35.02%	31.58%	2.97	3.12	2.81	5311	5,514	0
Malletts Bay	29.2	26.6	17.00%	67.92%	15.38%	4.96	19.83	4.49	3946	13,999	0
Northeast Arm	3.2	0	3.22%	83.07%	13.71%	0.10	2.66	0.44	792	450	0
St. Albans Bay	7.1	0	1.62%	68.92%	29.46%	0.12	4.89	2.09	1330	4,488	0
Missisquoi Bay	151.3	76.3	15.83%	71.56%	12.61%	23.95	108.27	19.08	7316	74,618	0
Isle LaMotte	21.5	3.2	9.37%	78.72%	11.90%	2.01	16.92	2.56	2193	31,210	0
	442				Total	69	298	75		226,122	0

Mid-Range Reduction Scenario

	max						min	max		Total Cropland
	202		Cap. cost of barn/milk/silo controls ($/AU)				100	300		% w/ high erosi
			Net O&M cost (benefit) of barn/silo control ($/AU/yr)				0	30		
	$1,800		Avg. reduction (kg/AU)			0.32				Edge of field P
	$21,994		Cost effectiveness ($/kg-yr)				20	156		Delivery factor
	5%		Cap. cost manure storage/mgmt. ($/AU)				125	500		Effective P. rec
			Net O&M cost (benefit) of manure mgmt.($/AU/yr)				0	30		
	$4,880		Avg. reduction (kg/AU)			0.23				Erosion control
			Cost effectiveness ($/kg-yr)				26	197		Cost effectiven
	Crop	Barn/milk/silo	Manure	Urban	Urban	NPS Load Reductions (mt/yr)			Max. NPS Reductions (	
Lake Segment	BMP's	Mgmt.	Mgmt.	BMP 1	BMP 2	Forest	Agric.	Urban	Forest	Agric.
South Lake B	0.00	0.73	0.30	0.00	0.00	0	8.26	0.00	0	32.72
South Lake A	0.00	0.83	0.50	0.00	0.00	0	1.44	0.00	0	3.17
Port Henry	0.00	0.00	0.00	0.00	0.00	0	0.00	0.00	0	1.59
Otter Creek	0.00	0.43	0.15	0.00	0.00	0	6.23	0.00	0	41.37
Main Lake	0.00	0.85	0.38	0.00	0.00	0	8.09	0.00	0	41.22
Shelburne Bay	0.00	0.00	0.00	0.00	0.00	0	0.00	0.00	0	8.35
Burlington Bay	0.00	0.00	0.00	0.00	0.00	0	0.00	0.00	0	0.06
Cumberland Bay	0.00	0.00	0.00	0.00	0.00	0	0.00	0.00	0	2.81
Malletts Bay	0.00	0.00	0.00	0.00	0.00	0	0.00	0.00	0	17.85
Northeast Arm	0.00	0.00	0.00	0.00	0.00	0	0.00	0.00	0	2.39
St. Albans Bay	0.00	0.00	0.00	0.00	0.00	0	0.00	0.00	0	4.40
Missisquoi Bay	0.00	1.00	1.00	0.80	0.00	0	40.70	1.53	0	97.44
Isle LaMotte	0.00	0.00	0.00	0.00	0.00	0	0.01	0.00	0	15.23
						0.00	64.75	1.53		268.60

Mid-Range Reduction Scenario

		0									
	on	50%									
			max	min							
	reduct. (kg/ha.)		3	0.5							
			1	0.4							
	uction (kg/ha)		3	0.2							
			min	max							
	costs ($/ha/yr.).		12	60							
	ess ($/kg-yr.)		4	300							
											NPS C
	mt/yr)	Final NPS Load (mt/yr)				Forest	Agric.				
Lake Segment	Urban	Forest	Agric.	Urban	Total		Capital	Ann. O&M	Total PV	Annualized	Capital
South Lake B	3.76	6.32	28.09	6.83	41.24	0	6,602	425	13,137	855	0
South Lake A	0.47	1.34	2.07	0.85	4.26	0	1,233	76	2,406	157	0
Port Henry	0.39	0.54	1.76	0.70	3.00	0	0	0	0	0	0
Otter Creek	3.14	6.43	39.73	5.71	51.87	0	4,856	318	9,738	633	0
Main Lake	15.12	19.52	37.71	27.49	84.71	0	6,530	418	12,953	843	0
Shelburne Bay	0.82	0.33	9.28	1.49	11.10	0	0	0	0	0	1
Burlington Bay	0.13	0.00	0.07	0.23	0.30	0	0	0	0	0	0
Cumberland Bay	1.55	2.97	3.12	2.81	8.90	0	0	0	0	0	2
Malletts Bay	2.47	4.96	19.83	4.49	29.29	0	0	0	0	0	0
Northeast Arm	0.24	0.10	2.66	0.44	3.20	0	0	0	0	0	0
St. Albans Bay	1.15	0.12	4.89	2.09	7.10	0	0	0	0	0	0
Missisquoi Bay	10.49	23.95	67.57	17.55	109.07	0	38,242	2,239	72,653	4,726	0
Isle LaMotte	1.41	2.01	16.91	2.56	21.48	0	20	1	34	2	0
	41.12	68.58	233.70	73.23	375.51	0	57,483	3,476	110,922	7,216	3

	ontrol Costs ($ 000's)						
	Urban			Total			
Lake Segment	Ann. O&M	Total PV	Annualized	Capital	Ann. O&M	Total PV	Annualized
South Lake B	0	0	0	6,602	425	13,137	855
South Lake A	0	0	0	1,233	76	2,406	157
Port Henry	0	0	0	0	0	0	0
Otter Creek	0	0	0	4,856	318	9,738	633
Main Lake	0	0	0	6,530	418	12,953	843
Shelburne Bay	0	1	0	1	0	1	0
Burlington Bay	0	0	0	0	0	0	0
Cumberland Bay	0	4	0	2	0	4	0
Malletts Bay	0	0	0	0	0	0	0
Northeast Arm	0	0	0	0	0	0	0
St. Albans Bay	0	0	0	0	0	0	0
Missisquoi Bay	737	11,336	737	38,242	2,976	83,990	5,464
Isle LaMotte	0	0	0	20	1	34	2
	738	11,342	738	57,486	4,214	122,265	7,953

Mid-Range Reduction Scenario

Lake Segment	Criterion ug/l	Pred. Conc. ug/l	Pred. Conc. mg/l	Trib. NPS Load mt/yr	Point Source Load mt/yr	Advect. Flow Downst. hm3/yr	Exchange Flow Downst. hm3/yr	Total Load mt/yr	Trib. Inflow hm3/yr	Area km2
1. South Lake B	50	40.3999	0.0404	41.24	4.27	829.64	712	45.58	829	5.79
2. South Lake A	25	25.24209	0.025242	4.26	9.84	1,263.40	1259	14.07	429	43.27
3. Port Henry	14	11.91825	0.011918	3.00	0.79	1,359.71	13998	4.80	88	75.55
4. Otter Creek	14	11.12502	0.011125	51.87	12.30	2,642.84	49427	64.56	1280	28.49
5. Main Lake	10	10.10042	0.0101	84.71	20.08	7,239.13	8861	110.35	2670	414.14
6. Shelburne Bay	14	12.23568	0.012236	11.10	2.00	58.06	4816	13.09	57	9.62
7. Burlington Bay	14	11.86374	0.011864	0.30	5.86	6.61	2986	6.23	6	5.51
8. Cumberland Bay	14	11.65573	0.011656	8.90	14.95	828.18	8672	24.00	827	10.75
9. Malletts Bay	10	9.42818	0.009428	29.29	4.77	987.89	272	34.80	1170	55.06
10. Northeast Arm	14	11.46461	0.011465	3.20	0.00	2,019.16	1968	6.55	41	248.25
11. St. Albans Bay	17	16.49806	0.016498	7.10	2.79	42.79	1844	9.99	42	7.21
12. Missisquoi Bay	27.5	27.7317	0.027732	109.07	5.29	1,719.89	297	115.59	1710	89.94
13. Isle LaMotte	14	10.70651	0.010707	21.48	8.84	9,671.71		32.85	393	185.59
				375.51	91.77			482.47	9542	1179.17
9a. Malletts N channel									188.16906	52

Mid-Range Reduction Scenario

Lake Segment	Volume km3	k m3/g-yr	kVc hm3/yr	Precip. Load mt/yr	Net Precip. Flow hm3/yr	Internal Load mt/yr	Withdraw Flow hm3/yr	Withdraw Load mt/yr
1. South Lake B	0.0078	100	31.5119253	0.078744	0.6369	0	0	0
2. South Lake A	0.125	100	385	0.588472	4.7597	0	24.1	0.6083343
3. Port Henry	1.463	100	2195	1.02748	8.3105	0	0.8	0.0095346
4. Otter Creek	0.955	100	1062.43909	0.387464	3.1339	0	0	0
5. Main Lake	16.787	100	16955.5673	5.632304	45.5554	0	7.6	0.0767632
6. Shelburne Bay	0.14	100	171.299541	0.130832	1.0582	0	11.5	0.1407103
7. Burlington Bay	0.063	100	74.7415642	0.074936	0.6061	0	0	0
8. Cumberland Bay	0.063	100	73.4310947	0.1462	1.1825	0	0	0
9. Malletts Bay	0.722	400	2722.85829	0.748816	6.0566	0	0	0
10. Northeast Arm	3.38	100	3875.03917	3.3762	27.3075	0	2.1	0.0240757
11. St. Albans Bay	0.023	0	0	0.098056	0.7931	0	0	0
12. Missisquoi Bay	0.205	400	2273.9993	1.223184	9.8934	0	0	0
13. Isle LaMotte	1.892	100	2025.67209	2.524024	20.4149	0	0	0
	25.8258			16.036712	129.7087		46.1	0.859418
9a. Malletts N channel								

Mid-Range Reduction Scenario

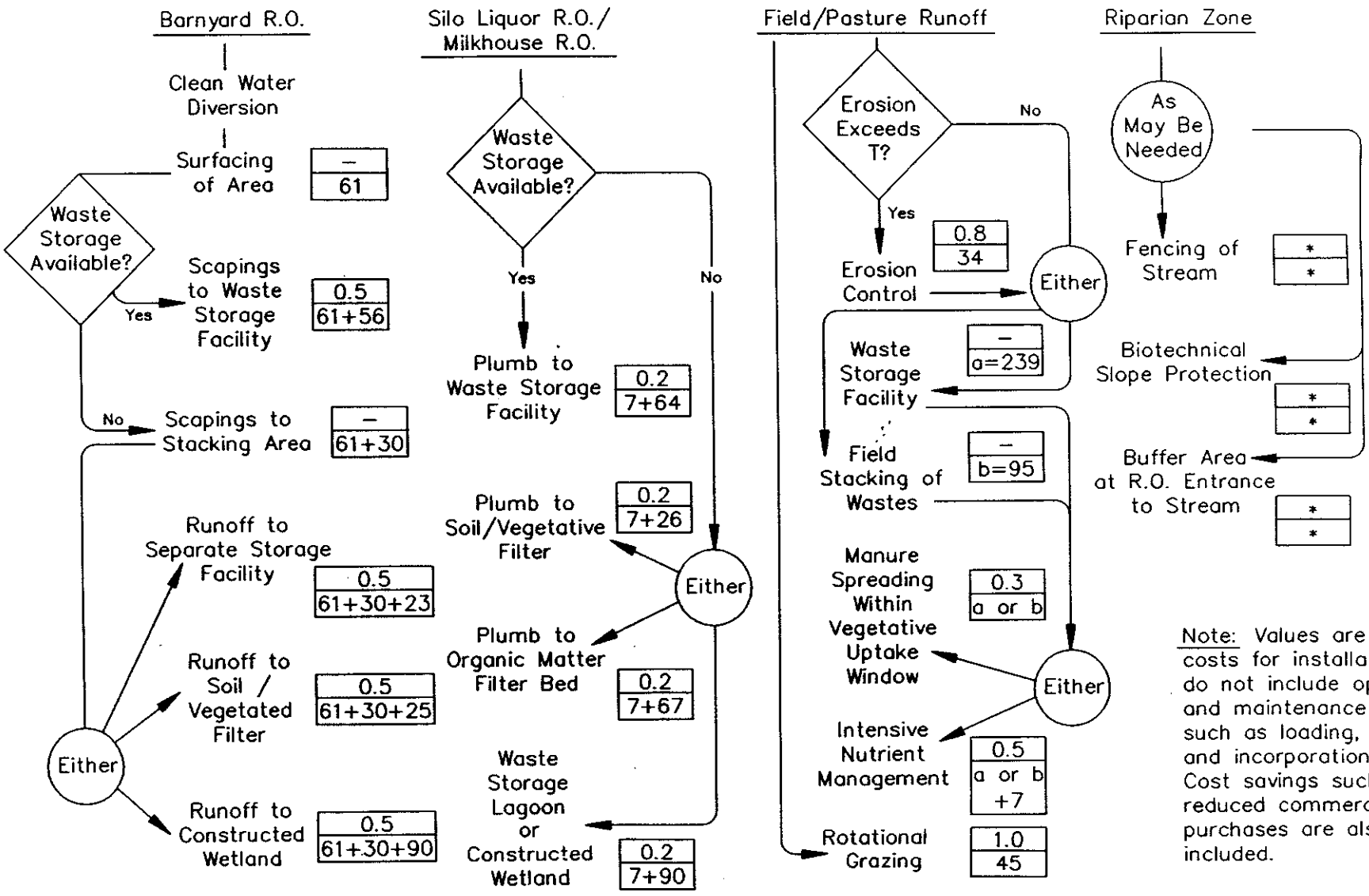
		PV NPS	PV PS	Total PV
		Cont. Costs	Cont. Costs	Cont. Costs
Lake Segment		($ millions)		
1. South Lake B		13	3	16
2. South Lake A		2	0	2
3. Port Henry		0	1	1
4. Otter Creek		10	9	19
5. Main Lake		13	40	53
6. Shelburne Bay		0	0	0
7. Burlington Bay		0	0	0
8. Cumberland Bay		0	10	10
9. Malletts Bay		0	0	0
10. Northeast Arm		0	0	0
11. St. Albans Bay		0	0	0
12. Missisquoi Bay		84	9	93
13. Isle LaMotte		0	0	0
		122	72	194.54
9a. Malletts N channel				

Appendix C:

Lake Champlain Basin, Vermont
Flow Chart for Managing Agricultural Runoff

5 Pages

Lake Champlain Basin, Vermont
Flow Chart for Managing Agricultural Runoff



Note: Values are capital costs for installation and do not include operation and maintenance costs such as loading, transporting and incorporation of wastes. Cost savings such as reduced commercial fertilizer purchases are also not included.

KEY:

0.5	Pounds Total Phosphorus Reduced per Animal Unit
61+10	Cost for the Reduction per Animal Unit in $
*	To be Determined

R.J.C.
Rev. 11/2/94

Explanation of
Flow Chart for Managing Agricultural Runoff
Lake Champlain Basin, Vermont

Background: The Lake Champlain Basin Program in development of the final management plan has a need for cost and effectiveness information for approaches to reduction of phosphorus loads to the lake from various point and nonpoint sources. The Vermont Legislature is considering cost and effectiveness in deliberations over a state agricultural NPS reduction cost share program. The Soil Conservation Service has over three decades of experience in agricultural runoff management and provides the following information to support a flow chart that may be considered at this time to help support some of the above needs.

Purpose: The purpose of the flow chart is to provide a generalized, one page overview of approaches to treatment, their probable effectiveness and estimated incremental costs.

Explanation: The flow chart is divided into four principal categories of agricultural nonpoint sources: barnyard runoff, silo liquor/stacks/ milkhouse runoff, field/ pasture runoff and riparian zone loadings. Each source can be treated in a variety of ways/ steps, some of the more common of which are shown along a vertical flow path in the chart. The probable effectiveness of each of these (expressed in pounds of phosphorus reduction per animal unit) is the value displayed in the upper portion of the rectangular box to the right of the treatment element.

The estimated cost for the element (expressed as dollars per animal unit) is shown as the lower value in that box. **These estimates are averages of hundreds of operations and obviously would not necessarily apply to an individual case.**

Animal units - au(an au equals 1000 pound of animal weight) - are used as the common index because this is one of the easiest parameters to obtain for dairy operations and generally relates directly to the loading situation.

No cost is shown for the loading, transport, spreading and incorporation of the stored wastes or for the operation and maintenance of any of the facilities. Also no savings are considered in terms of less commercial fertilizer used, reduced labor, etc. Costs shown are for the installation of a facility, ready to operate.

Barnyard Runoff: Most situations require the diversion of clean water around the barnyard area and the surfacing, fencing, curbing, and placement of ramps, etc. to transfer the waste for further treatment/ storage. It is assumed this is the basic treatment element in all operations. Once the waste from this treatment has been properly utilized a reduction in P load of 0.5 lb/au is scored. Cost estimate to this point - $61/au

There are several options for the treatment of wastes coming off the barnyard:

* Liquids and scrapings go to a storage facility - cost estimate $61/au + incremental $56/au (includes all waste and runoff from precipitation placed in storage at a cost of storage/au less transfer costs/au from the barn)
* Scrapings to a stacking pad/area; liquids to subsequent treatment - incremental cost estimate $30/au for stacking area, total to this level $61+$30/au
* Subsequent treatment of liquids from barnyard/ stacking area when not incorporated in storage
    - o liquid to separate storage facility/lagoon incremental cost $23/au, total cost $61+30+23/au
    - o liquid to soil/vegetated filter incremental cost $25/au, total cost $61+30+25/au
    - o liquid to constructed wetland incremental cost $90/au, total cost $61+30+90/au

<u>Silo Runoff/milkhouse effluent/stack runoff:</u> Generally there is only a choice of one level of treatment for these materials. This involves plumbing of the liquids to the treatment location and the cost for the treatment. Once the waste from these sources is properly treated a P reduction of 0.2 lb/au is scored.

There are several options for treatment:

* Plumb to waste storage facility
  cost - plumbing $7/au + storage $64 = $71/au
* Plumb to soil/ vegetative filter
  cost - plumbing $7/au + filter $26 = $33/au
* Plumb to organic matter filter bed
  cost - plumbing $7/au + OMFB $67 = $74/au
* Plumb to waste storage lagoon or constructed wetland
  cost - plumbing $7/au + lag/CW $90 = $97/au

<u>Field/ Pasture Runoff:</u> Most of the phosphorus runoff from fields/ pastures can be managed by first bringing soil erosion to within a preset limit, say T (although T may not be acceptable in critical watersheds where sources of P need to be substantially reduced to within certain economic constraints), and then properly utilizing wastes primarily for crop uptake. An average reduction for erosion control is scored as 0.8 lb/au in the Lake Champlain Basin; for waste utilization within the prescribed vegetative uptake window, score 0.3 lb/au; and when utilized and accompanied by intensive nutrient management, score at least 0.5 lb/au. Rotational grazing also provides an opportunity for substantial P reduction, a scoring value of 1 lb/au is estimated, at a cost of about $ 45/au (which does not consider substantial operational cost reductions)

Treatment sequences and options are

* Rotational grazing, cost - $45/au
  This would account for the grazing period

Wastes generated during non-grazing periods would need to be addressed, also any erosion control

* Erosion control (fields/pastures)
  Cost - $34/au
* Waste storage facility (basin average of waste storage structures and waste storage ponds)
  cost - $239/au
* Field stacking of wastes
  cost - $95/au
* Manure spreading within vegetative uptake window
  cost - ($239 or $95/au depending on storage method)
* Intensive Nutrient Management
  cost - $7/au for ICM services + ($239 or $95/au)

Riparian Zone: Several loading activities could be managed in the riparian zone. Neither the P load reductions or the costs of these treatments have been estimated at this time mainly because of the lack of a universe of jobs from which reasonable estimates could be made. These treatments should be considered for integration into an overall runoff management plan for the farm. The zone is particularly important because of its proximity to the stream and because of the opportunity to enhance other ecosystem values as well as reducing phosphorus loads.

R.J. Croft
11/2/94

Appendix D:

Preliminary Multipliers for the Lake Champlain Basin

Sector	Total Output Multipliers[1]			Total Employment Multipliers[2]		
	NY Basin Counties[3]	Clinton County[6]	Vermont State[4]	NY Basin Counties[3]	Clinton County[6]	Vermont State[4]
Recreation (NY: Entertainment) (Agg)[5]	1.74		2.86	48.8		80.1
Retail Trade (Aggregated)	1.57	1.57	1.89	50.0	36.9	50.9
Hotels and Lodging Places	1.42	1.53	2.04	34.2	22.9	49.9
Agricultural Production (VT: Dairy) (Agg)	1.40		1.69	20.8		25.3
Construction (Agg) (VT: New Const.)	1.35	1.47	1.78	22.0	19.3	28.1
Misc Manufacturing (Aggregated)	1.28		1.76	20.7		27.1
Transportation (Aggregated)	1.54		1.76	38.0		32.5
State & Local Government (Aggregated)	1.40		2.13	37.3		67.1

Notes:

1. Total Output Multipliers represent the total dollar change throughout the local economy for each additional dollar of demand for services produced by the sector.
2. Total Employment Multipliers represent the change in the number of jobs for every million dollars in demand for the sector services.
3. NY Basin County multipliers are an aggregate for the 3 main Basin counties (Clinton, Essex, & Washington) compiled for this project.
4. Vermont multipliers were presented in EFCA (1993); retail trade data from U.S. Dept. of Commerce (1992).
5. The Recreation, or Entertainment, Aggregate is comprised of a number of recreation sectors.
6. Clinton County multipliers were obtain directly from the U.S. Department of Commerce, having been compiled for economic study on the closing of the Plattsburgh Air Force Base (Pigler 1994).